Animating Performance Zoning at Sustainability's Competitive Edge

MICHAEL N. WIDENER*

ABSTRACT

This Article argues that economic competitiveness compels cities and towns to reimagine their zoning codes by incorporating technological advances into land planning and to implement resource sustainability[1] in commercial real estate development. The U.N. Climate Change Conference of the Parties (Twenty-first session) near Paris hosted a program, "Buildings Day at COP21" on December 3, 2015, advancing this thesis. Buildings Day's themes included the proposition that improving building operating efficiency is instrumental in reducing global energy demand and emissions.[2]

This Article asserts that the optimal means to accomplish this "de-carbonization" of the built environment at the local government level is to adopt a performance zoning platform—a type of American land use regulation with origins in the mid-20th Century but widely overlooked since the late 1980s. Such a platform facilitates engineering resolutions to problems accompanying increased urban core density in transit-oriented and other intensely occupied districts. Its re-introduction is desirable because performance zoning will better address negative land use externalities than conventional Euclidean zoning, as will be explained below. This Article argues that the imperative of community competitiveness, optimized when millennial-managed enterprises occupy and manage resource sustainability-focused urban developments, is animated best through performance zoning codes.

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* Adjunct Professor, Arizona Summit Law School, Zoning Adjustment Hearing Officer, City of Phoenix, and Of Counsel, Bonnett, Fairbourn, Friedman & Balint, P.C. This paper is for the late Michael J. Curley, Esq., a fine land use lawyer and civic leader, and an ever-generous man, and for Humberto Hidalgo Espeleta, sustainability guide and naturalist in Parque Nacional Tortuguero, Costa Rica.

1. I use the term "natural resource sustainability" in this paper to distinguish it from other "definitions" of an overused and badly-understood term sometimes addressing efficiency but nurturing our planet at others. See, e.g., Joseph Schumpeter, *A New Green Wave*, ECONOMIST (Aug. 30, 2014), http://www.economist.com/news/business/21614152-few-pioneering-businesses-are-developing-sustainability-policies-worthy-name-new ("Sustainability can refer to anything from building wind farms to combating social inequality . . .").

2. *See, e.g.,* Andrew Steer & Naoko Ishii, *Sustainable Cities and Buildings at COP21: Delivering Our Future Today*, 58 URBAN CLIMATE NEWS 3 (Dec. 2015) (Building Efficiency Accelerator will engage cities on policy implementation issues and the tracking and monitoring of building efficiency, including benchmarking and disclosure of such efficiency); Tony Liou, *International Spotlight on Buildings at Paris Climate Talks*, GLOBEST (Dec. 21, 2015), http://www.globest.com/blogs/buildingsciences/energy/Builing-energy-efficiency-at-COP21-364525-1.html. Certain results of that program are discussed further in the text accompanying *infra* notes 150–51.

This Article proceeds in Part II by exploring how performance zoning induces municipal sustainability gains by reviewing land use tenets of community competitiveness while also incentivizing private developers to leverage sustainability in order to increase profitability and institutional reputations. Next, in Part III, it reviews community competitiveness in the frame of sustainability, and in Part IV it describes the millennial generation's consciousness of sustainability's benefits and the modern worker's facility with sustainability technologies. In Part V, the Article identifies technology drivers of energy savings and other sustainability tools readily accessible to millennial professionals and suitable for incorporation into commercial projects, thus propelling interest in environmentally-advanced building performance in competitive cities. The final two parts inform readers of how technological innovation in design tools and monitoring systems enables the development community, together with local spatial regulators, to expand forthcoming urban projects' sustainability features and systems employing environmentally sound, flexible spatial regulations. Finally, this Article argues that a new era of heightened sustainability consciousness, embodied in performance zoning codes, will improve quality of life and spur democratization of local governance for both the millennial "pilots" of environmental awareness and citizens alike.

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I. THIS TIME, A GREAT NOTION

A. HISTORY, FEATURES, AND APPLICATION OF PERFORMANCE ZONING SYSTEMS

Dennis O'Harrow conceived performance zoning in the early 1950s when he concluded that typical industrial nuisances could be measured scientifically and, therefore, were manageable through objective zoning controls.[3] Thus, performance zoning was initially designed to accommodate industrial uses that otherwise might be banned altogether.[4] The first performance zoning regimes beyond heavy industrial applications were introduced in the mid-1960s.[5] The concept enjoyed sustained attention through the 1980s,[6] peaking around 1985. Among planning administrations, this interest coincided with three occurrences, beginning with Layne Kendig's model of performance zoning ordinance, which regulated permitted uses by managing undesirable "by-products" associated with each non-residential use.[7] Kendig boldly asserted that in contrast to prescriptive zoning, "performance zoning protects the environment."[8] Later, in 1981, New

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3. *See* DENNIS O'HARROW, PERFORMANCE STANDARDS IN INDUSTRIAL ZONING, PLANNING ADVISORY SERVICE INFORMATION REPORT NO. 32, at 3 (1951). O'Harrow borrowed "performance standard" as a term coined originally in building code terminology. *See id*. O'Harrow viewed performance standards as minimum, base levels as to which compliance must be rigidly required. *See* STOCKHAM, *infra* note 7, at 32. O'Harrow opined that the performance standard substitutes a quantitative measurement of an effect, measurable with standardized instruments, to determine if a use would perform within predetermined limits.

4. *See* Gillespie, *Industrial Zoning and Beyond: Compatibility through Performance Standards*, 46 J. URB. L. 723, 742, 751 (1969); DENNIS O'HARROW, *supra* note 3, at 2, 14.

5. *See* John R. Nolon, *Golden and its Emanations: The Surprising Origins of Smart Growth*, 35 URB. L. 15, 30 (2003). Frank Horack wrote about use of performance standards in residential zoning as early as 1952. *See generally* Frank E. Horack, Jr., *Performance Standards in Residential Zoning*, 1952 PLANNING 153 (1952).

6. *See* Douglas C. Baker, Neil G. Sipe & Brendan J. Gleeson, *Performance-based planning: perspectives from the United States, Australia, and New Zealand*, 25 J. OF PLAN. EDUC. & RES. 396, 404 (2006) (figure indicating dates of code implementation). Bucks County, Pennsylvania, endorsed, and many communities within its boundaries thereafter adopted, a performance zoning model in the middle 1970s applicable to housing development. *See* Nolon, *supra* note 5, at 30–31. A model performance zoning residentially based ordinance appeared in 1973, *see* Chester County Planning Commission, Performance Zoning, http://www.landscapes2.org/ToolsLandscape/pages/PerfZoning.cfm (Bucks County Planning Commission developed regulations in 1973 for residential development). In 1972, the Town of Gay Head, Massachusetts established a two-district, performance-based ordinance three pages in length. *See* Martin Jaffe, *Performance Zoning: A Reassessment*, 45 LAND USE L. & ZONING DIG. 3, 3 (Mar. 1993). That ordinance required developer attention to eight criteria: erosion control; tree preservation; screening requirements; trip generation; parking standards; undesirable off-site impacts; use or storage of temporary or mobile structures; and excess pollution. *See id*.

7. *See* LANE H. KENDIG, PERFORMANCE ZONING (1980). Kendig at one time was Director of Community Planning for Bucks County, PA, *See* JOHN STOCKHAM, OR. ST. U., PERFORMANCE STANDARDS: A TECHNIQUE FOR CONTROLLING LAND USE, SPECIAL REPORT 424, 23 (1974) (explaining that Euclidean schemes typically either over- or under-protect the environment, because a single district, while implicating many environmental conditions, usually contains no provisions addressing sustainability requirements tied to any type of use proposed).

8. KENDIG, *supra* note 7, at 3, 91. *See also* Robert J. Blackwell, *Overlay Zoning, Performance Standards and Environmental Protection After Nollan*, 16 B.C. ENVTL. AFF. L. REV. 615, 633–36 (1989) (describing how overlay zones have been implemented to substitute for the inadequacy of conventional zoning district regulation in protecting natural resources).

York City drafted a proposal to refocus development on Manhattan's West Side that attracted substantial citizen interest.[9] One approach (suggested in a draft plan) was to adopt a performance system offering the developer substantially more than the conventional number of design options afforded under prescriptive zoning.[10]

The aim of the performance zoning platform was to simplify the negotiating process for developers by implementing certain unconventional approaches for evaluating a proposed building's impact on the environment.[11] Accordingly, New York City planners proposed four criteria to test new projects, awarding "points" when these criteria exceeded certain thresholds: so-called "daylighting" (how a building affects light and air flow upon its adjacent streets), street wall height, street wall length, and structural reflectivity.[12] The local chapter of the American Institute of Architects (AIA) urged adoption of the performance system for its focus on broad design goals, as opposed to reliance on myriad details characteristic of the less flexible prescriptive zoning system.[13] It admonished "the Planning Commission to find a suitable and creative balance between the demands of the continuous urban fabric and the single building of fine design . . . ."[14] The AIA argued that each part of Midtown must realize its own character, "to which end we stress our strong preference for performance zoning bulk controls which will stimulate architectural creativity and diversity . . . ."[15] This was the first public conversation among land use stakeholders about the benefits of performance-based zoning affecting non-industrial districts in a major American metropolitan area. In the early 1980s, Houston adopted its billboard ordinance (removing some immediately while amortizing others' survival) and a development ordinance that prescribed block lengths and minimum street setbacks but little more. These innovations together earned Houston the designation, in some quarters, as a pioneer of "performance zoning."[16] Yet performance-driven regulation faded gradually into the background[17] as New Urbanism seized the foreground among

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9. *See* Carter B. Horsley, *Larger Structures on City's West Side Proposed by Panel*, N.Y. TIMES, Mar. 16, 1981, at A1 [hereinafter Horsley, *Larger Structures*].

10. *See* Carter B. Horsley, *Real Estate; Light, Air and Zoning in Midtown*, N.Y. TIMES, Feb. 11, 1981, at D21 [hereinafter Horsley, *Real Estate*].

11. *See id.*

12. *See id.*; *see generally* N.Y. DEPT. OF CITY PLAN. MIDTOWN DEVELOPMENT 19, 6290 (Jun. 1981).

13. *See* Horsley, *Real Estate*, *supra* note 10; *see also* N.Y.C. PLAN. COMM'N, MIDTOWN ZONING 34–35 (1982), http://www.nyc.gov/html/dcp/pdf/history_project/midtown_zoning.pdf [hereinafter MIDTOWN ZONING].

14. *See* Horsley, *Larger Structures*, *supra* note 9.

15. *See id*. Ultimately, city planners adopted the "daylighting" principles and optimized design flexibility by adopting alternate systems of bulk regulations. *See* Carter B. Horsley, *How Planners Re-tuned Midtown Zoning Keys*, N.Y. TIMES, Jul. 12, 1981, at R1 [hereinafter Horsley, *How Planners*]; N.Y.C. PLAN. COMM'N, *supra* note 13, at 33.

16. *See* Robert Reinhold, *Focus: Houston; A Fresh Approach to Zoning*, N.Y. TIMES, Aug. 17, 1986.

17. Reportedly, of eight local American governments introducing performance-based planning systems, most dropped or revised their systems. *See* EIJI TORISU ET AL., COMPETITIVE CITIES: A NEW ENTREPRENEURIAL PARADIGM IN SPATIAL DEVELOPMENT 71 (2007). However, it is unknown whether the reporting parties had

its adherents and their followers. So-called form-based codes seemed to accomplish New Urbanists' aims for walkability, disposing of an auto-centric planning domain.[18] Regardless, performance zoning's claim was, and remains, that it provides for greater flexibility, avoiding the detailed specification of "acceptable" uses in each district inherent in traditional Euclidean zoning.[19] It vests greater discretion in a regulatory jurisdiction at the time developments are proposed while establishing specific standards for the exercise of legislative discretion. Those standards reflect community goals; but the regulated party is empowered to decide how best to meet those goals.[20]

Under performance zoning, land development and use are regulated by a series of standards designed to address quantifiable impacts of a proposed development upon the social, economic, and physical environment of a neighborhood or larger physical realm within a community.[21] Performance standards limit, for example, the density of development, impacts of development on nearby land uses, and effects of development on public infrastructure. Concurrently, they protect the natural environment, determining a project's ultimate building volume or percentage of lot area that must be made permeable or vegetated, or retained as open space to buffer the use from adjoining uses.[22] For example, Metro Nashville passed an ordinance in 2007 requiring all new buildings' or existing-buildings' additions exceeding five thousand gross square feet of occupied space (or surpassing two million dollars in construction costs) to be LEED® certified "Silver" or better.[23]

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actually identified all communities with such land use regulatory systems (for instance, Havana, Florida's system) or how they defined those sets of ordinances in terms of their "pure performance standards" orientation, as opposed to a hybrid fashion of land use regulation. Stockham identified at least eight local governments by 1974 that were considering performance-based ordinances, while acknowledging some were in drafting stages or in phased implementation. *See* STOCKHAM, *supra* note 7, at 25–33. Accurate cataloging of how many communities have or are presently implementing performance-based standards may be elusive.

18. But as Stockham notes, if the specification refers to site design rather than relating a standard to a proposed use's effect, this is not performance-based regulation per se, *see* STOCKHAM, *supra* note 7, at 6. This is why mere LEED® compliance cannot uniformly constitute a performance standard.

19. John R. Ottensmann, *Planning Through Exchanges of Rights Under Performance Zoning*, 25 ECON. AFF. 40 (2005). In this respect, performance zoning does not regulate the parcel's intended use, but instead those adverse impacts anticipated by a use of the type intended. Indeed, some performance zoning ordinances in the 1970s had only one "district," as all uses were permitted throughout the jurisdiction, see STOCKHAM, *supra* note 7, at 25–33.

20. Dawn Jourdan et al., *Evidence-Based Sign Regulation: Regulating Signage on the Basis of Empirical Wisdom*, 45 URB. LAW. 327, 329 (2013); *see* STOCKHAM, *supra* note 7, at 7.

21. *See* STOCKHAM, *supra* note 7, at 3. Notably, within a single community a variety of performance standards may be used to reflect different districts or neighborhoods. *See id.* at 8. The rationale for each compilation of standards is explicit in the performance ordinances, reflecting local public acceptance of those controls expressed. *See id.* at 37. Of course, this suggests that more than a single zoning district may be suitable for a community's performance zoning ordinance.

22. *See* KENDIG, *supra* note 7, at 25–29*;* STOCKHAM, *supra* note 7, at 9–22; DANIEL E. CLEMENT, BACK TO THE FUTURE: ZONING ALTERNATIVES IN THE SUBURBS 43–45 (1991).

23. *See* NASHVILLE METRO BUILDING ORDINANCE, BL2007-1374 §1, Sustainable Development Design Standards (2007), https://www.nashville.gov/mc/ordinances/term_2003_2007/bl2007_1374.htm. Though a laud-

Performance standards can be negative or positive. Thus, they can set a maximum level for the noise impacts on adjacent property[24] or they can require specified types of physical buffers to be established between certain types of land uses.[25] Performance standards encourage environmental conservation through using green roofs or installing permeable surfaces by specifying the magnitude of "on-site stormwater retention" or limiting ambient air particulates.[26]

Since 1990, the Town of Havana, Florida, population 1,709 (2013 census count), has had a performance zoning code.[27] Fifteen years later, the Town of Hyde Park, New York, population 21,571 (2010 census count), adopted such a code.[28] A startlingly candid exposition of purpose opens the Havana Zoning Ordinance:

> Every effort has been made to make uses a matter of right subject to performance criteria capable of nondiscretionary, objective administrative evaluation, thus reducing the number of times that *ad hoc* decisions need be made. This greatly increases the potential uses or choices available to individual property owners. The *ad hoc* decisions appear to reduce the certainty of protection to neighbors and to increase the potential for adverse impacts to the Town of Havana. This ordinance contains performance criteria intended to insure that neighbors are protected from adverse impacts. The ordinance also contains performance criteria to protect the community's general welfare . . . . Where performance criteria severely limit the use of properties, the ordinance has gone to considerable extremes to provide the landowners with a range of choices, flexibility, and options for development.[29]

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able effort to set municipal performance standards, some argue that LEED® certification ratings adopted by governments barely scratch the surface of sustainability potential in building performance. *See* Sarah B. Schindler, *Following Industry's LEED®: Municipal Adoption of Private Green Building Standards*, 62 FLA. L. REV. 285, 328 (2010) (noting a market-based standard, when converted to a government mandate, fails to build an effective green building regime); *see also* Timothy D. Lytton, *Competitive Third-Party Regulation: How Private Certification Can Overcome Constraints That Frustrate Government Regulation*, 15 THEORETICAL INQUIRES L. 539 (2014).

24. *See, e.g.*, I-INCE TECH. STUDY GRP. ON CMTY. NOISE: ENVTL. NOISE IMPACT AND MITIGATION, I-INCE, PUB. NO. 11-1, GUIDELINES FOR COMMUNITY NOISE IMPACT ASSESSMENT AND MITIGATION (2011), http://www.i-ince.org/data/iince111.pdf.

25. *See, e.g.,* AM. SOC. PLAN. OFFICIALS, INFO REP. 133, ZONING BUFFERS: SOLUTION OR PANACEA? (1960), https://planning-org-uploaded-media.s3.amazonaws.com/legacy_resources/pas/at60/pdf/report133.pdf; STOCKHAM, *supra* note 7, at 14; *see also* William Leaf & Michael Lewyn, *Internally Buffered Districts: A New Technique to Make Zoning Less Exclusionary*, 44 REAL EST. L. J. 330, 342–47 (2015).

26. *See* James D. Brown, *Biophilic Laws: Planning for Cities with Nature*, 34 VA. ENVTL. L. J. 52, 84–89 (2016); STOCKHAM, *supra* note 7, at 9.

27. *See* U.S. CENSUS BUREAU, AMERICAN FACTFINDER, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml (search in search bar for "Havana town, Florida"); *see also* Susan Freiden & Richard Winters, *Performance Zoning Helps Key City's Comeback*, AM. CITY & CNTY. (June 1, 1997), http://americancityandcounty.com/mag/government_performance_zoning_helps. The urban core and development districts allow most non-heavy industrial uses so long as performance standards are met; these standards are based on the type of adjacent development.

28. U.S. CENSUS BUREAU, *supra* note 27 (search in search bar for "Hyde Park, NY").

29. *See* TOWN OF HAVANA, FL., PERFORMANCE ZONING ORD. § 1001, Commentary.

In the same vein, the Hyde Park ordinance, originally adopted in 2005 and revised in 2008, indicates in its statement of purposes "to establish clear, efficient and flexible land use review procedures and standards for future projects and to encourage the conservation of energy and the appropriate use of solar and other renewable energy resources."[30] Hyde Park's zoning code narrows zoning categories into just twelve districts, of which five are tied to enclaves in the town featuring a distinctive character.[31]

Performance zoning is easily distinguished from contract zoning, which is illegal in most states.[32] Contract zoning represents an agreement between a property owner and a local government in which the owner agrees in advance of a public hearing on certain conditions in return for the government's rezoning or enforceable promise to rezone.[33] However, performance zoning is not the result of bilateral negotiations. Instead, the community adopting the performance standards notifies potential development parties that if prescribed standards are achieved for (a) mitigating certain negative externalities (for example, carbon dioxide emissions and potable water waste), or (b) reaching specifically quantified community development goals such as jobs relocation, affordable housing development, or carbon-footprint reduction, then zoning vests without collateral agreements with the developer. Indeed, collateral agreements are unnecessary, as the developer decides (such as in Havana, Florida), how to achieve the community's goals.[34] "Hit the community's targets and build your project" captures the essence of performance zoning,[35] as it is the "carrying capacity" of the development site that determines its permitted intensity of use. This determination in turn rests on the site's natural land features and certain variables established by the

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30. TOWN OF HYDE PARK, N.Y., CODE ch. 108, § 108-1.4(K)–(L) (2005) (amended 2007).

31. *Id.*

32. *See* David W. Owens, *Contract Zoning*, U.N.C.: SCHOOL OF GOVERNMENT (Apr. 2014), https://www.sog.unc.edu/resources/legal-summaries/contract-zoning; Philip L. Fraietta, *Contract and Conditional Zoning without Romance: A Public Choice Analysis*, 81 FORDHAM L. REV. 1923, 1953–55 (2013).

33. James D. Lawlor, Annotation, *Validity, Construction, & Effect of Agreement to Rezone, or Amendment to Zoning Ordinance, Creating Special Restrictions or Conditions Not Applicable to Other Property Similarly Zoned,* 70 A.L.R.3d 125, 131 (1976); *cf.* Collard v. Incorporated Village of Flower Hill, 421 N.E. 2d 818, 821–22 (N.Y. 1981) ("absent proof of a contract purporting to bind the local legislature in advance to exercise its zoning authority in a bargained-for manner, a rule which would have the effect of forbidding a municipality from trying to protect landowners in the vicinity of a zoning change by imposing protective conditions based on the assertion that that body is bargaining away its discretion, would not be in the best interests of the public. The imposition of conditions on property sought to be rezoned may not be classified as a prospective commitment on the part of the municipality to zone . . . .").

34. *See, e.g.*, WARM SPRINGS/SOUTH FREMONT COMMUNITY PLAN 9 (Jul. 22, 2014), https://www.fremont.gov/DocumentCenter/View/24622 (strategies to create a hub of innovation "are designed to encourage flexibility and experimentation while setting performance standards for consistently high quality in the public realm"); STOCKHAM, *supra* note 7, at 7.

35. Nicole Stelle Garnett asserts that form-based codes are equivalent of "highly technical performance-zoning overlays" surmounting other zoning regulations. *See* Nicole Stelle Garnett, *Redeeming Transect Zoning?*, BROOK. L. REV. 571, 579–580 (2013); *see* DONALD L. ELLIOTT, A BETTER WAY TO ZONE: TEN PRINCIPLES TO CREATE MORE LIVABLE CITIES (2008).

community, based on its development-oriented preferences.[36]

Compliance with performance standards is usually assessed by using specified handbooks or formulas to determine any potential impacts of the proposed development.[37] For example, trip generation is measured by determining trip counts associated with the proposed use, using a handbook of trip generation factors.[38] Compliance with any particular standard depends upon the ultimate user of the development, whether owner-occupied or leased. Communities can employ a "points total" calculation system to determine whether approval of the intended use is appropriate.[39] A developer can adjust the project's performance to reach the required points threshold as the project moves through the administrative processes to building permitting.[40] Assessments of the adequacy of existing public facilities take place while the building permit is pending.[41] This avoids complications of monitoring continuing project compliance that might arise from changes in the provision of public facilities. There would not necessarily be any post-development completion measuring of actual trip-generation; if the proposed use is unchanged, the property owner would be deemed in compliance with the community's explicit trip generation standards.[42] This is no different from the enforcement of use requirements under a traditional zoning ordinance.[43]

Finally, some performance standards may require measurement of impacts after the permitted use is complete, for instance, a maximum noise standard. In most cases, need for measurement and subsequent enforcement actions would likely arise only in response to public complaints. This may seem risky for certain

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36. *See* Clement, *supra* note 22, at 46–47; *see* ELLIOTT, *supra* note 35.

37. For a discussion of various performance standards and how they are assessed, see RICHMOND REG'L PLANNING DIST. COMM'N, APPLICATIONS OF PERFORMANCE ZONING FOR INDUSTRIAL USES IN HANOVER COUNTY 3–16 (2001) [hereinafter RICHMOND RPDC], http://www.richmondregional.org/Publications/Reports_and_Documents/Planning/Hanover/Hanover_Industrial_Zoning.pdf.

38. *See, e.g.*, LOUDOUN CTY., VA., ZONING ORDINANCE § 5-1102(c)(1) (1999), *as reprinted in* RICHMOND RPDC, *supra* note 37, app. F at 61; *see* STOCKHAM, *supra* note 7, at 12.

39. *See* Jourdan et al., *supra* note 20, at 338.

40. *See id*.

41. In La Plata County, Colorado, which uses a performance zoning code, before land use permits are issued, the applicant's submittal must illustrate availability of adequate water and sewer service, and sufficient access to the property, along with the project's compatibility, measured by potential impacts on neighboring land. *See, e.g.*, Kosoglad v. Zoning Bd. App. of City of Chicago, 198 N.E.2d 216, 218 (Ill. App. 1964) (holding city can require applicant's showing that performance standards will be met before a special use permit issues); Jessica Pace, *Land-use Permit Process Streamlined in La Plata County*, DURANGO HERALD (Mar. 30, 2016), http://www.durangoherald.com/article/20160330/NEWS01/160339942/La-Plata-County-land-use-permit-process-streamlined (explaining that before land use permits are issued in La Plata County the applicant's submittal must illustrate availability of adequate water and sewer service and sufficient access to the property, along with the project's compatibility, measured by potential impacts on neighboring land).

42. *See* Ottensmann, *supra* note 19, at 41.

43. Jurisdictions imposing requirements for trip reductions below those normally associated with a given use might need to undertake subsequent monitoring of actual trip-generation, a task that wireless sensor networks handle easily and accurately. *See* Sing Yiu Cheung et al., *Traffic Measurement and Vehicle Classification with a Single Magnetic Sensor*, 1917 TRANSP. RES. REC. 173, 173, 181 (2005).

impacts like transit or bicycle performance effects of a project, or mass transit service expansion for occupants. However, traffic signal coordination and bicycle user amenity additions can mitigate transportation impacts of new development upon its occupancy.

Goal-achievement systems promoted by performance zoning resemble the affirmative obligations with private covenants in community benefits agreements.[44] Whereas performance zoning involves regulation by public administrators, private covenants usually occur among private landowners, enforceable only by those parties with contract privity.[45] Performance zoning is more closely related to the *planning* process, however, because the local government initially must identify planning goals and then draft regulations to advance those stated goals.[46] This process is preferable to reliance on restrictive covenants providing stakeholder protection, which requires agreement on and enforcement of private covenants. This may be impractical in an already-developed area if ownership is dispersed among many parties or if only a few vocal community groups dominate the affected stakeholders.[47] By contrast, performance zoning is imposed through government action and thus affects all properties identically, providing flexible but clear standards across a jurisdiction's boundaries.[48]

Performance zoning creates three classes of stakeholders. First is the property owner granted the rights to develop freely, subject only to complying with the baseline standards like vehicular trip generation.[49] In the second class, nearby property owners attain rights, primarily the right to be free of prescribed negative externalities such as noise pollution. The third stakeholder category is the larger community with rights such as to be free from roadway congestion as a result of over-development.[50]

An important product of creating rights for each stakeholder group is a marketplace in which those rights can be exchanged for other rights or sold outright. For example, in the case of adjacent dwellers, the developer may pay

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44. *See, e.g.*, Alejandro E. Camacho, *Community Benefits Agreements: A Symptom, Not the Antidote, of Bilateral Land Use Regulation*, 78 BROOK. L. REV. 355, 361, 367 (2013) (noting that CBAs specify public benefits a developer will provide in a project in return for community groups relinquishing the right to challenge project entitlements, thereby fostering community building; as such, they are a vehicle to promote flexibility and certainty in the regulation process); Patricia E. Salkin & Amy Lavine, *Community Benefits Agreements and Comprehensive Planning: Balancing Community Empowerment and the Police Power*, 18 J. L. & POL'Y 157, 178 (2009) (noting that commitments contained in CBAs address land use, housing, transportation, and environmental standards, among others).

45. *See* Salkin & Lavine, *supra* note 44, at 159.

46. *See* Travis Frew, Douglas Baker & Paul Donehue, *Performance Based Planning in Queensland: A Case of Unintended Plan-Making Outcomes*, 50 LAND USE POL'Y 239, 240–41 (2016) [hereinafter Frew] (noting a "comprehensive framework" that would not specify activities (uses) but would afford an opportunity for market innovation and technological change to define these activities).

47. *See* Camacho, *supra* note 44, at 368–72.

48. *See* Ottensmann, *supra* note 19; Frew, *supra* note 46, at 241.

49. *See* Ottensmann, *supra* note 19, at 41.

50. *See id.*

cash compensation to those neighbors potentially adversely affected by a project.[51] Individual property owners can gain from such trade without compromising the interests of the broader community.[52]

B. OPPORTUNITIES AVAILABLE UNDER PERFORMANCE ZONING CODES

Performance zoning yields opportunities and constraints, described in this and the following subpart, that are fundamental to the potential of municipalities to employ it for sustainability. The key aspect of performance zoning lies in the establishment of explicit standards designed to achieve defined public objectives.[53] If one public objective is to limit certain negative impacts of land uses on adjoining uses, then authorities define unacceptable levels of such impacts and develop standards either to prohibit or mitigate them.[54] It is also important to assure that development takes place within the capacity of available public infrastructure. To this end, authorities establish carrying capacity levels based on impact calculations and limit development within this framework.[55] For example, the effect of development on the transportation system can be controlled via standards addressing maximum levels of trip generation and requiring developers to adhere to a standard of infrastructure installation per acre developed.[56] Properly done, such standards are quantifiable and clear, and are therefore less susceptible to interpretation by the uninitiated.[57]

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51. *See id*. In that respect, a marketplace closely resembles Community Benefits Agreement negotiation, *cf. supra,* note 44 and accompanying text, except for the fact that the goods available for exchange (the rights of stakeholders sought to be protected from negative development impacts) are specified in advance under the terms of the performance zoning ordinance.

52. Ottensmann, *supra* note 19, at 40.

53. *Id.* Public objectives can include such items as demand on community facilities, impacts on schools, utilities infrastructure, roads, and burden on police and fire protection, parks, and hospitals, *see* STOCKHAM, *supra* note 7, at 18. The explicit nature of the standards is that the "devil in the details." For instance, the City of Palo Alto adopted an ordinance section labeled "Performance Criteria" for rental housing, commercial, manufacturing and planned community districts, *see* PALO ALTO, CAL., MUNI. C. Tit. 18, ch. 18.23 (2007)

54. *See* Ottensmann, *supra* note 19, at 41.

55. *See, e.g.*, STOCKHAM, *supra* note 7, at 21–22 (describing a performance zoning standard relating to land capacity, a dimensional requirement based on the presence of utilities and soils limits for onsite disposal of sewage effluents stemming from surveys of soil limitation "classes"). Such a capacity determination stipulates what requirements must be met for development in view of certain slope conditions. *See id.*

56. *See id.* at 41.

57. *See* Frew, *supra* note 46, at 241; RICHMOND RPDC, *supra* note 37, at 18. Craig Arnold distinguishes between "primitive" and "precision" standards, with the former limiting nuisances like odors, noise, gas, heat, glare, smoke, and other impacts beyond boundary lines that are more difficult to enforce, whereas precision standards distill scientific or engineering data that is more accurate and objective, leaving less discretion to a community zoning administration. *See* Craig A. Arnold, *Planning Milagros: Environmental Justice and Land Use Regulation*, 76 DENV. U. L. REV. 1, 118 (1998); *see also* Blackwell, *supra* note 8, at 616–17; STOCKHAM, *supra* note 7, at 5–6 (noting that while some standards are precise, they cannot be true "performance standards" unless they deal directly with the effect or impact of a proposed use's activity).

Quantification enables stakeholders in planning to better visualize the functions and appearances of their communities and thus to increase citizen inputs.[58] Further, standards provide a path to preserve a community's environmental features and to enhance its green infrastructure[59] through better site-planning.[60]

This is illustrated in Berlin's *Biotopflächenfaktor*, which aims to enhance the city's sustainable site design on private property by analyzing a project's "green area ratio"[61] (GAR). A GAR consists of three elements: (a) a set of ratings, (b) a set of targets, and (c) a ratio derived for each parcel or project. Land use regulators set the first two elements. The third element, a calculation generated by the parcel owner, establishes how the tract's GAR plan meets formulated targets.[62] For element (a), planning professionals rate sustainability techniques in property development by weighing or prioritizing each technique according to its environmental serviceability. For element (b), administrators set the minimum percentage of each parcel's area incorporating green infrastructure and related environmental services. These metrics mandate the preservation of existing on-site "green" amenities while encouraging the introduction of new green technologies such as those described in Part IV.[63]

Berlin's GAR point system promotes technology combinations, affording developers choice and flexibility in meeting on-site requirements.[64] Calculations allow developers to evaluate various scenarios to achieve the GAR plan's implementation.[65] The property owner or developer submits a GAR plan to the city, together with building permits' initial drawings, for plan approval.

Performance zoning, being inherently flexible, affords a business–friendly atmosphere without undermining a community's character.[66] By reducing community conflict undergirding Euclidean zoning scheme "contests,"[67] scarce time

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58. *Cf.* Arnold, *supra* note 57, at 118 (noting that performance standards offer communities a tool).

59. Compatible green infrastructure in urban areas consists of elements such as conventional street-side landscaping (trees and shrubs), green roofs, green facades, permeable pavements, rain gardens, and stormwater treatment swales. *See* Melissa Keeley, *The Green Area Ratio: An Urban Site Sustainability Metric*, 54 J. ENVTL. PLAN. & MGMT. 937, 938 (2011).

60. *See id*.

61. *See id.* at 939.

62. *See id.* at 940. Berlin's GAR solution seems to have answered whether quantifying vertical surfaces with accuracy would prove too difficult. *See* STOCKHAM, *supra* note 7, at 15.

63. *See* Keeley, *supra* note 59, at 948. Based upon allowable lot coverage, Berlin's target values dictate how much green infrastructure must be integrated on a site. *See id.* at 948. This approach avoids the ephemeral question of how much green infrastructure or environmental services is "sufficient." *See id*. Keely observes that overly ambitious greening targets could push community development outward to less densely developed areas where developer compliance costs are more reasonable. *See id*.

64. *See id*. at 951.

65. *See id*.

66. *See* RICHMOND RPDC, *supra* note 37, at 18.

67. *See* Michael N. Widener, *Land Use Consultations Advancing Therapeutic Jurisprudence: Ripe for Clinical Trials*, 18 CARDOZO CONFLICT RES. J. 85, 89–90 (2016) [hereinafter Widener, *Consultations*]; Michael N. Widener, *Shared Spatial Regulating in Sharing-Economy Districts*, 46 SETON HALL L. REV. 111, 176–85 (2015) [hereinafter Widener, *Regulating*].

and fiscal resources can be focused on quality development instead of on rallying opposition, lobbying governments, and exhausting appeals.[68] Seattle adapted Berlin's GAR system within its land use regulatory scheme in late 2006, labeling GAR as the "Seattle Green Factor."[69] Implemented in 2007 and revised in 2009, the Seattle Green Factor calculates point values for each functional element (such as rain gardens, green roofs or walls, and storm-water planters) occupying any new non-residential project larger than four thousand square feet or any new parking lot containing more than 20 stalls.[70] The city's project requirements call on developers to implement a certain number of "functional systems," rather than requiring adherence to prescriptive standards. This choice of systems enhances design diversity while encouraging connections between architectural form and landscape to improve municipal ecological systems.[71] Seattle's planners develop greening targets relating to the landscaping potential for each zone,[72] but focus on on-site amelioration of development impacts through increased green infrastructure.[73]

Because performance zoning dispenses with the numerous, narrowly-defined, and highly-specific use districts typical of prescriptive zoning, it allows all possible uses while establishing a uniform system of performance standards (such as the Seattle Green Factor) throughout a jurisdiction.[74] Some systems of performance zoning specify a relatively small number of generalized zones, with broad restrictions on types of use and varying standards allowed in each particular zone.[75] Limiting the number of zones reduces the magnitude of rezoning requests while freeing bureaucracies from endless staff updating on standards of review, administrative paperwork, and conserving time devoted to processing cases and approving site plans.[76]

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68. *See* RICHMOND RPDC, *supra* note 37, at 18; *cf.* Widener, *Consultations*, *supra* note 67.

69. *See* Keeley, *supra* note 59, at 953; Seattle, Wash. Ordinance 122311 (Dec. 21, 2006). The ordinance amended all commercial and neighborhood commercial districts and the industrial commercial district within urban village or urban center boundaries. *See* SEATTLE, WASH., MUN. CODE §§ 23.47A.016, 23.50.038 (2006).

70. *See* JASON HIRST ET AL., BERGER P'SHIP, FUNCTIONAL LANDSCAPES: ASSESSING ELEMENTS OF SEATTLE GREEN FACTOR 1–2 (2008), http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/dpds021359.pdf; *see* Brown, *supra* note 26, at 79–80.

71. HIRST, *supra* note 70, at 1.

72. *See* Keeley, *supra* note 59, at 953.

73. Seattle is not alone in its fervor for green infrastructure; Indy Rezone, Indianapolis-Marion County's new zoning code adopted in 2015, introduces a tool into the plan submittal and review process changing landscaping plan requirements from simply depicting placement of vegetation on a site to a more integrated functional landscape. Green Factor values (with scoring) have been established for all zones other than single family districts. *See* INDIANAPOLIS - MARION COUNTY, IND., CODE OF ORDINANCES § 744-509 (2016).

74. *See* Frederick W. Acker, Note, *Performance Zoning*, 67 NOTRE DAME L. REV. 363, 370 (1991); Ottensmann, *supra* note 19.

75. KENDIG, *supra* note 7, at 306.

76. *See* RICHMOND RPDC, *supra* note 37, at 18; Acker, *supra* note 74, at 384.

In achieving public objectives relating to land use, performance zoning is more flexible and ultimately more powerful than traditional Euclidean zoning.[77] Performance standards can achieve virtually any legitimate public objective, including the goal of environmental justice.[78] In a 2003 report to the U.S. Environmental Protection Agency, the National Academy of Public Administration noted that performance zoning strategies would substantially advance this goal and recommended that local governments "adopt more flexible zoning techniques, such as . . . [u]sing performance zoning to regulate the adverse impacts of nuisance-like activities, such as noise and odor . . . ."[79] Increased flexibility also allows land development and use to be more responsive to market forces, resulting in economically efficient outcomes.[80] Furthermore, performance zoning provides a framework to enable exchange of certain market-based rights while preserving public objectives sought by local land use control.[81] Consequently, in the 21st century, performance standards' malleability better dovetails with incorporating emerging technologies in the realty construction and building performance fields.[82]

C. CHALLENGES FOR PERFORMANCE ZONING PROCESSES: THE LUDDITES' LAMENT?

One common critique of an outcome-mitigation regulatory orientation is that though performance zoning may be more flexible than its land-use categorization predecessors, it is difficult to administer due to its concurrent complexity and indeterminacy.[83] Writing precise but adequately specific standards and adminis-

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77. *See* STOCKHAM, *supra* note 7, at 33–35.

78. *See* Keeley, *supra* note 59, at 952. Keely notes that when the environmental impacts of new development are defrayed at the source, instead of "shared" among the other users of city infrastructure, disproportionate burdening of those who cannot afford to share in the environmental costs of development is mitigated. *See id.* However, Keely also notes that GAR may negatively impact provision of affordable housing and residential opportunity diversity. *See id*.

79. *See* NAT'L ACAD. PUB. ADMIN., ADDRESSING COMMUNITY CONCERNS: HOW ENVIRONMENTAL JUSTICE RELATES TO LAND USE PLANNING AND ZONING 19 (2003).

80. *See* Ottensmann, *supra* note 19, at 40.

81. *See* Martin Jaffe, *supra* note 6, at 3. The removal of use restrictions allows the market to promote better integration among housing type, commerce, and industry. *See* STOCKHAM, *supra* note 7, at 35. Accordingly, industry (for one) will be induced to adopt new conventions to minimize plant nuisance generation and improve appearance. S*ee id.* at 36.

82. *See* Cary Coglianese et al., *Performance Based Regulation: Prospects and Limitation in Health, Safety and Environmental Protection*, 55 ADMIN. L. REV. 705, 711 (2003); *see infra* text accompanying notes 321–322; *infra* Part V.

83. *See, e.g.*, ELLIOTT, *supra* note 35, at 25–26; Jourdan et al., *supra* note 20, at 336; Alan C. Weinstein, *Performance Zoning: A Silver Anniversary Evaluation*, 21 ZONING & PLAN. L. REP. 7, 56–57 (Jul.–Aug. 1998); STOCKHAM, *supra* note 7, at 39–41. Elliott explains that the untrained planning staff in some circumstances lacks technical expertise, and thus would have to "take the builder's word for it" on issues of compliance with performance standards. A recent illustration of public concern about this type of flexibility arose in the Millennium Hollywood Project in Los Angeles, which was the subject of a "Land Use Equivalency Program." *See* Millennium Hollywood Project, *Land Use Equivalency Project*, CITY OF LOS ANGELES, http://clkrep.lacity.org/onlinedocs/2013/13-0593_misc_07-11-2013.pdf (last visited Jan. 30, 2016).

tering them were time-consuming when performance zoning was first introduced to community regulators;[84] such activities required extensive research and a deft political touch in calming the development community's opposition to proposed standards.[85] According to critics, this explains why no major city replaced Euclidean zoning with performance zoning "across the board,"[86] although Chicago has applied performance-based provisions to industrial zoning districts.[87] In the 1980s and 1990s, skeptics decried local administrators' unfamiliarity with technical specifications in the adoption and monitoring of standards' compliance.[88] Concerns arose that planners would fail to grasp the effects that performance standards might have on a project's visual impacts, or that standards might collectively and unduly restrict development intensity.[89] There was doubt as to predictability for planners' forecasting future growth patterns because a community's zoning map would lose all predictive function.[90]

This critique predated the widespread use of the Internet[91] (including the Internet of Things, featuring microprocessor-driven sensors), camera devices, and machine (artificial) intelligence. But today local planners can learn by sharing existing research and so-called best practices, using direct communications with counterparts operating in the sustainability performance-standards realm, or via online seminars. Sophisticated knowledge of the technology supporting these techniques vastly outstrips land-planner acumen of twenty-five years ago, supported by the rise of advanced digital communications, algorithms for performance metrics analysis and measurement devices.

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84. *See* Jourdan et al., *supra* note 20, at 337–338 (lamenting the discomfort of relying on either administrator or developer discretion to interpret vague standards); Coglianese, *supra* note 82, at 714–715; Dan Tasman, *One-district Zoning and Performance Zoning: Hey, Planners, Remember the Eighties?*, CYBURBIA FORUM THREAD (June 22, 2011), http://www.cyburbia.org/forums/showthread.php?t=44518; STOCKHAM, *supra* note 7, at 40.

85. ELLIOTT, *supra* note 35, at 25.

86. *See* STOCKHAM, *supra* note 7, at 23.

87. *See* Henry B. Madsen, *Noncumulative Zoning in Illinois*, CHI.-KENT L. REV. 108, 112 n.8 (1960); Ottensmann, *supra* note 19, at 40. The 1957 Comprehensive Amendment to the Chicago Zoning Ordinance of 1923, Article 4, was the performance-based ordinance premised on O'Harrow's criteria. *See* STOCKHAM, *supra* note 7, at 28–29. Palo Alto, California, has adopted performance criteria across districts other than single-family zones. *See* Ottensmann, *supra* note 19, at 41.

88. *See, e.g.,* Tasman, *supra* note 84 (noting performance zoning was horrible for place-making, exacerbated dependence upon motor vehicles and enabled a lack of connectivity [between places]; and it was "unpredictable and a nightmare to administer"); STOCKHAM, *supra* note 6, at 41 (describing problems of a technical nature about measuring impacts).

89. *See* RICHMOND RPDC, *supra* note 37, at 18.

90. *See* STOCKHAM, *supra* note 7, at 43. In 1974, Stockham dismissed this contention based on his belief that zoning maps had little predictive power. *See id.*

91. Prior to the 2013 publication of the Jourdan et al. study, *supra* note 20, prior performance zoning commentary was concentrated prior to and in the early 1990s. *See, e.g.*, DOUGLAS R. PORTER, PATRICK L. PHILLIPS & TERRY J. LASSAR, FLEXIBLE ZONING: HOW IT WORKS 11, 95–96 (1988) (identifying case studies on the basis of local officials' interviews); Martin Jaffe, *supra* note 6, at 3; Acker, *supra* note 74.

On those occasions when community administrators feel standards adoption is inadequate, trade groups of contractors and property developers, together with professional associations in the engineering and design fields, can aid in developing suitable specifications addressing the adverse impacts of densely-developed projects. Indeed, many such standards already exist. For example, in the realms of ambient noise caps, street configurations accommodate commercial vehicular and pedestrian traffic patterns and parking burdens.[92] In the European Union, the desire to understand the impacts of land use changes on sustainability has led to development of the Impact Assessment guidelines for Sustainable Impact Assessments, a component of the EU Sustainable Development Strategy,[93] affording spatial regulators a number of reference points. The EU's desire to integrate economic, environmental, and social issues in assessing impacts of land policy decision-making drove the Land Use Functions conceptual framework. The framework consists of a large set of indicators and ultimately condenses them into nine discrete Land Use Functions.[94] Outcomes for sustainability are predicted by comparing values of the indicators with corresponding sustainability limits and thresholds, and then analyzing how a particular policy option stimulates or hinders a Land Use Function.[95] In short, regulators can predict the impacts of implementing a proposed spatial policy option on the prevalent land uses in a region, and thus evaluate probable sustainability results before making a final land use decision.[96]

Monitoring standards have achieved greater precision as well. In 2011, the U.S. General Services Administration (GSA), together with the U.S. Department of Energy, analyzed building performance in 22 federal buildings.[97] They analyzed factors such as carbon dioxide equivalent emissions, aggregate opera-

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92. *See, e.g.*, Nat'l Ass'n City Transp. Officials, *Bicycle Boulevards*, *in* URBAN BIKEWAY DESIGN GUIDE (2d ed. 2012), https://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/; INST. OF TRANSP. ENG'R & CONG. FOR NEW URBANISM, DESIGNING WALKABLE URBAN THOROUGHFARES: A CONTEXT SENSITIVE APPROACH (2010).

93. *See* Marta Perez-Soba et al., *Land Use Functions –A Multifunctionality Approach to Assess the Impact of Land Use Changes on Land Use Sustainability*, *in* SUSTAINABILITY IMPACT ASSESSMENT OF LAND USE CHANGES, 377 (Katharina Helming et al., eds., 2008) [hereinafter "SIA"].

94. *See id.* at 378. This ecosystem function-based approach inquires about how environmental quality influences human well-being, while assuming that the environmental impacts society and economics. *See id.* at 379.

95. *See id.* at 381. The nine Land Use Functions, identified by an interdisciplinary group of European experts, are described by the authors in detail, *see id.* at 382-9. Sustainability limits are defined as a level of "unacceptable damage of a pressure on a social, economic or environmental system based on current knowledge," and these limits can be quantitative or qualitative, being scientifically justified. *See id.* at 397.

96. *See id.* at 381. Thus, the EU continues to develop a conceptual framework assessing impacts of simulated (proposed) decisions on the sustainability of land use at various levels of spatial aggregation, leading to stimulating efficient resource allocation. *See id.* at 400. This undoubtedly represents a commendable effort in regional-scale regulation, advantageous where spatial planning administrators tend to operate in geographically larger territories.

97. GSA PUB. BLDGS. SERV., GREEN BUILDING PERFORMANCE: A POST-OCCUPANCY EVALUATION OF 22 GSA BUILDINGS (2011), https://www.gsa.gov/graphics/pbs/Green_Building_Performance.pdf.

tions costs for electricity, gas and water usage, waste generation and recycling costs, occupant commute times, and occupant satisfaction.[98] The GSA concluded it could successfully monitor building compliance and contrast these public buildings' performance with comparable structures in the private sector. Nothing prevents local governments from following the GSA's lead in testing performance against established standards for resource conservation and energy savings of privately-owned buildings. The application of unbiased, intelligent instruments of control, governing complex systems of data-generating sensors, can also advance monitoring capabilities and ensure developer compliance with mitigation obligations.[99] As demonstrated in Chicago, local authorities can achieve this as easily as their federal counterparts. Chicago compiled and disclosed the results of a 2014 survey of large commercial building performance standards in its Energy Benchmarking Report.[100] This work began with Chicago adopting its Building Energy Use Benchmarking Ordinance in 2013.[101] For 2015, the Ordinance required owners and managers of commercial (and municipal) buildings larger than fifty thousand square feet to report their buildings' performance via "property profiles" on a City Web interface and to detail their whole-building energy use data (derived from utility provider bills) for calendar year 2014.[102] This ordinance enabled the City to implement the Retrofit Chicago's Commercial Building Initiative, under which participating owners and managers will voluntarily attempt to increase energy efficiency in older, large commercial buildings by twenty percent within five years.[103]

The technology tools to gauge performance exist today, but arguments against performance-based zoning persist. In a 2011 paper, Professor Michael Wolf cautioned against incorporating LEED or like "privately-generated standards"

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98. *See id.* at 2.

99. *See* ALFREDO ANDIA ET AL., POST-PARAMETRIC AUTOMATION IN DESIGN AND CONSTRUCTION 30 (2015) (noting that today's sophisticated building automation systems operate using intelligent agents and machine-learning algorithms); Alexandre Nassiopoulos & Frederic Bourquin, *Real-Time Monitoring of Building Energy Behavior: A Conceptual Framework*, PROC. 4TH NAT. CONF. IBPSA-USA, New York, NY 24, 30 (Aug. 11-13, 2010) (suggesting low-cost, easily installed monitoring systems allowing quantifying of heat transfers between the building and its environment and among different components of the building envelope to measure energy consumption).

100. *See* CITY OF CHICAGO, BUILDING ENERGY BENCHMARKING REPORT (2014), http://www.cityofchicago.org/content/dam/city/progs/env/EnergyBenchmark/2014_Benchmarking_Report_Final.pdf (last visited May 12, 2017). Energy benchmarking is comparing a building's current energy performance with its energy baseline, or its energy performance with that of similar buildings. *See id.* at 4.

101. *See* Chi., Ill., Mun. Code §§ 18-24-101.1–102.3 (2013).

102. *See Chicago Energy Benchmarking, Benchmarking Guide, Step-by-Step Compliance Instructions for 2017,* CITY OF CHICAGO (2017), https://www.cityofchicago.org/content/dam/city/progs/env/EnergyBenchmark/2017_Chicago_Benchmarking_Guide.pdf.

103. *See About the Retrofit Chicago Energy Challenge,* RETROFIT CHICAGO, http://www.retrofitchicago.net/ (last visited Nov. 5, 2017); Ellen Bell, *Meeting Retrofit Chicago's Energy Goals: Three Key Constituencies*, FORBES ENERGY (Feb. 12, 2014), http://www.forbes.com/sites/edfenergyexchange/2014/02/12/meeting-retrofit-chicagos-energy-goals-three-key-constituencies/.

into local government law.[104] Admonishing land use regulators, he said:

(a) That local laws should not be based on moving targets, particularly privately-derived standards that continue evolving;[105]
(b) That local officials, burdened with many responsibilities, may not be equal to the task of incorporating these standards and overseeing their implementation;[106]
(c) That adoptable standards (if any) should be incorporated into *state* law for purposes of community-based uniformity;[107] and
(d) That builders, architects and "industry experts" ought not to shape planning and zoning ordinances.[108]

Addressing Wolf's reservations in reverse, here are reactions derived from real life: Why must a career building official from Lander, Wyoming, be a better authority for shaping another city's performance standard than an engineer practicing in the resource sustainability field in Los Angeles, the site of a proposed project? Sustainability advances must build on best practices in technological applications to energy savings.[109] The goal is not to maintain a sinecure of public officialdom. Governments adopt private industry standards in local ordinances fairly often,[110] whereas other government regulations incorporate a private-industry standard by reference.[111] Although one cannot claim that the International Code Council's (ICC) suite of International Building Codes (IBCs) are "private industry" standards (after all, a final adoption vote is reserved to public enforcement officials),[112] the ICC's process allows for broad participation in uniform code writing and in testimony regarding proposed code revisions.[113] That suite of IBCs results from hundreds of individual inputs, many coming from private sector trade associations like America's national societies of civil and mechanical engineers.

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104. Michael Allan Wolf, *A Yellow Light for "Green Zoning": Some Words of Caution About Incorporating Green Building Standards into Local Land Use Law*, 43 URB. LAW. 949, 951 (2011).

105. *See id.*

106. *See id.* at 952.

107. *See id.*

108. *See id.* In fairness to Wolf, he resolves all these issues in the negative, meaning these four points, he argues, are sufficient to avoid using LEED® as a performance standard (to that degree, I concur). *Id*. at 957, 964, 968, 973. Wolf's argument recapitulates objections to performance zoning from years past. *See supra* notes 84 through 91 and accompanying text; *see also* Schindler, *supra* note 23.

109. *See* WORLD BUSINESS COUNCIL FOR SUSTAINABLE DEVELOPMENT, ENERGY EFFICIENCY IN BUILDINGS—TRANSFORMING THE MARKET 8–9, 60 (2009), http://www.wbcsd.org/Projects/Energy-Efficiency-in-Buildings/Resources/Transforming-the-Market-Energy-Efficiency-in-Buildings.

110. *See* Lytton, *supra* note 23, at 540–41.

111. *See id.* at 564. To be sure, governments grant tacit approval to this process when electing to have the private sector set standards on its own.

112. *See* INTERNATIONAL CODE COUNCIL, CP#28-05 CODE DEVELOPMENT § 9.1 (2014), https://www.iccsafe.org/AboutICC/Documents/CP28-05.pdf.

113. *See id.* at §§ 1.2, 5.4.3.

Uniform standards for energy efficiency and other sustainable dimensions of land development are welcomed by the private sector when timely imposed. Compliance with performance standards is simplified if there is only one regimen to be followed. In that event, architects and builders only have to refer to (and occasionally seek relief from) a single, statewide-endorsed code.[114] But the capacity of state governments to iteratively adopt performance standards is outpaced by the velocity of technological change.[115] Elected officials often prefer incrementally-driven, reactive policies.[116] Proactive approaches require officials to make difficult policy choices (often balancing inputs from communities with vastly disparate needs and agendas) and to trust others in government agencies to execute them according to their intentions.[117] Accordingly, elected officials too often find it prohibitively costly to be proactive in policy adoption;[118] their habit of "reaction" ensures that many standards addressing what becomes a steady stream of innovation becomes essentially obsolete prior to their adoption dates.

The Phoenix City Council adopted zoning standards for 3G cellular technology (wireless voice telephony) in 2009[119] after months of study and numerous inputs, barely before the wireless communication industry announced the implementation of 4G (fourth generation) technology[120] (accommodating handsets' data services) on cellular towers and similar vertical facilities. Personal wireless's newer 4G technology requires substantially larger (eight feet tall) and more antennae (six versus the formerly-conventional three antennae). Notably, the technology shift from 3G to 4G LTE is transitional. Many wireless customers still use products only compatible with 3G technology, which forces carriers to

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114. *See, e.g.,* S. Assemb. 802, 2015 Leg. (Cal. 2015), http://www.energy.ca.gov/benchmarking/documents/AB_802_benchmarking_provisions.pdf. This bill requires public utilities to provide energy consumption data for covered buildings to the building owners upon their request, and requires the Energy Commission to establish a building energy use benchmarking and public disclosure program for commercial and multifamily residential buildings types of greater than 50,000 square feet.

115. Vivek Wadhwa, *Laws and Ethics Can't keep Pace with Technology*, MIT TECH. REV. (Apr. 15, 2014), http://www.technologyreview.com/view/526401/laws-and-ethics-cant-keep-pace-with-technology/.

116. *See, e.g.*, ROGER H. DAVIDSON, WALTER J. OLESZEK & FRANCES E. LEE, CONGRESS AND ITS MEMBERS 415 (13th ed. 2012).

117. *See id.*

118. *See id.*

119. *See* PHOENIX, ARIZ., ZONING ORDINANCE § 715 (Apr. 3, 2009). Phoenix was not alone in being "behind the curve" among local governments. *See* JAMES B. MURRAY, WIRELESS NATION: THE FRENZIED LAUNCH OF THE CELLULAR REVOLUTION IN AMERICA 315 (2002).

120. MetroPCS became the first operator to offer 4G LTE service in the United States in 2010, and LTE Smartphones first arrived on the scene in early 2011. *See MetroPCS Launches First 4G LTE Service in the U.S.*, MOBILE TECHNEWS (Sept. 22, 2010), http://www.mobiletechnews.com/info/2010/09/22/114437.html. As a result of the dated city ordinance provisions, dozens of applications for special exceptions moved through Phoenix's zoning adjustment process so that LTE implementation could take place when the carriers' antennas and related instrumentation was ready for installation. In short, insufficient time was available to rework the zoning ordinance to make new antennas permissible as of right in many zoning districts.

provide both 3G and 4G antennas on their towers[121] and thus requires a total of some nine antennas being mixed for placement on each cellular tower. Disruption in communications technology does not render early adoption of Phoenix's wireless communications zoning standards foolhardy, wasteful, or even "premature." The point is that obsolete-on-arrival regulations require ongoing community determination of non-conforming status, investment of time in ordinance interpretive analysis, and perhaps zoning adjustment.[122] If cities are slow in adapting to rapidly-morphing technologies, we must assume that states (still larger bureaucracies) will be equally slow if not slower still.[123]

Few question that local regulators have full plates and are often understaffed.[124] As Professor Wolf and his forebears have noted,[125] mid-level technical and management staff, at times, lack sufficient technological training to run analytical equipment to assess performance. But, if the community intends to be competitive, can it afford not to invest in its employees' ongoing training?[126] Should not the private sector (also seeking competitive advantages over rival employers in other communities) be willing to participate in that training by offering temporary internship-type opportunities through which public employees may develop facility with breaking technologies, sensors, and related advances?[127] This challenge's solution turns on a community's determination to incentivize development and productivity, to lure knowledge workers into higher paying jobs. Such an agenda mandates redirected community investment into the public sector's training of its personnel in sustainability-initiative leadership.[128]

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121. *See, e.g.*, David Goldman, *Verizon is Killing Off 3G*, CNNMONEY (Dec. 4, 2014), http://money.cnn.com/2014/12/04/technology/mobile/verizon-killing-off-3g/ (noting that wireless carriers have been forced to simultaneously maintain three networks, 2G, 3G and 4G, an expensive and incredibly inefficient task, since 4G networks are able to cram significantly more data into their wireless spectrum than 3G and 2G networks combined).

122. *See, e.g.*, Letter from Tricia Gomes, Zoning Administrator, Phoenix Planning and Development Department, to Drew Huseth (Sept. 10, 2015) (on file with Georgetown Environmental Law Review). Zoning adjustment may shape land use regulation to an even greater extent as 5G technology becomes widely available to consumers by 2019, *see* Matt Lopez, *Guest: How 5G Will Shake Up Marketing in a Digital Era*, VIDEOINK, Nov. 17, 2017, https://www.thevideoink.com/2017/11/17/guest-5g-will-shake-marketing-digital-era/.

123. *See* MARIANA MAZZUCATO, THE ENTREPRENEURIAL STATE: DEBUNKING PUBLIC VS. PRIVATE SECTOR MYTHS 6 (2014).

124. *See, e.g.*, Andrew Scutro, *Head of Understaffed Planning Department says the Shortage of Affordable Housing is the Root Cause of Development Bottleneck*, MONTEREY CO. WKLY. (Nov. 29, 2001), http://www.montereycountyweekly.com/news/local_news/head-of-understaffed-planning-department-says-the-shortage-of-affordable/article_cf744767-48bb-534c-a733-431d794dd144.html.

125. *See supra* text accompanying notes 85–92 and 107–112.

126. *See* AMERICAN PLANNING ASSOCIATION, SMART CITIES AND SUSTAINABILITY INITIATIVE 29 (2015), https://planning-org-uploaded-media.s3.amazonaws.com/legacy_resources/leadership/agendas/2015/spr/pdf/SmartCitiesSustainabilityFinal.pdf.

127. This might resemble the Research Experience in Carbon Sequestration, incorporating private and public partners and sponsors. *See RECS Sponsors and Partners*, RESEARCH EXPERIENCE IN CARBON SEQUESTRATION, http://www.recsco2.org/sponsors (last visited May 13, 2017).

128. *See* Yamuna Kaluarachchi, *Challenges to Leaders Promoting Innovative and Sustainable Social Housing in the UK*, LEADERSHIP AND SUSTAINABILITY IN THE BUILT ENVIRONMENT 109–110 (ALEX OPOKU & VIAN AHMED EDS., 2015).

When untrained local governments' staff lacks skill sets and other resources to conduct municipal audits of developer compliance, these analyses can be outsourced to other persons and their equipment. The Internet of Things implants microprocessors in myriad devices to provide internal building management or outside parties with rich reporting of performance metrics in real time.[129] By applying tested algorithms in the not-distant future, machine intelligence will monitor performance and adjust as needed to ensure compliance with water, power and other grid-like utility conservation standards.[130] Sensors embedded in curbs or street lamp supports can track traffic volumes and parking stalls' availability, verifying whether project developers are adequately mitigating impacts of greater vehicle density.[131] Although many jurisdictions are technologically positioned to implement performance zoning, their legislatures may struggle to abandon the "tried and true systems" imbedded in prescriptive land use regulatory environments.[132]

Professor Wolf's chief reservation seems to be the difficulty of deciding which version of an iterative performance standard ought to apply; he implies that there should be a "fixing" before each performance standard is implemented, eliminating moving targets in standards' adoption and application. But it constitutes neither failure in sustainability initiatives, nor wasted community resources to make use of sensory technology advances to iteratively adopt progressively more sophisticated performance standards.

A compelling aspect of digital technology is that it forces measurement, accuracy, and other performance standards to rise in an upward arc. The point of technology is to make human lives more convenient and of higher-quality. Successive technological advances are bound to improve our ability to quantify impacts of project energy efficiency.[133] That does not render earlier iterations of sensors (and their readings), algorithms, and programs untrustworthy or ill-suited for sustainability policy optimization through performance standards adoption. Equally, zoning performance standards are not "unworthy" of initial adoption due to their eventual obsolescence—even if they are replaced closely after their original adoption dates.[134]

No performance standard ever serves as the "last word" in measurements of optimal project performance in energy efficiency, and that is a welcome opportunity. Consider, for instance, Vehicle Miles Traveled (VMT), a metric of energy

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129. *See* Michael Totty, *The Rise of the Smart City*, WALL ST. J. (Apr. 17, 2017), https://www.wsj.com/articles/the-rise-of-the-smart-city-1492395120. *See also* Part V.C., *infra*.

130. *See id.*

131. *See* notes 318–20, and accompanying text, *infra.*

132. *See* Michael E. Porter, *The Competitive Advantage of the Inner City*, HARV. BUS. REV. (May 1995), https://hbr.org/1995/05/the-competitive-advantage-of-the-inner-city.

133. *See* NATIONAL ACADEMY OF SCIENCES ET AL., REAL PROSPECTS FOR ENERGY EFFICIENCY IN THE UNITED STATES 109–10 (2010).

134. *Cf.* text at notes 121–26 *supra*.

consumption, air pollution and greenhouse gas (GHG) emissions contributing to global warming,[135] This metric has been slow to attain credibility as a per-capita determinant of community sustainability. Though VMT per capita is a primary performance indicator for land use and transportation systems, land regulators understand that population, income, and gasoline prices are primary indirect factors impacting VMT, and development density is the primary direct driver.[136]

The apparent effectiveness of land use policies is unclear, although several factors (such as compact, mixed-use development, smaller block lengths, and infill development) potentially influence the connection between built-environment shifts and VMT change, and so might urban area size, existing built-environment characteristics and transit service coverage and quality.[137] Higher development densities and per capita transit use combined seem calculated to produce lower VMT; however, the impact of transit ridership seems outstripped by the so-called "land use multiplier" of higher density development.[138] The uncertainty in applying a cross-sectional analysis is that it establishes just one correlation without proving, for example, that increased light rail ridership reduces VMT.[139] Although VMT as a metric today will not determine whether a project's sustainability design is better than other conceivable designs, VMT for now is the best available gauge of sustainability among many other community transportation metrics—until better algorithms and analyses inevitably arise. So, there is no logic in disregarding the best-available metric because it is not irrefutably accurate.

Iterative improvement in performance standards development is not hostile to planning concepts. General plans are aspirational reflections of community goals;[140] and mandating vehicle trip reduction within projects is a legitimate goal even though the best measure of its attainment may not be perfectly understood today. A community's ordinance may assert that sustainability metrics govern compliance with performance standards when filing any project's building permit

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135. *See generally* LOUISE BEDSWORTH ET AL., DRIVING CHANGE: REDUCING VEHICLE MILES TRAVELED IN CALIFORNIA, PUBLIC POLICY INSTITUTE OF CALIFORNIA 1–3 (2011), http://www.ppic.org/content/pubs/report/R_211LBR.pdf.

136. *See* Reid Ewing et al., *Combined Effects of Compact Development, Transportation Investments, and Road User Pricing on Vehicle Miles Traveled in Urbanized Areas*, 2397 TRANSP. RES. REC.: J. TRANSP. RES. BD. 117, 123 (2014).

137. *See* Lei Zhang et al., *How Built Environment Affects Travel Behavior: A Comparative Analysis of the Connections Between Land Use and Vehicle Miles Traveled in U.S. Cities*, 5 J. TRANS. & LAND USE 40, 50 (2012).

138. *See generally* Reid Ewing & Shima Hamidi, *Longitudinal Analysis of Transit's Land Use Multiplier in Portland (OR)*, 80 J. AM. PLAN. ASSN. 123 (2014).

139. *See* Reid Ewing et al., *Effects of Light-Rail Transit on Traffic in a Travel Corridor,* 17 J. PUB. TRANS. 93, 111 (2014). Using the analytics of big data, "correlation" imparts that *if* A occurs, B is likely to result; in contrast, causation or "proof" means that *since* A occurs, B occurs, *see* MARTIN FORD, RISE OF THE ROBOTS: TECHNOLOGY AND THE THREAT OF A JOBLESS FUTURE 88–89, 102 (2015).

140. *See* Michael N. Widener, *Moderating Citizen "Visioning" in Town Comprehensive Planning: Deliberative Dialog Processes*, 59 WAYNE L. REV. 29, 31–32 (2012).

application.[141] The community can readily agree that if such "barriers to entry" prove too stringent when the developer files for permits, then *more lenient* performance standards adopted later in subsequent iterations of the general plan or specific parts of the zoning ordinance (including the Official Zoning Map), from their dates of adoption, will substitute as the applicable performance standards.

Millennials expect serial changes in technology and assume that game-changing innovations are forthcoming in short order.[142] Delaying implementation of iterative performance standards in zoning codes is unlikely to deter millennials from proceeding, except for those fixated upon uniformity of zoning standards for their own sake. These heavy consumers of technology wish to communicate and share data with the least inconvenience, and eagerly incorporate the latest devices and components of the Internet of Things into their daily lives.[143] Millennials likely are not concerned about whether local zoning codes "definitively" address the use of new technologies. What may seem like foolish impatience to some assumes greater significance on the frontiers of this generation of knowledge-workers that Americans hope will propel innovation, sustained job growth, and community economic prosperity. Millennials will seek increased opportunities to engage with land use regulators and those engaged in building efficiency improvements to ensure future land use policies mesh with (or at least do not hinder) new technological advances building towards social equity and inclusiveness.[144]

Opportunities for millennial engagement spurred in 2015. Initially, the Copenhagen Centre on Energy Efficiency with the World Resource Institute co-hosted the Building Efficiency Accelerator Round Table as part of the 3rd Livable Cities Symposium in Istanbul. These two organizations introduced the Building Efficiency Accelerator (BEA) of the Sustainable Energy for All initiative, allowing local governments to consider policy instruments in the building sector usable to improve energy efficiency.[145] During the 2015 Paris climate talks (COP21), leaders announced that the BEA will collaborate with the United Nations

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141. This is how IBC codes would be applied in communities; and an application form prepared by the community can indicate references to the codes for the unacquainted.

142. *See* Part IV, *infra*.

143. *See generally*, Totty, *supra* note 129, at R2; PEW RESEARCH CENTER, THE INTERNET OF THINGS WILL THRIVE BY 2025 (2014), http://www.pewinternet.org/files/2014/05/PIP_Internet-of-things_0514142.pdf.

144. *See* Zachary J. McDade, *How Millennials' Taste for Cities Can Build a More Inclusive Generation*, URB. INST. (June 17, 2015), http://www.urban.org/urban-wire/how-millennials-taste-cities-can-build-more-inclusive-generation.

145. *See C2E2 and WRI Co-organize Building Efficiency Accelerator Round Table*, COPENHAGEN CTR. ENERGY EFFICIENCY (Nov. 24, 2015), http://www.energyefficiencycentre.org/Nyheder/2015/11/C2E2-and-WRI-co-organize-Building-Efficiency-Accelerator-Round-Table?id=ea8c290c-41f0-478a-9ff2-2208f13b2f80. This "accelerator" initially was proposed at the 2014 UN Climate Summit. *See* SANDER CHAN ET AL., STRENGTHENING NON-STATE CLIMATE ACTION: A PROGRESS ASSESSMENT OF COMMITMENTS LAUNCHED AT THE 2014 UN CLIMATE SUMMIT (Nov. 2015), http://eprints.lse.ac.uk/64493/1/Working-Paper-216-Chan-et-al.pdf.

Sustainable Energy for All (SE4ALL) Energy Efficiency Platform and the Global Alliance for Buildings and Construction.

This coalition of public and private enterprise (involving national governments, international trade organizations, multinational companies, and other thought leaders) will engage twenty cities on policy implementation, focusing on modernizing building codes, project development, and scoring and monitoring building efficiency.[146] The BEA will generate strategies for cities' leadership groups from among these endeavors:

a. Codes and standards: Developing community policies for minimum requirements for energy-related design characteristics of buildings or their components.
b. Building energy targets: Aligning decision-makers toward common objectives, encourage accountability, and spur actions to improve energy performance in building operations.
c. Performance information and certifications: Gathering and interpreting data, baselines, evidence of transparency, and certifications of building performance.[147]

Peer networking for code officials, energy leaders, and facilities managers alike shortly will overcome any lack of knowledge among local government employees. While fully-prepared millennials take control of communities' spatial regulation apparatuses, the next subpart reminds readers why *prescriptive* zoning protocols are impractical during this period of unprecedented emphasis on urban sustainability in the realm of building efficiency.

D. LOCAL LAND USE ADMINISTRATION IMPAIRMENT OF DEVELOPER SUSTAINABILITY FOCUS

Separating regulatory authority based on disciplines (building, land use/zoning, environmental impact, sustainability, public health, transportation, utilities, etc.) or jurisdictions rarely matches the complex and interrelated realities of the regulated activities and their risks.[148] This has been a fundamental shortcoming in traditional local administration. For example, separating spatial planning

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146. *See* Nick Michell, *Countries Unite to Launch Global Alliance for Buildings and Construction*, DEV. FIN. (Dec. 4, 2015), http://www.devfinance.net/countries-unite-to-launch-global-alliance-for-buildings-and-construction/; Steer & Ishii, *supra* note 2, at 3; s*ee also* GLOBAL ALLIANCE FOR BUILDINGS AND CONSTRUCTION, https://globalabc.org/ (last visited Nov. 27, 2017).

147. *See* Eric Mackres, *Crowdsourcing Local Knowledge to Make Buildings More Efficient*, CITY FIX (Apr. 23, 2015), http://thecityfix.com/blog/crowdsourcing-local-knowledge-make-buildings-more-efficient-energy-workshop-eric-mackres/?utm_campaign=BuildingEfficiencyInitiative&utm_source=BEINewsletter_2015-06-11&utm_medium=email&utm_content=learnmore.

148. *See* DAVID EISENBERG & SONJA PERSRAM, LIVING BUILDING CHALLENGE: CODE, REGULATORY AND SYSTEMIC BARRIERS AFFECTING LIVING BUILDING PROJECTS 38 (July 29, 2009) [hereinafter BARRIERS], https://access.living-future.org/sites/default/files/photos/09-0729%20code%20paper%20Eisenberg%281%29.pdf.

from the regulation of land use (zoning, site plan review) and building permitting, as happens in many local governments, fragments the regulation of activities and outcomes that cross governance boundaries.[149] Transportation departments may object to the use of sustainability-based pervious pavements or alternative street designs minimizing hardscapes because these methods diverge from their currently accepted policies and standards.[150] Zoning laws in the Euclidean mold typically require more parking than sustainable land use and development practices recommend, particularly where there is suitable access to public transportation.[151] Reducing parking requirements advances urban densification in part by encouraging alternative modes of transportation; but reaching an agreement that denser cities are more sustainable[152] is difficult.

Developers with high-performance building goals frequently experience delays from appeals of requirements and broken-sequence approval processes, especially where multiple agencies conduct them.[153] Variances and special exceptions processes, and prosecuting court appeals of those discretionary devices, can lengthen project durations by years, resulting in costs developers cannot recover.[154] The sequencing and timing of approvals frequently present obstacles during permitting. Building permits typically are secured prior to the issuance of demolition permits, whether for existing building renovation and site demolition or deconstruction for new development.[155] The administrative provisions in building codes provide officials with invaluable authority and legal "backstopping" to apply judgment to interpret those codes; but conflicting policies toward codes enforcement arise across departments vying for hegemony or protecting "turf" within their bailiwicks.[156] Building officials may be unaware of rulings or changes setting new precedents for approval of a green design strategy.[157] Significantly, unfamiliarity with "green" alternative building systems often leads to permitting officials insisting on inappropriate changes, extra plan

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149. *See id.* at 38.

150. *See id.*

151. *See id.* at 39; *see generally* DAVID SHOUP, THE HIGH COST OF FREE PARKING 75–111 (updated ed. 2011).

152. *See* JOEL KOTKIN, THE HUMAN CITY: URBANISM FOR THE REST OF US 10–11 (2016); *see also* EDWARD GLAESER, TRIUMPH OF THE CITY: HOW OUR GREATEST INVENTION MAKES US RICHER, SMARTER, GREENER, HEALTHIER AND HAPPIER, 209–10, 217, 267–68 (reprt. ed. 2012).

153. *See* BARRIERS, *supra* note 148, at 38.

154. *See id*. at 40; STOCKHAM, *supra* note 7, at 38; *see also* John R. Nolon, *Mitigating Climate Change by Zoning for Solar Energy Systems: Embracing Clean Energy Technology in Zoning's Centennial Year*, 38 ZONING & PLAN. L. REP. 1, 6, 8 (2015), http://digitalcommons.pace.edu/cgi/viewcontent.cgi?article=1995&context=lawfaculty [hereinafter *Nolon 2015*].

155. *See* BARRIERS, *supra* note 148, at 40–42. Of course, some municipalities have "at risk" permitting systems for demolition or site grading, hardly satisfying approaches when large-scale development is contemplated.

156. *See id*. Professor Nolon finds that on the whole, local regulators' "barriers to solar energy system implementation are ubiquitous." *See also Nolon 2015*, *supra* note 154, at 2, 7 (observing that some barriers arise from lack of explicit use definitions, as in the case of solar energy systems).

157. *See* BARRIERS, *supra* note 148, at 40.

details or additional application requirements.[158] In summary, significant obstacles remain to adding decentralized alternatives into the mix of community approvals processes, even where those alternatives can ameliorate, in a more integrated fashion, inadequacies in centralized bureaucratic systems.[159]

Euclidean zoning regulatory processes are neither so precise nor ideal to foreclose thoughtful review of alternative methods for project approvals, to better address negative externalities. Furthermore, their anachronistic features impede community competitiveness, an overarching goal of today's municipalities—a fact no more evident than when zoning restrictions curb exciting neighborhood variety while spurring loss of amenity and convenience. This proposition is well-illustrated by the scarcity of small shops and cafes in denser residentially-zoned neighborhoods, and by limited choices existing in housing stock within single-family residential districts.[160] Part III explains the consequence of community competitiveness undergirding today's local administration of spatial regulation.

II. COMMUNITY COMPETITIVENESS AND THE KNOWLEDGE WORKER

Cities compete in many realms.[161] In the United States, municipal competitive focus usually rests on economic development—that is, competing with peer communities to attract businesses, thereby increasing a city's tax base. More recently, however, municipal competitiveness features enticing businesses to choose a community where it will provide employment base growth—in other words, recruiting job-generators. Urban competitiveness mavens trumpet growing city cadres of "knowledge workers" possessing skills sets to lead innovative companies or to form new companies employing workers in long-tenured jobs paying excellent salaries and benefits.[162] Following the recession of the later years of the 21st century's first decade, the challenge of replacing living-wage jobs was amplified by increased automation as proxies for human labor.[163]

Urban oracles say community competitiveness relies on luring a subset of knowledge workers (primarily, though not exclusively, millennials) that Richard

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158. *See id*. at 40. In contrast, Croton, NY entirely eliminated zoning requirements for some eligible solar energy systems thanks to a statewide "unified solar permit." *See Nolon 2015*, *supra* note 154, at 15, 18–19.

159. *See* BARRIERS, *supra* note 148, at 50.

160. *See* STOCKHAM, *supra* note 7, at 34. Until the advent of planned unit developments that permitted clustering and other design innovations, Euclidean separation of uses gave rise to little imagination in design and scant variety. *See id.* at 35.

161. Iain Begg, *Cities and Competitiveness*, 36 URB. STUD. 795, 807 (1999).

162. *See* Lauren Weber, *Companies Flock to Cities with Top Talent*, WALL ST. J. (Apr. 12, 2016), https://www.wsj.com/articles/companies-flock-to-cities-with-top-talent-1460482766 (noting company executives polled rated talent availability as leading consideration in firm moves and expansions).

163. *See* Derek Thompson, *A World without Work*, ATLANTIC (July/Aug. 2015), http://www.theatlantic.com/magazine/archive/2015/07/world-without-work/395294/. The author notes that a severe employment downturn in a community causes the breakdown of cultural cohesion, quoting Prof. John Russo. *See id.*

Florida calls the "creative class." These individuals, Florida argues, will enable startup enterprises in urban areas to drive higher productivity and incomes, as this class has a "substantial effect on regional economic growth."[164] Florida's creative class includes skilled persons in knowledge-intensive industries producing new ideas and products stemming from creative problem-solving.[165] Drawing these persons to a city requires affording four elements: technology, talent, tolerance, and territorial assets, the last of these constituting an attribute of *place*.[166] Florida argues that these elements, quality of place being not the least, must be bolstered by communities targeting creative persons working for innovative companies or devising their own businesses models.[167] These persons and their preferences in cities contribute mightily, development scholars believe, to a community's jobs growth, attracting progressive waves of creative people to the mix of established residents while promoting high value-added, information-based work opportunities.[168]

Florida's call to attract creatives spawned city rankings on quality of urban life, several of them grounded in sustainable development dimensions, confirming that environmental sustainability is a core dimension of municipal competitiveness today.[169] SustainLane's U.S. City Ranking, performed by a "green media company," evaluated major American cities for several years on their livability based partially on their ecological footprints. This ranking assessed a city's ability to maintain healthy air, drinking water, parks, and public transit systems, as well as its promotion (through planning and land use policies among other devices) of a robust, sustainable local economy embracing green building, farmers' markets, renewable energy and alternative fuels.[170] In June 2013, The

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164. *See, e.g.*, Richard Florida, *The Creative Class and Economic Development*, 28 ECON. DEV. Q. 196, 199, 201 (2014). Few question Florida's basic assumption that many leading urban areas quest for increasingly knowledge-intensive and innovation-driven economies; and some researchers contend that his theories prove that creativity effects economic growth independent of a community's endowment of human capital. *See, e.g.*, Enrico Moretti, *Where the Good Jobs Are—and Why*, WALL ST. J. (Sept. 18, 2013), http://www.wsj.com/articles/SB10001424127887324576304579072773954985630 (arguing the best way for a city to generate jobs for all citizens is attracting innovative companies hiring highly-educated workers); David McGranahan & Timothy Wojan, *Recasting the Creative Class to Examine Growth Processes in Rural and Urban Countries*, 41 REG'L STUD. 197, 216 (2007).

165. Florida, *supra* note 164, at 197.

166. Florida refers to this alternatively as "quality of place." *See* Florida, *supra* note 164, at 203. It consists of the dimensions of combined built and natural environment, or "setting," the diversity of dwellers in the community, and the vibrancy of street life. *See id*. (for a definition of "place").

167. *See* Marco Bontje & Sako Musterd, *Creative Industries, Creative Class and Competitiveness: Expert Opinions Critically Appraised*, 40 GEOFORUM 843, 845 (2009).

168. *See* Richard Hu, *Sustainability and Competitiveness in Australian Cities*, 7 SUSTAINABILITY 1840, 1844 (2015); Peter North & Alexander Nurse, *Beyond Entrepreneurial Cities: Towards a Post-Capitalist Grassroots Urban Politics of Climate Change and Resource Constraint*, 15 METROPOLES 1, 3 ¶ 8 (2014), https://metropoles.revues.org/5005?lang=en.

169. *See* Hu, *supra* note 168, at 1842. The consequential indicators are conservation and quality of air, water, waste treatment, transport use and available green space. *See id.*

170. *See* PETER A. WALKER & PATRICK T. HURLEY, PLANNING PARADISE: POLITICS AND VISIONING OF LAND USE IN OREGON 158–59 (2011).

Economist Intelligence Unit ranked 120 global cities by their respective capacities for garnering capital investment, businesses, talent, and visitors, looking at eight thematic categories of competitiveness, one of which is "environmental and natural hazards."[171] Additionally, the 2015 ARCADIS Sustainable Cities Index, ranking fifty cities in thirty-one countries, assumed three dimensions of sustainability—the demands of societies, economies and environment, or what is referred to colloquially as "people, profit and planet."[172]

Community administrators heed such competitiveness opinion-makers and gurus. One adherent, former New York Mayor Michael Bloomberg, opined that "talent attracts capital," and that "a city that wants to attract creators must offer a fertile breeding ground for new ideas and innovations."[173] Regions in other nations are equally intrigued by this formula; municipalities and alliances of communities now market themselves to the talented as vibrant centers of creativity and the knowledge economy, striving to strengthen their profiles in these respects.[174] Among other initiatives, they employ incentive programs for creative and knowledge-intensive industries.[175] One popular initiative is to build or repurpose centrally-located commercial properties to establish "creative" milieus.[176]

Some observers scoff at these endeavors, however, alleging that the concurrent pursuit of competing policy agendas of "competitiveness" and "sustainability" necessitates regional coalitions[177] to incorporate principles of "smart growth" as the engine for collaborative, multi-municipal policy-making.[178] Tassilo Herrschel,

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171. *See* ECONOMIST INTELLIGENCE UNIT, HOT SPOTS 2025: BENCHMARKING THE FUTURE COMPETIVENESS OF CITIES 1, 5, 21 (2013), http://www.citigroup.com/citi/citiforcities/pdfs/hotspots2025.pdf. According to this report, Chicago ranks first among American cities on its "environmental governance and ability of dealing with environmental challenges." *Id.* at 8. Five percent weight was allocated to the survey benchmark for "environment and natural hazards," a reference to municipal resiliency policies and initiatives. *Id.* at 22.

172. *See* ARCADIS, SUSTAINABLE CITIES INDEX 1, 5 (2015), https://s3.amazonaws.com/arcadis-whitepaper/arcadis-sustainable-cities-index-report.pdf. A forward, guest-authored by Eugenie L. Birch, offers that "as this index demonstrates, the more sustainable an urban area is, the higher the quality of life, greater prosperity and lower per capita greenhouse gas production it possesses." *Id.* at 6. The "planet" sub-index rates city energy consumption and renewable energy share, recycling rates, greenhouse gas emissions, natural catastrophe risk, drinking water availability, sanitation, and air pollution. *Id.* at 11.

173. Michael Bloomberg, *Cities Must Be Cool, Creative and in Control*, FIN. TIMES (Mar. 27, 2012), http://www.ft.com/cms/s/0/c09235b6-72ac-11e1-ae73-00144feab49a.html#axzz3anbGh0Aj.

174. *See* Bontje & Musterd, *supra* note 167, at 844. *See, e.g.*, CITY OF SANTA MONICA, CREATIVE CAPITAL: A PLAN FOR THE DEVELOPMENT OF SANTA MONICA'S ARTS AND CULTURE 1, 6–7, 32–35 (2007), https://www.smgov.net/uploadedFiles/Portals/Culture/Resources/SM%20Creative%20Capital%20Plan.pdf (plan element to implement city's "broad vision" of sustainability).

175. *See* Bontje & Musterd, *supra* note 167, at 845.

176. *See id.* Bontje and Musterd observe that EU nations on the local level at present are more cautious in policy development to be "all in" where creative person-attraction is concerned; they prefer instead to build economies in which when a particular sector's failure does not bury the region but is offset by other, better-performing sectors. *See id.* at 849.

177. *See* Tassilo Herrschel, *Competitiveness and Sustainability: Can "Smart City Regionalism" Square the Circle?*, 50 URB. STUD. 2332-33, 2338 (2013).

178. *See id.* at 2340, 2345.

for one, argues that regional coordination allows sustainability to emerge as a core economic quality and community bedrock, demonstrating that joint municipal endeavors are "smart" and, therefore, appealing to the creative class.[179] Other commentators hold that urban competitiveness evolved from its economic growth-centeredness to incorporate multiple city "performance" dimensions that are inviting to business operations, with environmental sustainability being consequential if not dominant among these attributes.[180] Thus, argue these pundits, when urban competition focuses on attracting capital, businesses, talent and visitors, the community's physical environment is a determining factor.[181] When competitiveness focuses on property-linked business strategies, ecological footprints, and environmentally-responsible land development policies, it signals success.[182] The question is how best to plan and execute policies driving such public goods.

One enduring recipe for community competitiveness is for urban governments' administrations to abandon hierarchical structure, instead enabling "institutions that promote a decentralized process of industrial self-organization without sacrificing individual autonomy or flexibility."[183] Annalee Saxenian's regional network formula claims that encouraging emigrant "brain circulation" (versus fearing "brain drain") results in increased domestic economic opportunities.[184] Saxenian's conclusion dovetails with Florida's creative class thesis, since entrepreneurial knowledge-workers are independent, diverse, and variety-seeking persons. Florida identifies these traits among creatives in their leisure and working lives and finds that in their search for "place," they are nimble in relocating.[185] These economic development credos suggest that optimal policy direction in land use administration approximates a partnership (sometimes

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179. *See id.* at 2342; Hu, *supra* note 168, at 1852 (noting that regionalism fuses competitiveness and sustainability through policies advocating for innovation, collaboration and co-ordination). Herrschel views regional scale as a "mediating platform" addressing local and global considerations of competitiveness and sustainability policies. *See* Herrschel, *supra* note 177, at 2344.

180. *See* Hu, *supra* note 168, at 1840–41. The latest city performance-dimension report rating sustainable cities emphasizes affordability of global housing prices, *see* Ni Pangfei, et al., THE GLOBAL URBAN COMPETITIVENESS REPORT 2017-2018: HOUSE PRICES, CHANGING THE CITY WORLD (Oct. 24, 2017), https://unhabitat.org/wp-content/uploads/2017/11/GUCR2017-2018-Short-Version.pdf.

181. *See id*. at 1841.

182. *See id*. An "ecological footprint," Hu observes, is the measure of the quantity of land needed to supply those resources demanded to sustain local residents. *See id*. at 1845.

183. ANNALEE SAXENIAN, REGIONAL ADVANTAGE: CULTURE AND COMPETITION IN SILICON VALLEY AND ROUTE 128, at 165 (1996). Otherwise stated, the logic of urban competition is to make regulations as "light as possible" and administrations business-friendly, so as to position cities as "change agents, not just social structures." *See* North & Nurse, *supra* note 168, at para. 8. North and Nurse's statement of the municipal task, in response to climate change and resource depletion is to "bring public, private and community–based actors together to develop a consistent urban narrative of place and a governing coalition enabling it to be successfully delivered." *Id*.

184. *See* ANALEE SAXENIAN, THE NEW ARGONAUTS: REGIONAL ADVANTAGE IN A GLOBAL ECONOMY 18–21 (2006).

185. *See* Florida, *supra* note 164, at 198, 202.

known as P3s for public-private partnerships) between government actors and private sector participants towards "civic cooperation."[186] In this partnership approach, these joint communities' citizenry is engaged in a sustainability conversation, maximizing policy initiatives.[187]

Competitive local communities need to employ innovative strategies and systems not typically present (or contemplated) in the current maze of zoning and building regulations that govern conventional commercial development projects. Properly crafted to promote sustainability innovation in private development, performance zoning reduces community environmental injustice in densely-populated urban cores.[188] Improvements in community environmental conditions, in turn, spur novel and improved vision, policy, and planning governance responses from community leaders.[189] For example, community-wide conservation of non-renewable energy resources (drastically reducing consumption) increases the supply of non-renewable energy, thereby lowering consumer energy prices. Similarly, local initiatives to recycle rainwater are a sustainable way to make more water available for domestic use, making public spaces greener, improving public health, and promoting urban plant and animal life.

Civic cooperation works best on a regional, rather than on a municipality-by-municipality basis; sustainability matters are no exception.[190] This is because (as recent studies indicate) there are two subsets of "creative class" businesses, those focused mainly in the arts, and those in science and technology.[191] The latter typically populate campus-like offices and lab buildings adjacent to highway access in lower-density suburban locations. The former, downtown-focused creative businesses (graphic design, advertising, gaming, galleries, and website development firms among others), tend to develop in store-front rental spaces and converted industrial brick-and-beam buildings with bike racks and streetcar stops nearby, and along vibrant, walkable streets near enough to where they live.[192] Millennials in this subgroup of the creative class workers are dispersed among dense urban cores, exurbs or suburban centers, and quieter neighborhoods.[193] The regional impacts of ecological footprints transcend fixed municipal political

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186. Begg, *supra* note 161, at 807.

187. *See* Kent E. Portney & Jeffrey M. Berry, *Participation and the Pursuit of Sustainability in U.S. Cities*, 20 URB. AFF. REV. 1, 3 (2010) (arguing for citizen "buy-in," as such initiatives and policy statements cannot "simply be orchestrated from the top, even if some sustainability experts would wish it so.").

188. *See, e.g.,* Donna Houston et al., *Planning the Climate-Just City*, 17 INT'L PLAN. STUD. 67, 76–79 (2012) (noting this is a moral and ethical imperative gaining influence among urbanists, advocates, and scholars); NAT'L ACAD. PUB. ADMIN., *supra* note 79, at 19–20.

189. *See* Houston et al., *supra* note 188, at 84–85.

190. *See* KAREN CHAPPLE, PLANNING SUSTAINABLE CITIES AND REGIONS: TOWARDS MORE EQUITABLE DEVELOPMENT 30–35 (2015); Herrschel, *supra* note 177, at 2340, 2345; *See, e.g.*, SAXENIAN, *supra* note 184, at 23.

191. Gregory M. Spencer, *Knowledge Neighbourhoods: Urban Form and Evolutionary Economic Geography*, 49 REG'L STUD. 883, 885 (2015), http://www.tandfonline.com/doi/pdf/10.1080/00343404.2015.1019846.

192. *See id.* at 896.

193. *See id.*; Widener *Consultations*, *supra* note 67, at 173–75.

boundaries,[194] so cooperation across community lines facilitates bargaining with other municipalities and neighborhoods, minimizing factionalism.[195]

III. RISE OF THE ICT *COGNOSCENTI*

This Part describes those objects of earnest community investment that attract highly-skilled digital specialists such as knowledge workers and other millennials, and perhaps post-millennials who have recently entered the workplace, and who know the effects of sustainability.[196] However, recent research indicates that many millennials think "sustainability" refers to consumer products' longevity and reusability rather than energy conservation or ethical trade (typical of a sustainable business model).[197] Millennials respond better to concrete and direct calls to environmental action, such as saving electricity or conserving water, than to general messages about preserving the environment.[198] Still, research shows that some millennials seem unprepared to sacrifice consumer product quality in the name of sustainability.[199] Frequent calls for action to reverse or arrest climate change seemingly fail to resonate among millennials, in part due to perceptions that there are few (if any) individual actions instrumental to reducing greenhouse gas emissions,[200] and that whatever its cause or momentum, global warming is irreversible.[201] In truth, many millennials, even when enlightened about carbon footprint and similar principles, are well-distanced from the places where the greatest ecological damage results from human consumption habits (denaturing of threatened flora and fauna habitats).[202]

Without special expertise, millennials still know that the built environment contributes greatly to global energy use and greenhouse gas emissions,[203] especially when fossil fuel energy powers commercial buildings. Accordingly,

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194. *See* Portney & Berry, *supra* note 187, at 3–4.

195. *See id.* at 4–5.

196. *See* Morley Winograd & Michael D. Hais, *How Green Are Millennials*? NEWGEOGRAPHY BLOG (Feb. 5, 2013), http://www.newgeography.com/content/003455-how-green-are-millennials; JOHN R. EHRENFELD & ANDREW J. HOFFMAN, FLOURISHING: A FRANK CONVERSATION ABOUT SUSTAINABILITY, 125–34 (2013).

197. Likely this millennial reaction is due partially to the fuzziness of the concept of sustainability. *See* Schumpeter, *supra* note 2.

198. *See* David Benady, *What Really Inspires Millennials to Live More Sustainably?*, THE GUARDIAN (Dec. 22, 2014), https://web.archive.org/web/20141222231822/http://www.theguardian.com/sustainable-business/2014/dec/22/what-really-inspires-millennials-to-live-more-sustainably.

199. *See id.*; Katherine Taken Smith & Tracy R. Brower, *Longitudinal Study of Green Marketing Strategies that Influence Millennials*, 20 J. STRATEGIC MARKETING 535, 539, 542 (2012).

200. Jonathan Franzen, *Carbon Capture: Has Climate Change Made it Harder for People to Care About Conservation?*, NEW YORKER at 56, 59 (Apr. 6, 2015).

201. *See* Franzen, *supra* note 200, at 60; Franzen's argument in part is that since climate-related actions produce no discernable result, they are eschatological, at best postponing the inevitable. *See id.* at 63.

202. *See id.* at 64.

203. Markus Moos & Nick Revington, *Will Millennials Remain in the City? Residential Mobility in Post-Industrial, Post-Modern, Post-Suburban America*, THE MILLENNIAL CITY: TRENDS, IMPLICATIONS, AND PROSPECTS FOR URBAN PLANNING AND POLICY CH. 14, at 197 (Markus Moos et al. eds., 2018).

they realize that so-called green buildings (also referred to as "green-intent buildings") by definition reduce their environmental impacts by using less energy in their construction and operation.[204] Buildings featuring natural ventilation capabilities (contrasted with centralized climate-controlled buildings with HVAC), for example, are typically acknowledged as "green" buildings.[205] Green buildings have greater thermal variations compared to their 20th century counterparts, and according to some researchers, green building users are more forgiving of these workplaces. Apparently, "green" buildings are best meshed with "green" occupants,[206] since those expressing higher levels of environmental sensitivity tolerated better occasional temperature discomfort.[207] The prominent green office building attributes in demand by today's American indoor workers,[208] according to the few available research findings in the United States,[209] are: natural light availability in the building's interior; conveniently located public transportation; good building indoor air ("fresher" air);[210] and predictable temperature control.[211] These findings suggest that people, not profit motives, dominate green building consumer value measures.[212]

This sampling of opinion is supported in larger-scale surveys. Consultant GVA Project Control Group Pty. Ltd. (PCG)[213] interviewed 2,400 employees in twenty Australian businesses in 2011. Analyzing the resulting responses, PCG identified six critical criteria for optimal 21st Century built-workplace conditions:

1. Environment, defined as comforts afforded by light, views, air quality, and temperature;
2. Privacy, both acoustical and visual, allowing for concentrated work within or outside the "personal workspace";

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204. Avis Devine, *Why Energy-Efficient Commercial Real Estate Matters*, in ENERGY EFFICIENCY AND THE FUTURE OF REAL ESTATE 19–20 (N. Edward Coulson et al., eds., 2017); Max Paul Deuble & Richard John de Dear, *Green Occupants for Green Buildings: The Missing Link?* 56 BLDG. & ENV'T 21, 21 (2012).

205. *See* Robert A. Simons et al., *Green Office Buildings: A Qualitative Exploration of Green Office Building Attributes*, 6 J. SUSTAINABLE REAL EST. 1, 211–12 (2014); Adrian Learman & Bill Bordass, *Are Users More Tolerant of 'Green' Buildings?*, 35 BUILDING RES. & INFO. 662, 664 (2007).

206. *See* Deuble & John de Dear, *supra* note 204, at 26.

207. *See generally* Learman & Bordass, *supra* note 205, at 673.

208. *See* Simons, *supra* note 205, at 213 (describing the "people-oriented benefits" deemed most important by those surveyed).

209. *See id.* at 221–22. This was a small sample of forty-eight "focus group" participants (within seven focus groups interviewed in four American cities). *See id.* at 221.

210. *See Bay Area Research Finds Lack of Fresh Air Makes Workers Sick*, CBS SFBAY AREA (Jul. 18, 2011), http://sanfrancisco.cbslocal.com/2011/07/18/bay-area-research-finds-lack-of-fresh-air-makes-workers-sick/.

211. *See* Simons, *supra* note 205, at 222. Notably, a building's LEED certification status was not highly rated, nor were such elements as availability of bicycle racks, recycling of refuse, and water conservation. *See id.*

212. *See id.* at 223.

213. PCG is an independent corporate real estate, design, and project management partner for leading Australian tenant and owner-occupant employers. *See Our Story & Team,* PCG, http://www.pcg.com.au/about-pcg/our-story-team (last visited Nov. 3, 2017).

3. Amenity, including the quality and number of staff facilities easing work at unconventional times;
4. Flexibility, accommodating growth and changing team structures with minimal cost and work disruption;
5. Image, reflecting the culture and values of the particular workplace; and
6. Interactivity, conveniently affording opportunities to meet colleagues in myriad workplace environments.[214]

Three of the six criteria (environment, flexibility, and image) are sustainability concerns among the youngest workforce generation that by 2025 will constitute as much as 75% of America's workers.[215] Yet, even if later-stage millennials were entirely indifferent to environmental causes and the challenges of GHG emissions, they still would champion two dimensions of building performance in urban core workplaces.[216] The first dimension is utility of technological devices, and the second is the relationship between aesthetics and the built environment. These elements are considered in more detail below.

A. AESTHETICS OF THE BUILT ENVIRONMENT

Aesthetics matter in youthful assessment of workplace sustainability.[217] The psychology of consumerism in technology products reflexively endorses "the latest advance."[218] But the experience of young adults' use of products transcends mere gadgetry and mass psychology of consumption. Millennials' consumerism (especially in the "green ethos") favors beauty and simplicity over functionality

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214. *See* Simon Gunnis, *A Workplace Fit for Duty*, SYDNEY MORNING HERALD 42 (Jun. 25, 2011), http://newsstore.fairfax.com.au/apps/viewDocument.ac;jsessionid=4C1DAE31B37AA58FDFC0269BADFDCEF2?sy=afr&pb=all_ffx&dt=selectRange&dr=1month&so=relevance&sf=text&sf=headline&rc=10&rm=200&sp=brs&cls=217&clsPage=1&docID=SMH1106259S7IT3L23A8.

215. *See* MORLEY WINOGRAD & MICHAEL HAIS, HOW MILLENNIALS COULD UPEND WALL STREET AND CORPORATE AMERICA 2 (May 2014), http://www.brookings.edu//media/research/files/papers/2014/05/millennials-wall-st/brookings_winogradfinal.pdf. These authors opine that millennials will "display a greater reverence for the environment," *see id.*, without clarifying who (or what group) expresses less reverence, although one assumes they referred to younger generation Americans as a whole.

216. This Article heavily emphasizes office building and similarly structured white-collar workplaces. Common commercial building workplace types include industrial buildings, portions of college and university campuses, stadiums and arenas, hotels and motels, and retail projects. I do not ignore these alternative workplaces as potential loci of sustainability in construction and building management; but these other building types, usually being dispersed across larger floor plates, typically do not house as many individual full-time employees per square foot of floor area as do offices. Retail buildings temporarily house shoppers and educational institutions periodically house staff and students, and their employee occupants usually are more transient than office workers in the U.S. For a discussion of retail property sustainability issues, see Karla Zens, *Retail Sustainability: Do Shoppers Even Care?*, NAT'L REAL EST. INVESTOR (Feb. 26, 2015), www.nreionline.com (citing a Forrester Research, Inc. study involving retail center sustainability).

217. *See* DEBORAH STEVENSON, CITIES OF CULTURE: A GLOBAL PERSPECTIVE 78–81, 96, 132–33 (2014); Bill Scholz, *The Aesthetic Workspace: State of the Research*, ERIE DECENTER (Jul. 20, 2014), http://erie.decenter.us/writing/theaestheticworkspace-stateofthereseach/.

218. *See, e.g.*, NIGEL WHITELEY, DESIGN FOR SOCIETY 61 (2006) ("[T]echnology makes the new model possible and so it is self-evident, according to the logic of consumerism, that we should want to possess it.").

in use of tools and technology services.[219] Steve Jobs, a technology guru among older millennials, advanced a hierarchy of product virtues. Jobs' hierarchy demanded that the consumer's environment integrate, in a digital-hub realm, her primary digital device to a variety of portable tools, to seamlessly manage digital content.[220] For Jobs, plugged-in devices, like the hub itself, must foremost be objects of beauty.[221]

Aesthetics of design was the highest virtue in the Jobsian hierarchy, surpassing even "friendliness" of the devices to the user, the second highest virtue.[222] After beauty and simplicity (or friendliness) came functionality, in Jobs' ecosystem of digital integration.[223] Computing capacity yielded, as needed, to more compact dimensions, to an "insanely great" interface,[224] and to affordability. Jobs understood that the value proposition in technology products was less about functional capability than about presenting a compelling package,[225] and this philosophy permeated America's consumer psyche. In so influencing the masses, Apple's products captured worldwide public imagination.[226]

Older millennials in management and digital natives soon to enter the workforce will increasingly apply this hierarchy to the built environment. Accordingly, the future workspace must exceed mere livability, in pursuit of "greatness."[227] If the hub of the live-interaction working environment is interior space, then maneuverability around the space, and ease of communication with all those sharing that space, become paramount virtues. Functionality consists of these initial two factors. However, the seamless technological capacity (sufficient building-tenant computing power and interior artifact presence)[228] of the space,

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219. *See id*. at 60. For this reason, some millennials see personal devices as fashion items, and seek to replace them frequently to keep current with the trend. *See* Yue Pan et al., *Fashion Thinking: Fashion Practices and Sustainable Interaction Design*, 9 INT'L J. DESIGN 53 (2015), http://ijdesign.org/ojs/index.php/IJDesign/article/view/1372/675.

220. *See* WALTER ISAACSON, STEVE JOBS 373 (2011); Walter Isaacson, *American Icon*, 178 TIME 35 (Oct. 17, 2011). For this reason, Jobs resisted allowing Apple software running on another company's inferior hardware, or unapproved applications running on an Apple device. *Id*.

221. However, Jobs believed that aesthetic tastes could be taught, and that it was Apple's job to teach the consumer aesthetics. *See* ISAACSON, *supra* note 220, at 265.

222. *See id.* at 127, 372; Walter Isaacson, *How Steve Jobs' Love of Simplicity Fueled a Design Revolution*, SMITHSONIAN (September 2012), http://www.smithsonianmag.com/arts-culture/how-steve-jobs-love-of-simplicity-fueled-a-design-revolution-23868877/?no-ist.

223. *See* Lev Grossman & Harry McCracken, *The Inventor of the Future*, 178 TIME 41 (Oct. 17, 2011).

224. *See* ISAACSON, *supra* note 220, at 110–11, 166, 169.

225. *See id.* at 71, 173.

226. *See id.* at 160.

227. *Cf.* Quentin Hardy, *The Monuments of Tech*, N.Y. TIMES (Mar. 1, 2014), http://www.nytimes.com/2014/03/02/technology/the-monuments-of-tech.html?_r=0 (noting the distinctiveness of the new work spaces despite their simplicity and functionality); Alfons H. van Marrewijk, *Corporate Headquarters as Physical Embodiments of Organizational Change*, 22 J. ORG. CHANGE MGMT. 290, 290–91 (2009) (noting interdependency of corporate architecture and the organization's cultural change, as corporate headquarters today are symbols of corporate change ambitions).

228. Iris Vilnai-Yavetz et al., *Instrumentality, Aesthetics and Symbolism of Office Design*, 37 ENV. & BEH. 533, 535 (Jul. 2005), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.930.2274&rep=rep1&type=pdf.

like sustainability elements of the project, will be regarded by millennial management as integral to a desirable landlord's leasehold package.[229] This hierarchy of built-environment virtues increasingly will include environmentally friendly features like landscaping, "green elevators"[230] and other sustainable elements such as enhanced interior impacts of windows.[231]

B. MILLENNIAL COMMITMENT TO TECHNOLOGICAL DEVICES AND THEIR UTILITY

PriceWaterhouseCooper's (PWC) paper on the connected employee experience[232] explains why employers must align management practices and priorities to reflect several millennial values and, fundamentally, to increase the level of worker trust.[233] PWC's white paper urges engaging workers via social media tools to expand an employee's capacity to engage and transact with people and information—anywhere, anytime, on multiple devices, and across organizational lines. As a result, it is possible for employees to more easily learn about and "own" brand value and customer offerings. Employees at every level can be heard and acknowledged through dialogue and collaboration up and down and across traditional organizational reporting structures.[234] Managerial reporting of achievements that is less revenue-oriented and more related to sustainability should become crucial in company recruitment and retention of millennial employees.[235]

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229. *See* ANDREW CAREY & SIMON PARSONS, IMPROVING SUSTAINABILITY THROUGH THE 21ST CENTURY WORKPLACE, AND IBM'S VISION OF THE OFFICE OF THE FUTURE 1, 2, 6 (2009), http://www.ibm.com/ibm/files/A276547C41208O73/uk__en__buildings__Office_of_the_future.pdf.

230. Michael MacRae, *What Makes an Elevator Green?* ASME BLOG (Sept. 2012), https://www.asme.org/engineering-topics/articles/elevators/what-makes-an-elevator-green.

231. Beauty, accessibility and functionality become integral to the development of skyscrapers with the declining impetus to erect super-tall structures strictly for proof that man can "build higher." An ongoing debate about the energy efficiency of super-tall buildings, particularly in view of evidence that sixty stories reaches maximum efficiency, slows down construction of such structures. *See* Julie V. Iovine, *The Skyscraper as a Pillar of Confidence*, WALL ST. J. (Sept. 8, 2011), http://www.wsj.com/articles/SB10001424053111904537404576550753689370760 (last visited Jan. 15, 2016); *cf. Super-Talls Are More Energy Efficient, Says Smith*, CONSTRUCTIONWEEKONLINE (Oct. 25, 2011), http://www.constructionweekonline.com/article-14438-super-talls-are-more-energy-efficient-says-smith/.

232. *See generally*, PWC TECHNOLOGY INSTITUTE, THE CONNECTED EMPLOYEE EXPERIENCE (Feb. 2014) [hereinafter "PWC 2014"].

233. *See id.* at 7.

234. *See id.* at 5. Erin Grossi suggests that in the future, live data on building air quality may be integrated with dashboards viewable by building occupants. *See* ERIN GROSSI, DAWN OF THE BUILDING PERFORMANCE ERA 11 (Dec. 2014), http://library.ul.com/wp-content/uploads/sites/40/2015/02/Dawn-of-the-Building-Performance-Era.pdf.

235. GROSSI, *supra* note 234, at 6. In addition, as consumers, millennials familiar with sensors, monitors, and dashboards integrated into building systems are increasingly aware of the ways their office and retail employment venues are managed to conserve natural resources and providing occupants healthy air to breathe. *See id.* at 3, 12.

Millennials have fused their social lives with data transmitter objects.[236] The youngest members of this generation know that serial advances in technology promise ever-greater efficiency in time utilization.[237] A recent survey conducted by Jones Lang LaSalle, Inc. unsurprisingly noted 70% of millennials desire to work with cutting-edge technology.[238] Awareness of this intention informs the real estate development industry's initiative to educate millennials in principles of "smart buildings" and integrated energy management technologies.[239] Sensing an inflection point, the Chief Economist of Underwriter Laboratories opines that America is on the cusp of the "building performance era."[240] Ms. Grossi argues that the sustainability movement "set the building industry on a new path for the future," and that millennials expect building automation technologies to be a fact of standard operations by the time they assume management roles in corporate workplaces.[241]

Millennials understand the environmental and public health challenges they are poised to inherit, and they already naturally look to their trusted technology sources to provide answers. In the midst of an Information Age, where software's inevitable journey to disrupt and transform virtually every major industry on the planet has just begun, it is the millennials that appear best positioned to really put technology to work to solve man's most pressing environmental problems and achieve a higher-quality of life for the masses in the process.[242]

Communities drawing in knowledge workers as professionals and managers in commercial enterprises must encourage developers of new commercial projects to innovate for sustainability, particularly by implementing smart technologies in workplaces, since companies in the "sustainability industry" space depend on the technology expertise possessed by many members of the millennial genera-

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236. *See* PWC 2014, *supra* note 232, at 6; PEW RESEARCH CENTER, MILLENNIALS: A PORTRAIT OF GENERATION NEXT: CONFIDENT. CONNECTED. OPEN TO CHANGE. 6 (2010).

237. *See* FIRST DATA CORPORATION, THERE'S NO SLOWING DOWN MILLENNIALS, 2 (2015), https://www.firstdata.com/fdc_site/homepage_v2/millennials/images/millennial-white-paper-FNL.pdf,

238. *See* Chris Pesek, *What Millennials Really Want*, DEV. MAG. Winter, 2014, http://www.naiop.org/en/Magazine/2014/Winter-2014/Business-Trends/What-Millennials-Really-Want.aspx; Chris Pesek, *Want to Hire Millennial Talent? Can the Free Beer Stereotype and Take These 6 Steps*, FORBES (Sep. 18, 2014), http://www.forbes.com/sites/janetnovack/2014/09/18/want-to-hire-millennial-talent-can-the-free-beer-stereotype-and-take-these-6-steps/.

239. *See id.* "Smart Buildings" is a term referring to a high functioning building where a technology and human interface combines data and action to keep occupants and building owners comfortable and productive at the lowest feasible cost. *See* A.H. Buckman et al., *What is a Smart Building?*, 3 SMART & SUSTAINABLE BUILT ENV'T 92, 104 (2014) (such buildings address both intelligence and sustainability issues by utilizing computer and intelligent technologies to achieve the optimal combinations of overall comfort level and energy consumption). *See also* AMXtalk, *What is a Smart Building?*, YOUTUBE (Nov. 12, 2013), https://www.youtube.com/watch?v=NKBwJtq-TQo.

240. *See* GROSSI, *supra* note 234, at 1.

241. *See id.* at 12.

242. *Id.*

tion.[243] These persons will be among the key early adopters and the sophisticated consumers of innovative sustainability initiatives.[244] Indeed, nearly half of the most "super connected" millennials (high-frequency users of social media) believe that a fundamental purpose of business is to improve society, one metric being environmental protection.[245] Sustainable communities fuse renewable energy generation and storage technologies with energy-efficient transportation, business development, job creation, and authentic local social activities.[246] Such interactivity stimulates migration of knowledge workers. Part V below forecasts how commercial building developers will contribute to inducing occupancy by late-millennials and succeeding cohorts of business owners and managers. Their joint activities will underpin energy savings by generating building sustainability "performance standards," enhanced by revising community zoning protocols.

IV. ENTER THE WATCHMEN: SUSTAINABILITY INITIATIVES IN THE WORKPLACE

Building owners, in office spaces and to a lesser degree in retail projects, will inexorably give attention to sustainability both because technology is developing to affordably permit this, and because sustainability[247] is a current principal value proposition in the commercial leasing marketplace. Consider as evidence the advent of the Leadership in Energy and Environment Design certification system in America.[248] Millennials' apparent preference to work for businesses having strong environmental sensitivity credentials,[249] along with developers' grants and tax incentives,[250] builds momentum in this direction. Nineteen states and the

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243. *See* Sheila Martin & Heike Mayer, *Sustainability, Clusters and Competitiveness*, 22 ECON. DEV. Q. 272, 274 (2008).

244. *See id.*

245. *See* DELOITTE, MIND THE GAPS: THE 2015 DELOITTE MILLENNIAL SURVEY, EXECUTIVE SUMMARY 3, 5, 10, 25 (2015), http://www2.deloitte.com/content/dam/Deloitte/global/Documents/About-Deloitte/gx-wef-2015-millennial-survey-executivesummary.pdf. The super-connected millennials typically are the younger members of that cohort. *See id.*

246. Woodrow W. Clark II & Grant Cooke, *The Green Industrial Revolution*, *in* GLOBAL SUSTAINABLE COMMUNITIES HANDBOOK: GREEN DESIGN TECHNOLOGIES AND ECONOMICS, Ch. 2 (Woodrow W. Clark II ed., 2014).

247. *E.g.,* GRO HARLEM BRUNDTLAND, WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT: OUR COMMON FUTURE ix (1987) (sustainable development meets the needs of the present without thwarting the ability of future generations to meet their own needs by depleting non-renewables).

248. *See* Pesek, *supra* note 238, at 4 (LEED certification resonates well with tenants and customers). The statement of what LEED represents is found on the U.S. Green Building Council Website, https://new.usgbc.org/leed (last visited Nov. 8, 2017). In 2007, this council adopted LEED for Neighborhoods ("LEED ND"), addressing sustainable design in larger-scale developments, certifying neighborhoods that integrate smart growth, green building and other principles of New Urbanism. *See id.* LEED's Rating System is summarized in LISA M. TUCKER, SUSTAINABLE BUILDING SYSTEMS AND CONSTRUCTION FOR DESIGNERS 6, 99 (2015).

249. *See* CONE COMMUNICATIONS, 2017 CONE GEN Z CSR STUDY: HOW TO SPEAK Z 8 (2017); Devine, *supra* note 204.

250. *See* Changbum Ahn et al., *Toward Environmentally Sustainable Construction Processes: The U.S. and Canada's Perspective on Energy Consumption and GHG/CAP Emissions*, 2 SUSTAINABILITY 354, 364–65 (2010).

District of Columbia have active Property Assessed Clean Energy (PACE) legislation, under which special taxing districts finance energy-sustainable upgrades to commercial buildings, by recouping the costs of upgrading through property tax surcharges.[251] Thus, market forces, local legislation, and tax advantages increasingly drive office and retail building developers and owners to construct or retrofit projects to pursue self-sustaining targets to the degree affordable.[252]

Commercial building workers are more productive when they feel happier,[253] and incorporating sustainable and environmentally responsible products and materials into their business environments make "digital immigrant" and "digital native" employees eager to collaborate in atmospheres suffused with these amenities. Increased availability of "green" technologies, and millennials' acceptance of new ways of saving fossil fuels, will further induce companies to occupy quarters demonstrating their commitments to sustainability, in part as an employee recruiting and retention tool.[254] Such headquarters reveal not just the sense of corporate social responsibility but also reflect a company's "edginess."[255] What seems to be "fringe architecture" in 2016, like Seattle's Bullitt Center[256] or Amsterdam's Edge building[257] will be *de rigueur*, even passé, as the

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251. Jocelyn Durkay, *A Clean-Energy Financing Program for Homeowners Now Has Tougher Consumer Protections*, ST. LEGISLATURES MAG. (Dec. 2017), http://www.ncsl.org/bookstore/state-legislatures-magazine/clean-energy-financing-consumer-protection.aspx; *but see* Prentiss Cox, *Keeping PACE?: The Case Against Property Assessed Clean Energy Financing Systems*, 83 U. COLO. L. REV. 83 (2011) (noting some of the early programs were suspended due to opposition from federal secondary mortgage market regulators concerned that residential PACE assessment liens would trump their mortgage liens).

252. *See* Brown, *supra* note 26, at 64–117 (surveys of local legislation, including those ordinances allowing density/floor area ratio bonuses or awarding tax credit or cash rebates).

253. *See* Nancy Rothbard, *Put on a Happy Face. Seriously*., WALL ST. J., Oct. 24, 2011, at R2 (virtuous and vicious cycles influence the mood of employees depending on their feelings of contentment at the beginning of their work day, and good moods impact the quality of work performed; management will understand their desires to encounter beauty and stimulation in the work environment based on their own preferences).

254. C.B. Bhattacharya et al., *Using Corporate Social Responsibility to Win the War for Talent*, MIT SLOAN MGMT. REV. 2 (Jan. 1, 2008), http://sloanreview.mit.edu/article/using-corporate-social-responsibility-to-win-the-war-for-talent/.

255. *See, e.g.*, *LPA's Sustainable and Collaborative San Diego Office*, OFFICE SNAPSHOTS, http://officesnapshots.com/2012/08/22/lpa-san-diego/ (last visited May 17, 2017) (depicting the conversion of the 1924 Wonder Bread building in San Diego to the corporate quarters of an architecture firm seeking a modern work environment, and showcasing the building's historic character and original materials such as grain silos while demonstrating achievable sustainability construction methods).

256. *See* Lawrence W. Cheek, *The Bullitt Building Follows Nature's Lead in Elegant Efficiency*, Seattle Times Pac. Nw. Mag. (Jan. 25, 2013), http://seattletimes.com/html/pacificnw/2020148827_pacificpgreen27.html; *see* Maria L. LaGanga, *Seattle's Bullitt Center is Flush with Green Features, Including Toilets*, L.A. Times (Mar. 31, 2015), http://www.latimes.com/nation/la-na-greenest-office-building-20150401-story.html.

257. *See* Lorraine Chow, *Take a Tour of the World's Most Sustainable Office Building*, ECOWATCH (Jun. 8, 2015), http://ecowatch.com/2015/06/08/worlds-most-sustainable-office-building/. The Edge is "energy neutral" due to an acre of solar panels mounted on the roof and on every surface of the southern façade of the building not occupied by windows, and the power produced operates 130 meters below ground, a thermal system heating and cooling the building. *See id.* Rainwater flushes toilets and irrigates the greenscape on the building's rooftop terrace and curtilage surrounding the Edge. *See id.*

sustainability dimensions of projects grow. Six areas of resource sustainability many commercial projects developers will implement to achieve energy efficiency and entice millennial business owners engaged in sustainability initiatives are featured below.

A. MERGING THE OUTDOORS AND INDOORS

Ground level green space is often lost in urbanized city cores as a result of high-density developments.[258] Yet most humans seek to be surrounded by living vegetation, a phenomenon called biophilia.[259] A trend developing in recently-built commercial and retail workspaces is increasing plant material in projects, integrated through an initial design process evaluating indoor and outdoor spaces.[260] Vertical indoor gardens[261] are viable in areas of a building where natural light abounds, enabling installation of green living walls.[262] Using natural processes of imbedded vegetation, these walls mitigate negative consequences such as airborne toxic substances and the urban heat island effect, further enhancing a building's thermal performance and its indoor air quality.[263] In addition, the plant-covered layer acts as a solar barrier, absorbing solar radiation.[264] Living systems can contribute to managing on-site storm water by retaining water on rooftops and removing contaminants.[265]

Wood, Bahrami, and Safarik have identified fifteen benefits at the "urban scale" and "building scale" levels of these types of installations. Besides heat island effect reduction and improving local air quality, these include sequestering of carbon, providing biodiversity and augmenting animal natural habitats, sound dampening, and enhancing psychological impact on passers-by due to the

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258. *See* Warwick Savvas, *Valuing Greenery Up High*, SOURCEABLE (Jan. 28, 2015), https://sourceable.net/valuing-greenery-up-high/#.

259. *See id.*

260. *See* Savvas*, supra* note 258.

261. *See*, *e.g.*, Julia Flynn Siler, *The Green Man Whose Gardens Defy Gravity*, WALL ST. J., Nov. 5, 2011, at C11. PATRICK BLANC, THE VERTICAL GARDEN: FROM NATURE TO THE CITY (2011) (describes vertical gardens in a skyscraper in Kuala Lumpur and in the Doha Office Tower in Qatar).

262. *See* ANTONY WOOD ET AL., GREEN WALLS IN HIGH-RISE BUILDINGS: AN OUTPUT OF THE CTBUH SUSTAINABILITY WORKING GROUP 15–19 (2014); George Irwin, *Green Wall Research, Full Steam Ahead*, THE GREEN WALLS COLUMN (Apr. 26, 2009), http://www.greenroofs.com/content/green_walls003.htm. For an installation of a vertical green wall on a tall building, consider One Central Park, on Broadway in the Central Park precinct of Sydney, Australia. *See* Jean Nouvel, *Sydney Towers Boast Vertical Gardens and a Huge Sunlight Reflector*, DE ZEEN (Oct. 10, 2014), http://www.dezeen.com/2014/10/10/one-central-park-sydney-jean-nouvel-vertical-gardens/ (hydroponic irrigation systems make it possible to grow a soil-less vertical veil of vegetation in planters and on walls all the way up to the tower tops. The resulting green facades trap carbon dioxide, emit oxygen, and provide energy-saving shade).

263. *See* Sam C.M. Hui & Zhao Zheng, *Thermal Regulation Performance of Green Living Walls in Buildings*, JOINT SYMPOSIUM 2013: INNOVATION & TECH. FOR BUILT ENVIRONMENT, HONG KONG 2 (Nov. 12, 2013).

264. *See id.*

265. *See* Savvas, *supra* note 258.

aesthetic appeal of such walls.[266] The building-scale benefits also include air filtration and oxygenation (and attending health improvements of occupants), reducing internal noise and gaining LEED® sustainability rating system credits.[267] Initial efforts at integrating organic plant life include Riverwood 100, a 23-story office tower near Atlanta, featuring a curved greenhouse on three upper floors as well as at the base of the tower's setting in a sunken garden; the project's parking garage resides in an existing subterranean ravine.[268]

Other office buildings will feature alternative integration of the exterior environment into the interior space.[269] Park-like spaces, gardens,[270] water features[271] and outdoor exercise centers (as opposed to the conventional indoor "fitness center") for multi-purpose recreation and social gatherings will become conventional. One illustration of this option is Bosco Verticale in Milan, where two residential skyscrapers of 76 and 110 meters in height were completed in 2014.[272] The project houses 780 trees, ranging from three to nine meters in height, together with over 2,000 plants.[273] According to Boeri Architects, these buildings house what equates to 7,000 square meters of forest.[274]

B. POWER GENERATION OR SELF-SUFFICIENCY

To be certified as a LEED® Platinum[275] office in 2016, standards require on-site generation of power (wind or solar) or recycling of storm water or

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266. *See* Wood et al., *supra* note 262, at 20–24.

267. *See id.* at 20, 24–28. While there is doubt about the influence of certification when there is only one percent or less of LEED® compliance by overall American building stock. Millennial workers still pay attention to corporate social responsibility metrics (like environmental sustainability) disclosed for potential employers. *See* Grossi, *supra* note 234, at 6.

268. *See* JOHN PORTMAN & ASSOCIATES, PROJECT EXPERIENCE OFFICE 18 (2016), https://www.portmanusa.com/assets/lib/2015/05/19/Office.pdf.

269. Among other initiatives referenced here is integration of urban spontaneous landscaping, that is, plant material growing on essentially unattended vacant parcels. *See* Peter Del Tredici, *The Flora of the Future*, PLACES (Apr. 2014), https://placesjournal.org/article/the-flora-of-the-future.

270. The discovery of the viability of vertical indoor gardens where natural light abounds leads to green living walls. *See, e.g.*, Julia Flynn Siler, *The Green Man Whose Gardens Defy Gravity*, WALL ST. J., Nov. 5, 2011, at C11; PATRICK BLANC, THE VERTICAL GARDEN: FROM NATURE TO THE CITY (2011) (describes vertical gardens in a skyscraper in Kuala Lumpur and in the Doha Office Tower in Qatar).

271. *See, e.g.*, Anthony P. Pagorek, Building Ecosystems: The Creation of an Artificial Indoor Stream (2002) (unpublished B.A. thesis, Kalamazoo College) (on file with the Kalamazoo College CACHE team); Johnson County's Sunset Drive Office Building in Olathe, Kansas, *see* Carolyn Szczepanski, *Recycled Excuses*, PITCH NEWS (Jan. 25, 2017), http://www.pitch.com/news/article/20604286/recycled-excuses (describing an office that integrates an indoor stream).

272. Angela Fedele, *MAD's Urban Forest Skyscrapers Break Ground*, SOURCEABLE (Jun. 11, 2014), https://sourceable.net/mads-urban-forest-skyscrapers-break-ground/#.

273. Lauren Grieco, *Stefano Boeri: Bosco Vertical/Vertical Forest in Milan*, DESIGNBOOM (Nov. 10, 2011), https://www.designboom.com/architecture/stefano-boeri-vertical-forest/.

274. Not everyone is convinced "vertical forests" are viable biologically or economically. *See* Tim de Chant, *More Reasons to Stop Putting Trees on Skyscrapers*, PER SQUARE MILE (Apr. 23, 2013), www.persquaremile.com.

275. *See* Tucker, *supra* note 248, at 99.

grey-water. Most recent-vintage offices have roofs that can bear the weight of photovoltaic solar panels. Current technology allows solar heat insulation via spray-on insulation coating applied to glass windows or building tiles to increase reflectivity,[276] and thin-film[277] allows converting absorbing surfaces to electricity-generating modules. Building integrated photovoltaic (BIPV) systems today may be integrated directly into the design of a structure.[278] For instance, transparent solar panels are usable for facades, roof lights and canopies, and installable over existing windows and doors.[279] Thin-film solar laminate technology, combined with roofing membranes, create highly efficient rooftop solar generating systems even under lower-light atmospheric conditions.[280] Another variety of thin film under development employs nano-particles sprayable onto glass and other material surfaces to create a thin solar "skin."[281] Also, nano-particles glaze buildings with panes covered in semi-transparent perovskite cells,[282] that soon will convert windows or the commercial structure's walls into a low-current, electricity generating module.[283] Elevators soon will be solar-powered in new

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276. The Industrial Technology Research Institute (Taiwan) Spray-IT's tin-dioxide material is less costly than silver-based films and is applicable without any specialized spraying equipment, *see* Press Release, Marketwired, ITRI Introduces Spray-IT, the First Low-Corst Green Spray-On Glass & Surface Coating to Keep Buildings Cool in Summer and Warm in Winter (Nov. 2, 2011), http://www.marketwired.com/press-release/ITRI-Introduces-Spray-IT-First-Low-Cost-Green-Spray-On-Glass-Surface-Coating-Keep-1581353.htm.

277. *See* Eric Peeters, *TCE Advanced Materials*, TCE: THE CHEMICAL ENGINEER 34–35 (Mar. 2011).

278. *See* PATRINA EIFFERT & GREGORY J. KISS, BUILDING-INTEGRATED PHOTOVOLTAIC DESIGNS FOR COMMERCIAL AND INSTITUTIONAL STRUCTURES: A SOURCEBOOK FOR ARCHITECTS 3 (2000), http://www.kisscathcart.com/pdf/Building-Integrated-Photovoltaic-Designs-for-Commercial-and-Institutional-Structures.pdf. *See also How Can We Use Emerging Technology to Create a Building Envelope of the Future that Integrates All the Functions of a Conventional Wall Into a Thin, Transparent Plastic Film?*, KIERAN TIMBERLAKE, http://kierantimberlake.com/pages/view/28/smartwrap-sup-tm-sup/parent:3 (describes a building material that is lightweight, energy-generating, essentially plastic wrap).

279. *See, e.g.,* Guillermo Quesada et al., *A comprehensive review of solar facades. Transparent and Translucent Solar Facades*, 16 RENEWABLE & SUSTAINABLE ENERGY REV. 2643 (2012); Barbara Speed, *New Transparent Solar Panels Could Fit Invisibly Over Windows and Phone Screens*, CITYMETRIC (Sep. 16, 2014), http://www.citymetric.com/new-transparent-solar-panels-could-fit-invisibly-over-windows-and-phone-screens.

280. *See, e.g.*, Cheryl Katz, *Will New Technologies Give Critical Boost to Solar Power?*, YALE ENV'T 360 (Dec. 11, 2014), (outlining a new generation of materials that can harvest the sun's energy far more efficiently than traditional silicon photovoltaic cells).

281. *See* Juniper Foo, *Spray-on Film Turns Glass into Solar Panels*, CNET CULTURE (Aug. 19, 2010), https://www.cnet.com/news/spray-on-film-turns-glass-into-solar-panels/.

282. *Crystal Clear?,* ECONOMIST 71–72 (May 16, 2015), http://www.economist.com/news/science-and-technology/21651166-perovskites-may-give-silicon-solar-cells-run-their-money-crystal-clear. This approach holds particular promise since the launch of a new manufacturing process using pervoskite materials, which have only been incorporated into solar cells since 2009. *See* Alexander Chilton, *Pervoskite Solar Cells*, CONVERTER NEWS (Mar. 17, 2015), http://www.converternews.com/researchers-identify-new-method-for-manufacturing-perovskite-solar-cells/.

283. *See* Starre Varlan, *Solar Windows? How the Latest Technology Makes it Possible*, MOTHER NATURE NETWORK (Jan. 14, 2014), http://www.mnn.com/earth-matters/energy/stories/solar-windows-how-the-latest-technology-makes-it-possible. An office's building materials, its spine, may itself become a selling point for occupants, as developers market buildings constructed of volumes of recycled waste, such as "green steel," made in part from plastics and waste tires and forged in electric arc furnaces, invented by the Smart Centre at the

construction,[284] as commercial building owners and managers approach net-zero energy consumption.[285]

Tower Two at the La Jolla Commons in University Town Center, San Diego, opened for business in 2014. It encompasses about 415 thousand square feet of floor area and reportedly is the largest carbon-neutral commercial office building in the United States.[286] Eighty eight percent of the building's water is recycled for irrigating landscaping as well as operating the HVAC system.[287] The building's three fuel cells convert natural and methane gas into electricity. Both natural gas and biogas created from nearby landfills and sewage treatment plants are exploited here and the combined gasses are converted to electricity by the building's fuel cells, generating 4.3 million kilowatt hours a year.[288]

The Living Building Challenge (LBC) illustrates another opportunity for increased performance-based accreditation.[289] Whereas LEED® and other environmental standards pre-certify buildings based on conformance of design specifications with adopted best practices, the Living Building Challenge approves buildings only after a rigorously-documented, year-long initial occupancy phase. The LBC monitors twenty so-called design "imperatives" in the categories of site, water, energy, health, materials, social equity, and beauty.[290] These mandates, including net-zero energy and water use, must be maintained over the full trial year of occupancy.

University of New South Wales. *See* Cheryl Jones, *Adapting "Green" Steelmaking to Other Industries*, AUSTRALIAN (Jul. 14, 2014), http://smart.unsw.edu.au/sites/default/files/uploads/Innovation%20Challenge-Adapting%20%27green%27%20steelmaking%20to%20other%20industries%2C%20The%20Australian%2014%20July%202014.pdf.

284. *See Otis Introduces its First Solar-Powered Elevator in France*, UNITED TECHNOLOGIES PRESS RELEASE (Apr. 3, 2015), http://www.utc.com/News/BIS/Pages/Otis-Introduces-its-First-Solar-Powered-Elevator-in-France.aspx; Seth Masia, *Elevator Uses Solar and Storage for Net-zero Operation*, SOLARTODAY (May 30, 2014), http://solartoday.org/2014/05/elevator-uses-solar-and-storage-for-net-zero-operation/.

285. *See* SHANTI PLESS & PAUL TORCELLINI, NET-ZERO ENERGY BUILDINGS: A CLASSIFICATION SYSTEM BASED ON RENEWABLE ENERGY SUPPLY OPTIONS, NREL/TP-550-44586 TECHNICAL REPORT, at iii (Jun. 2010), http://www.nrel.gov/sustainable_nrel/pdfs/44586.pdf (in NZE buildings, efficiency gains have been made such that the balance of energy needs can be supplied with renewable energy technologies).

286. *See* Mike Allen, *Building Brings State-of-Art Touches to Sustainability Efforts*, SAN DIEGO BUS. J. 7 (Sep. 1, 2014), http://www.sdbj.com/accounts/login/?next=/news/2014/aug/29/building-brings-state-art-touches-sustainability-e/.

287. *See id.*

288. *See id*.

289. The Living Building Challenge sets substantially higher performance requirements across a more comprehensive set of criteria than zoning and building regulations require, or any current LEED®-style rating system. The Living Building Challenge 3.1 Standard is the core document project teams use toward certification; and it can be obtained at no cost from the International Living Future Institute's Website, *see* https://living-future.org/product/lbc-3-1-standard/. Project developers striving to meet these Living Building criteria need to employ innovative strategies and systems not contemplated in the current maze of regulations governing non- Sustainability-oriented projects. *See* BARRIERS, *supra* note 148, at 21–22, 38.

290. *See id.*

C. ENERGY SAVINGS THROUGH TECHNOLOGY PLATFORMS AND ICT

Self-sustaining projects gradually are increasingly attractive tenant alternatives in the office leasing and built-to-suit markets.[291] Proving the *bona fides* of a prospective landlord's sustainability commitment today has greater consequence, so computing in the cloud will ensure continued development of tools measuring and verifying energy use.[292] Beginning in 2011, cloud computing and analytics software charted heating, cooling and lighting usage in thirteen Microsoft buildings totaling 2.6 Million square feet on its headquarters campus in Redmond, Washington.[293] By equipping these buildings to be "smarter," therefore able to power-down the use of utilities in real time during periods of workplace inactivity,[294] greater efficiency was achieved without serial and expensive retrofits, and upfront investment in new construction was offset by shortened "payback" durations.[295]

Cloud-based architecture affordably analyzes "big data" on efficiency using complex algorithms to refine heating, air-conditioning, and lighting patterns in multiple buildings.[296] Data-driven energy management combines smart meters and management software (EMS) for real-time monitoring and adjustment (such as of temperature settings) of every building mechanical device consuming electricity.[297] These systems have adaptive capabilities as well.[298] A user-building interface, or UBI, tracks the building's user experience, specifically how users want and need to use the design, which in turn permits the UBI interface

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291. *See* Nathan A. Canova, *Greening the Traditional Commercial Lease: Building a Case for Sustainable Commercial Real Estate through Economically Profitable Green Leases*, 61 DRAKE L. REV. 883, 894–99 (2013); Stuart D. Kaplow, *Does a Green Building Need a Green Lease?*, 38 U. BALT. L. REV. 375, 408 (2009).

292. *See, e.g.*, Totty, *supra* note 129, at R2; M. Victoria Moreno et al., *How can We Tackle Energy Efficiency in IoT Based Smart Buildings?*, 14 SENSORS 9582–9614 (2014); ALAN ROSE, SUBRAMANIAN VADARI & LORIE WIGLE, HOW THE INTERNET OF THINGS WILL ENABLE VAST NEW LEVELS OF EFFICIENCY 9-295 (2014), http://aceee.org/files/proceedings/2014/data/papers/9-832.pdf.

293. *See* ACCENTURE, ENERGY-SMART BUILDINGS: DEMONSTRATING HOW INFORMATION TECHNOLOGY CAN CUT ENERGY USE AND COSTS OF REAL ESTATE PORTFOLIOS 3 (2011), http://czgbc.org/energy-smart-buildings-whitepaper.pdf (last visited Nov. 3, 2017).

294. *See* Derek Clements-Croome & Alan Johnstone, *Intelligent Buildings Management Systems*, *in* INTELLIGENT BUILDINGS: AN INTRODUCTION (Derek Clements-Croome ed., 2011). Among other functions, occupancy sensors turn off lights in vacant rooms, saving up to 40 percent on energy and operating costs. *See Building Automation*, ENOCEAN, https://www.enocean.com/en/internet-of-things-applications/building-automation/ (last visited Nov. 3, 2017).

295. *See* ACCENTURE, *supra* note 293, at 8, 13, 20.

296. *See* Maureen Ehrenberg, *Facilities Management on the Frontier of Service and Technology*, AREA DEV. ONLINE (2015), http://www.areadevelopment.com/AssetManagement/December-2014/facility-management-evolves-as-business-driver-28282611.shtml.

297. *See* Nate Kessman, *In Focus: Utilizing Data to Enhance Energy Management Strategies*, AREA DEV. ONLINE (2015), http://www.areadevelopment.com/sustainable-development/Q1-2015/utilizing-data-energy-management-strategy-1929266.html.

298. Kelly Kalvelage & Michael Dorneich, *A User-Centered Approach to User-Building Interactions*, 58 PROC. HUMAN FACTORS & ERGONOMICS SOC'Y, 2008, 2008 (2014).

design to support the users' tasks and activities.[299] For example, if a user directly lowers the building temperature, an ordinary metering system does not know why that user is warm or what the user desires, except colder surroundings. But if a user indicates to the building controls that a current task requires extensive physical movement, the system may recognize why and when the user is warm, perhaps not immediately but after her task is underway for a short time.[300] The smarter system also understands that other users may not feel warm and concludes that completely cooling the room down may cause other occupants discomfort. So, the system increases air speed around the user performing the physically-demanding task, maintaining this air speed until the user's body temperature returns to a comparable level to that of others around her.[301]

Progress in individual building components themselves, such as smart windows that report on the opportunity to reduce cooling loads in buildings,[302] will yield substantial savings to building owners and their operators. Garages themselves are also smarter today; containing sensors in the parking stalls allowing a smart phone application (or in a newer vehicle, its onboard computer) to get notice of a stall's availability, reducing inefficient parking-seeking behaviors.[303] Smart parking meters along the curb similarly can cooperate with drivers to minimize "stall-search" traffic mileage.[304]

D. TRANSPORTATION AND PARTNERSHIPS IN LAND USE CONTROLS

Millennials approach travel differently than their elders. Many are (and more will become) "multimodal," meaning they choose the best mode of transportation, such as driving, transit, biking or walking, based on the trip they are planning.[305] They consider public transportation satisfactory for digital socializing and enabling connection to the communities they live in.[306] Millennials also

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299. *See id.* at 2011.

300. *See id.*

301. *See id.* at 2011–12.

302. *See, e.g.*, Ruben Baetens et al., *Properties, Requirements and Possibilities of Smart Windows for Dynamic Daylight and Solar Energy Control in Buildings: A State-of-the-Art Review*, 94 SOLAR ENERGY MATERIALS & SOLAR CELLS 87–105 (2010) (commercial electrochromic windows seem most promising to reduce cooling loads, heating loads and lighting energy in buildings).

303. *See* MeshNetics, *Parking Lots Get Smarter with* ZigBee, MESHNETICS, http://www2.ee.ic.ac.uk/t.clarke/projects/Resources/ZDK_v2.0_Complete/Product%20Information/M-25302-(ZigBee%20Parking%20Automation%20Case%20Study).pdf (last visited Nov. 3, 2017).

304. *See* Sarfraz Nawaz et al., *ParkSense, a Smartphone Based Sensing System for On-street Parking* COMPUTER LABORATORY: UNIV. OF CAMBRIDGE (2013), http://www.cl.cam.ac.uk/cm542/papers/mobicom2013.pdf.

305. *See* NEELA SAKARIA & NATALIE STEHFEST, MILLENNIALS & MOBILITY: UNDERSTANDING THE MILLENNIAL MINDSET 3 (2013), http://www.apta.com/resources/reportsandpublications/Documents/APTA-Millennials-and-Mobility.pdf.

306. TRANSIT CENTER WITH RSG, INC., WHO'S ON BOARD: MOBILITY ATTITUDES SURVEY, at ii, 31, 41, 47 (2014) http://transitcenter.org/wp-content/uploads/2014/08/WhosOnBoard2014-ForWeb.pdf [hereinafter TRANSIT CENTER].

appreciate that transit allows them to work while they travel.[307] However, fundamentals like travel time, cost, and maintenance of reliable schedules are the most important criteria for transit mode decision-making.[308] In response, transit companies will develop, in partnership with traditional commercial developers, parking structures that directly connect to intra-urban core people movers, enabling service to those who drive private vehicles.[309] Such a route was scheduled to open in Italy in 2013, but was delayed due to political machinations.[310] The Irisbus Civis technology propelling the proposed Solar Energy Belt was programmed to use white lines painted upon pavement for vehicle guidance.[311]

Developing office projects with built-in transit components in megapolitan areas affords a competitive advantage to their owners' venues, positioning them as "environmentally conscious" developers. For example, Princeton University's Arts and Transit Neighborhood integrates multiple transportation modes into housing, retail stores, offices, and performing and other arts venues.[312] Princeton Township and Princeton Borough each adopted a new zoning ordinance, an "Arts and Transit" overlay district of sorts, flexibly accommodating mixed uses and the university's sustainability standards while addressing traffic congestion challenges.[313] At Stadium Place Development in Seattle, a 3.85 acre residential area, approximately 420 thousand square feet of office and hotel space share a four-story high podium filled with retail vendors and parking.[314] The project is adjacent to an intermodal regional transit hub at King Street Station,[315] allowing passengers to access the Washington State ferry terminal, airport light rail,

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307. TONY DUTZIK ET AL., A NEW WAY TO GO: THE TRANSPORTATION APPS AND VEHICLE-SHARING TOOLS THAT ARE GIVING MORE AMERICANS THE FREEDOM TO DRIVE LESS 9, 13 (2013), http://www.uspirg.org/sites/pirg/files/reports/A%20New%20Way%20to%20Go%20vUS1.pdf.

308. *See* TRANSIT CENTER, *supra* note 306. Transit stations themselves will incorporate vertical gardens to cool, heat and, filter air.

309. *See* METROTRAM, http://www.metrotram.it/ (last visited Jan. 22, 2016). The Solar Energy Belt, a system designed by Iosa Ghini Associati intending links between the City of Bologna, Italy and the Marconi International Airport atop a viaduct (except at ground-level stations) and that outfits stations and the viaduct with photovoltaic panels along its 5 kilometers, tram-on-tires route). *See also* Kingsley Akwaa, *Metro-Bus System; The Future of Ghana's Transportation*, MODERN GHANA (Oct. 6, 2017), https://www.modernghana.com/news/807830/metro-bus-system-the-future-of-ghanas-transportation.html (People Mover P35 is monorail inner city system using only solar system and wind).

310. *See* Bridgette Meinhold, *A Solar Powered Monorail System for Bologna*, INHABITAT (Nov. 2, 2009), https://inhabitat.com/a-solar-powered-monorail-system-for-bologna/.

311. *See* Jean-Marc Boucheret, *Briefing: The CIVIS Optically-Guided Urban Transport System*, 157 PROC. OF THE ICE—MUN. ENG'R. 13–15 (2004).

312. *See* PRINCETON UNIVERSITY ARTS & TRANSIT PROJECT, http://www.princeton.edu/artsandtransit/design/ (last visited Nov. 3, 2016).

313. *See* PRINCETON UNIVERSITY, MEMORANDUM OF UNDERSTANDING (Oct. 2011), http://www.princeton.edu/artsandtransit/documents/MOU-September-28-2011-REVISED-DRAFT.PDF.

314. *See* STADIUM PLACE, http://www.northlotdevelopment.com/overview.html (last visited May 12, 2017); *see also Stadium Place Scores Several Top Awards*, DAILY J. COMM. (Feb. 9, 2015), https://www.djc.com/news/ae/12074529.html.

315. *See Transit*, NORTH LOT, http://www.northlotdevelopment.com/ (last visited Jan. 22, 2016).

Sounder Commuter Rail, Amtrak, and dozens of King County Metro buses.[316] Given the Seattle knowledge worker's commitment to sustainability issues, millennials will view Stadium Place as a template for future office and mixed-use development.

Pent-up demand[317] among millennials for walkable urban development in megapolitan areas[318] will increasingly be served. Walkable urban development is high-density development affording multi-modal transit, including trips completed on foot.[319] Such places are at least five times more intense, measured in floor area ratios, than drivable suburban areas.[320] Knowledge workers view such intensity of development as desirable because of the offsetting convenience and stimulation that accompany density of buildings and concentration of workers.[321] "Smart city" for this purpose integrates environmentally-sensitive transportation infrastructures with green buildings, parks, and place-making.[322] This entails two mobility features, the first providing complete citizen accessibility to and from transit stops by means of personal mobility devices or driverless "swarm cars" addressing departure and arrival challenges.[323] The second feature is more persons acquiring financial and personal incentives to store personal vehicles long term except for weekend use for recreational travel or undertaking substantial consumer expeditions.[324] This could be accomplished, for example, by increased investment in reducing carbon footprints instead of adjusting parking rates tied to demand. All these opportunities are facilitated by transit availability, as well as by mobility apps like SFPark, ParkNOW, and Waze.[325] Parking of private vehicles will receive increasing local government scrutiny under demand-based protocol programs such as ParkDC,[326] under which rates for public parking (sometimes known as "surge pricing") are based on how many spaces remain

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316. *See id.*

317. *See* BROOKINGS METROPOLITAN POLICY PROGRAM, THE PATH TO GEORGIA'S 21ST CENTURY KNOWLEDGE ECONOMY: ECONOMIC DEVELOPMENT, CAPITAL AND OPERATING COST ESTIMATES, STATION AREA PLANS, MARKET ASSESSMENT, AND FINANCING OPTIONS FOR THE MACON TO ATLANTA PASSENGER RAIL CORRIDOR 3 (May, 2010), http://www.georgiarail.org/wp-content/uploads/2010/08/3.-Final-report.pdf.

318. *See* HIROAKI SUZUKI ET AL., TRANSFORMING CITIES WITH TRANSIT: TRANSIT AND LAND-USE INTEGRATION FOR SUSTAINABLE URBAN DEVELOPMENT 134 (World Bank, 2013).

319. *Id*. at 36.

320. *Id.*

321. *Id.*

322. *Id.* at 117–21 (describing Bogota's connectivity among transit and parks and other open spaces).

323. *See* U.S. DEP'T OF TRANSP., THE SMART/CONNECTED CITY AND ITS IMPLICATIONS FOR CONNECTED TRANSPORTATION, WHITE PAPER 33 (Oct. 14, 2014), http://www.its.dot.gov/itspac/Dec2014/Smart_Connected_City_FINAL_111314.pdf. This is the human equivalent of freight "last mile" delivery, a sustainability challenge worthy of the standards-setting of performance zoning, *see* Michael N. Widener, *Tactical Urbanism v2: Dynamic Land Use Regulation and Partnership Tools Regenerating First Suburbs*, 8 DREXEL L. REV. 113, 144–45 (2015).

324. *Cf.* SUZUKI, *supra* note 318, at 72 (Singapore has an off-peak vehicle licensing scheme that allows vehicles holding such licenses to be used only during the morning and evening off-peak periods).

325. *See* U.S. DEP'T OF TRANSP., *supra* note 323, at 33.

326. *See ParkDC*, DIST. DEP'T OF TRANSP., http://ddot.dc.gov/page/parkdc (last visited May 12, 2017).

available at any given time in a particular quarter.[327]

Transit provision will approach fusion with office development where the densest development requires comprehensive multi-modal worker delivery to places of business. Light rail and bus stations sited in dedicated pathways located down the centers of arterial streets are in the offing, with roadway vehicular lanes reduced in width in opposing directions to accommodate self-driving vehicles.[328] This roadway width will be sufficient to support emergency access to bordering buildings while affording room for bicycle lanes,[329] curbside parking and sidewalks. Roadway speeds in densely traveled areas will be reduced to stanch incentive to use passenger-operated vehicles instead of bicycles or mass transit transportation alternatives. Public-private partnerships will create means of movement from fixed-path transportation routes into workspaces, satisfying varied preferences for navigation on the first and final "legs" of work commutes.[330] For example, such partnerships may invest in technologies transporting people by single track, above-ground conveyances, powered by sustainable energy sources.[331]

Transit-oriented districts soon will feature pedestrian accessibility (integrating transit malls) to fixed guideway systems and buses using dedicated lanes linking commerce nodes to transit stations.[332] Office-with-transit infrastructure initiatives ultimately will lead to performance zoning overlays accommodating not just mixed uses but integrated work and living spaces within individual buildings and multi-building projects.[333] One result will be reducing commuter gas-

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327. *See, e.g.*, Michael Perkins, *DDOT's Newest Performance Parking Program Will be its Best*, GREATER WASHINGTON (April 13, 2015), https://ggwash.org/view/37777/ddots-newest-performance-parking-program-will-be-its-best; Randall Stross, *The Learning Curve of Smart Parking*, N.Y. TIMES (Dec. 22, 2012), http://www.nytimes.com/2012/12/23/technology/smart-parking-has-a-learning-curve-too.html?_r=0.

328. *See* SUZUKI, *supra* note 318, at 68, 83 (depicting trinary road system).

329. *See* Luigi dell'Olio et al., *Implementing Bike Sharing Systems*, 164 Proc. ICE—Muni. Eng'r. 89–101 (2011) (discussing a location model for fixing bicycle pick-up and drop-off stations aided by a geographical information system, along with maximum tariffs calculated to guarantee satisfactory levels of consumer participation).

330. *See, e.g.*, MARC SCHLOSSBERG ET AL., HOW FAR, BY WHICH ROUTE AND WHY? A SPATIAL ANALYSIS OF PEDESTRIAN PREFERENCE 7 (Mineta Transportation Institute ed., 2007) (addressing interconnected issues of obesity, sprawl, and quality of life, the study's purpose was to understand how far Americans will walk to transit and environmental factors influencing them).

331. *See, e.g.*, SUZUKI, *supra* 318 (the Solar Energy Belt, a monorail system designed by Iosa Ghini Associati, intends linking the City of Bologna, Italy with the Marconi International Airport atop a viaduct (except at ground-level stations) and outfits stations and the viaduct with photovoltaic panels along its 5 km, tram-on-tires route); MARCONI EXPRESS, http://www.marconiexpress.it/ (last visited Nov. 3, 2017).

332. *See, e.g.,* SUZUKI, *supra* note 318, at 22, 36, 159; Stephen Smith, *North Jersey Jitneys Take Off*, MARKET URBANISM, (Sept. 17, 2010), http://marketurbanism.com/2010/09/17/north-jersey-jitneys-take-off/; Randal O'Toole, *Urban Transit*, CATO INST. (June, 2010), http://www.downsizinggovernment.org/transportation/urban-transit. Transit-oriented development as a sustainable concept, and its adherents, are summarized in Patricia E. Salkin, *Sustainability and Land Use Planning: Greening State and Local Land Use Plans and Regulations to Address Climate Change Challenges and Preserve Resources for Future Generations*, 34 WM. & MARY ENVTL. L. & POL'Y. REV. 121, 153 (2009).

333. In Phoenix's CBD, the Downtown Code (a form-based Code effective February 15, 2013, *see* PHOENIX, ARIZ., CODE APP. A. (ZON. ORD.) Ch. 12, § 1201 *et seq.*) calls out, in the Business Core (§1209) and the

powered motor vehicles, eliminating the heat islands created in asphalt-paved parking lots while reducing fuel consumption. Another will be that excess electric power will be diverted to meet transit system cars' electricity demand. Communities incentivize transportation sustainability, partly by selling (or trading for density increases) surplus electrical output (the product of so-called "net metering") to transit operators, or by supplying it to publicly available electric vehicle chargers where alt-fuels and self-driving vehicles are in highest demand.[334]

Integrating future development into transit nodes is increasingly becoming standard procedure within the development industry.[335] Instead of community emphasis on transportation impact "offsets" for new development, increasing public-private conflicts over "proportionality" of municipal exactions,[336] performance standards induce developers to facilitate worker commuting and movement within mass-transit corridors. In vicinities where intersections of two or more transit nodes occur, developers can respond by linking their projects' employee entrances and those of their neighbors, thus, meeting transit performance standards and attaining greater project density targets.[337]

Transportation infrastructure and its accessibility dividend play key roles in developing office use-intensive clusters,[338] with "people movers" joining transit stations with office projects either above ground or at ground level.[339] Transit companies interested in intra-urban core transportation[340] and sustainability, like

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Downtown Gateway (§ 1212), among other districts, for frequent service by multiple modes of public transit; this Downtown Code endorses various neighborhoods and character areas becoming mixed-use development nodes, *see id*. Phoenix's Interim Transit-Oriented Development Overlay Districts further encourage mixed use development in other parts of the city, *see* CITY OF PHOENIX, METRO LIGHT RAIL: TRANSIT-ORIENTED DEVELOPMENT IN PHOENIX 4–5, http://www.valleymetro.org/images/uploads/lightrail_publications/TOD_Brochure.pdf; Carol Atkinson-Palombo & Michael J. Kuby, *The Geography of Advance Transit-Oriented Development in Metropolitan Phoenix, Arizona, 2000–2007*, 19 J. TRANSP. GEOG. 189, 191–92 (2011).

334. *See, e.g*., Ken Belson, *Portland Plans for Transit All Powered by Electricity*, N.Y. TIMES (Aug. 28, 2011), http://www.nytimes.com/2011/08/28/automobiles/portland-plans-for-transit-all-powered-by-electricity.html?pagewanted=all.

335. *See, e.g.,* SUZUKI, *supra* note 318, at 41, 125–26.

336. *See* Erin Ryan, *Zoning, Taking and Dealing: The Problems and Promise of Bargaining in Land Use Planning Conflicts*, 7 HARV. NEGOT. L. REV. 337, 377–79 (2002); Richard Duane Faus, *Exactions, Impact Fees, and Dedications—Local Government Responses to Nollan/Dolan Takings Law Issues*, 29 STETSON L. REV. 675, 680–89 (1999–2000).

337. *See* ROBERT CERVERO ET AL., TRANSIT-ORIENTED DEVELOPMENT IN THE UNITED STATES: EXPERIENCES, CHALLENGES, AND PROSPECTS 122 (2004).

338. *See id.*

339. Indraswari Kusumaningtyas & Gabriel Lodewijks, *Accelerating Moving Walkway: A Review of the Characteristics and Potential Application*, 42 TRANSP. RESEARCH PART A 591, 591 (2008).

340. Historically, American transportation companies, especially railroads, engaged in land development. For example, Plant Hall, a historic building at the University of Tampa, was originally the Tampa Bay Hotel, developed by Henry B. Plant, owner of the Tampa and Thonotosassa Railroad, a part of the Plant Rail System; this hotel was built near the Tampa terminus of this line. *See* HENRY B. PLANT MUSEUM, http://www.plantmuseum.com/about/the-museum (last visited May 17, 2017).

Veolia and Transdev,[341] are likely partners in physically integrating transit into office and retail projects. Transit avenues will capture knowledge workers' businesses as neighbors; business executives will realize that maximum ease in worker movement contributes to recruiting and retention advantages, to worker productivity increases and to healthcare cost decreases.

Coming generations of office projects increasingly will feature "vehicle to grid" technologies. Through these technologies, electrical vehicles parked in garages will either substantially reduce their "charge" rates or deliver electricity to power lines feeding the grid, maintaining its equilibrium.[342] Vehicles coordinated into this process decrease electricity costs by selling surplus production to the electric utility[343] so that, when combined with developer-installed solar power or wind power generation systems, power substations will be decreasingly relied upon by net-zero energy commercial buildings.[344]

E. NOURISHING A SUSTAINABLE PROJECT'S OCCUPANTS

Tokyo's Pasona Urban Farm shows how the future of food sustainability in dense urban projects will evolve. Pasona, a 43,000 square foot garden that grows up, down, and across a nine story-high, 215,000 square foot corporate office building, houses a personnel recruitment company.[345] Its vertical garden boasts 200 species of plants, incorporating fruits, vegetables, and rice that are harvested, prepared, and served in the office building's cafeterias. Pasona represents the largest and most direct farm-to-table indoors initiative of its kind.[346] The farm is not, however, a nirvana of sustainability. Because its gardens utilize a mix of

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341. Transdev is the largest private sector provider of public transportation systems worldwide. Transdev is the delegated manager of all public transit for the New Orleans Regional Transit Authority, *see* Richard Rainey, *New Orleans RTA Signals Post-Katrina Pivot with New 5-year Management Deal*, THE TIMES-PICAYUNE (Apr. 2, 2015), http://www.nola.com/politics/index.ssf/2015/04/new_orleans_rta_signals_post-k.html. Veolia's Environmental Services Division specializes in solid waste management services like recycling. *See Recycling and Waste Services*, VEOLIA, http://veolia.co.uk/our-services/our-services/recycling-and-waste-services (last visited Nov. 4, 2017). A company with multiple, intersecting areas of expertise will be much in demand as planning and execution partners where people movement and sustainability are vital dimensions of an office development.

342. *See* Sarah Shelton, *Electrified Vehicles Poised to Supply Power to the Grid*, HYBRIDCARS (Jul. 15, 2015), http://www.hybridcars.com/electrified-vehicles-poised-to-supply-power-to-the-grid/; *V2G Concept,* UNIVERSITY OF DELAWARE, http://www.udel.edu/V2G/V2Gconcept.html (last visited Nov. 4, 2017).

343. Under Delaware law, electric utilities are required to compensate owners of electric cars for electricity reverting to the grid at the same rate those owners pay for electricity to charge their auto batteries. *See* DEL. CODE ANN. tit. 26, § 1014(g) (West 2017).

344. *See* Shanti D. Pless & Paul A. Torcellini, *Net-Zero Energy Buildings: A Classification System Based on Renewable Energy Supply Options,* NREL 5–6 (2010), https://www.nrel.gov/docs/fy10osti/44586.pdf.

345. *See* Simple Prosperity, *Aquaponics Network Australia: Integrated Aquaponics and Urban Agriculture*, 63(1) SCI. ED. NEWS 32, 33–34 (2014); Beth Buczynski, *Pasona Urban Farm Engulfs Tokyo Office Building with Fresh Food*, EARTHTECHLING (Sep. 15, 2013), http://earthtechling.com/2013/09/pasona-urban-farm-engulfs-tokyo-office-building-with-fresh-food.

346. *See* Kate Andrews, *Pasona Urban Farm by Kono Designs*, DEZEEN (Sep. 12, 2013), http://www.dezeen.com/2013/09/12/pasona-urban-farm-by-kono-designs/.

hydroponic and soil-based farming, they require specific climate controls within the building that render the office space warmer than what American workers expect.[347] Still, Pasona's intelligent climate control system monitors humidity, temperature, and breeze to address human comfort during office hours and to optimize crop growth when the employees depart.[348]

Brooklyn Grange Farm comprises two and a half acres of growing space atop the roofs of Brooklyn and Queens office buildings.[349] There, Brooklyn Grange LLC grows more than 50,000 pounds of food each year, which it sells through farmers markets, community supported agriculture (CSA) subscriptions and wholesale accounts.[350] In addition to boosting New York City's local food supply, the farm absorbs more than 1,000,000 gallons of urban storm water every year, reducing what the city's infrastructure otherwise must manage.[351] Similarly, Urban Harvest's STL's Food Roof Farm received a $135,000 grant from the Metropolitan St. Louis Sewer District to reduce overflows from the city's combined storm and waste sewerage system for its two-story building rooftop operation.[352] The rate of water capture and reuse is measurable, as is the food output of these initiatives.

F. WASTE ELIMINATION AND TOTAL RECYCLING IN COMMERCIAL PROJECTS

Some cities with higher sustainability ratings have introduced aggressive programs to reduce commercial community waste or to eliminate it entirely.[353] In 2015, New York's Earth Day announced a plan (part of the OneNYC plan),[354] to reduce commercial waste disposal by ninety percent by 2030. The plan includes:

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347. Katherine Allen, *In Tokyo, a Vertical Farm Inside and Out*, ARCH DAILY (Sep. 29, 2013), http://www.archdaily.com/428868/in-tokyo-a-vertical-farm-inside-and-out/.

348. *See* Andrews, *supra* note 346.

349. *See* ANASTASIA COLE PLAKIAS, THE FARM ON THE ROOF: WHAT BROOKLYN GRANGE TAUGHT US ABOUT ENTREPRENEURSHIP, COMMUNITY, AND GROWING A SUSTAINABLE BUSINESS 5 (2016).

350. *See About Brooklyn Grange*, BROOKLYN GRANGE, https://www.brooklyngrangefarm.com/about-brooklyn-grange-1/ (last visited Nov. 4, 2017).

351. *See* PLAKIAS, *supra* note 349, at 146, 264; Sarah Shemkus, *Next-Gen Urban Farms: 10 Innovative Projects from Around the World,* THE GUARDIAN (Jul. 2, 2014), http://www.theguardian.com/sustainable-business/2014/jul/02/next-gen-urban-farms-10-innovative-projects-from-around-the-world.

352. *See* Joe Gose, *In St. Louis, an Urban Farmer Uses a Rooftop and Food to Spur Renewal*, N.Y. TIMES (Jun. 30, 2015), http://www.nytimes.com/2015/07/01/realestate/commercial/in-st-louis-an-urban-farmer-uses-a-rooftop-and-food-to-spur-renewal.html?_r=0. The owner will derive most of its revenue from nearby residents who pay an up-front fee to pick produce throughout the growing season, and it is renting garden beds to as many as twenty residents of the apartment building. *See id*; Brown, *supra* note 26, at 105–10 (describing municipal urban agriculture ordinances that could mesh with performance standards in zoning ordinances).

353. *See* Tanvi Misra, *It's About Time New York Solved Its Trash Problem*, ATLANTIC CITYLAB (Apr. 23, 2015), http://www.citylab.com/politics/2015/04/its-about-time-new-york-solved-its-trash-problem/391315/. Seattle and San Francisco are other cities with such programs.

354. *See* William Solecki et al., *New York, USA*, *in* CITIES ON A FINITE PLANET: TOWARDS TRANSFORMATIVE RESPONSES TO CLIMATE CHANGE 181–82, 207 (Sheridan Bartlett & David Satterthwaite eds., 2016).

(a) implementing universal single-stream recycling[355] to facilitate everyone's recycling contributions; (b) expanding the city's composting program to every residence by 2018; (c) restricting the sale of non-recyclable and non-compostable items; and (d) offering tax incentives to businesses complying with the city's "Zero Waste"[356] reduction goals.[357]

Coming soon are artificial intelligence machine agents that will differentiate between paper, plastic, and organic compost-worthy materials and will direct collection in the appropriate containers for later processing.[358] Because these machine agents have already learned human facial recognition to some degree of accuracy,[359] soon they will adapt algorithms for agents to learn to automatically recognize and sort-as-deposited recyclables before these reusable materials even leave a commercial project.[360]

This initiative assumes substantial priority due to discoveries in 2014 of new classes of recyclable thermosetting polymers known as polyhexahydrotriazines or PHTs. PHTs are rigid, resistant to heat, and tough; they should replace all forms of unrecyclable thermosets, becoming ubiquitous in newly manufactured goods by 2025.[361] This breakthrough in plastics chemistry will accelerate a

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355. In a single-stream process, all recyclable materials are deposited in a single container (a growing commitment from recyclers), to be sorted by a complex process that cannot address the problem of contaminated (such as by grease or other residue) commingled recyclable materials. *See* Cole Rosengren, *Single-Stream Recycling: Simple for Residents, Complex for the City*, CITYLIMITS (May 20, 2015), http://citylimits.org/2015/05/20/single-stream-recycling-simple-for-residents-complex-for-the-city/.

356. Under Zero Waste policies, no recyclables are burned or buried in landfills. *See id.* at 10, 217, 276.

357. The city's commitment also forecasts a thirty percent reduction in greenhouse gases from retrofitting buildings for greater energy performance by 2025 and investing in green jobs growth. *See One City: Built to Last, Transforming New York City's Buildings for a Low-Carbon Future*, THE CITY OF NEW YORK: MAYOR'S OFFICE OF LONG-TERM PLANNING AND SUSTAINABILITY 28–29, 49, 59, 98 (2015), http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf.

358. *See* Catalin Buiu, *Design and Development of a Waste Cleanup Service Robot*, PROC. FIRST INTERNATIONAL EUROBOT CONFERENCE, HEIDELBERG, GERMANY, 2008, at 194–202 (2008), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.599.8685&rep=rep1&type=pdf; Catalin Buiu et al., *Developing of a Service Robot to Recognize and Sort Waste*, PROC. 16TH INTERNATIONAL CONFERENCE ON CONTROL SYSTEMS AND COMPUTER SCIENCE (MAY 22, 2007) 298, 303.

359. *Artificial Intelligence: Rise of the Machines*, THE ECONOMIST (May 9, 2015), http://www.economist.com/news/briefing/21650526-artificial-intelligence-scares-peopleexcessively-so-rise-machines?zid=291&ah=906e69ad01d2ee51960100b7fa502595 [hereinafter Machines Rising] (describing an algorithm called DeepFace that can recognize specific human faces in images roughly ninety-seven percent of the time, even when the faces are partly hidden or poorly illuminated).

360. Tuomas J. Lukka et al., *ZenRobotics Recycler—Robotic Sorting using Machine Learning*, SENSOR BASED SORTING 2014 CONF. (Mar. 11–13, 2014), http://users.ics.aalto.fi/praiko/papers/SBS14.pdf; Anthony Cuthbertson, *Recycling Robots—A Look Inside the World's First AI Waste Management Centre*, INT'L BUS. TIMES (Jun. 13, 2014), http://www.ibtimes.co.uk/recycling-robots-look-inside-worlds-first-ai-waste-management-centre-1452389; ZenRobotics, *ZenRobotics - Next Generation ZenRobotics Recycler - Robotic Sorting Station*, YOUTUBE (Nov. 13, 2014), https://www.youtube.com/watch?v=X_1sOPqM_VA. These robots are working in a recycling plant but seem adaptable to an office environment.

361. *Cf.* Jeannette M. Garcia et al., *Recyclable, Strong Thermosets and Organogels via Paraformaldehyde Condensation with Diamines*, 344 SCI. 732–35 (May 16, 2014) (stating a thermoset that can be inherently depolymerized would afford a useful route for thermoset recyclability and redeployment); *see also* Bernard

reuse-driven, "circular" economy, vastly reducing landfills' plastic waste. Avoiding an increased carbon footprint in the recycling process itself will become a competitive city's keystone, resonating with knowledge workers seeking sustainable places to live, recreate, and work.

At this rate, many United States municipalities should be propelled by performance zoning standards aimed at attaining ecocity status. An ecocity, loosely defined by the declaration of the World Ecocity Summit 2008,[362] is "an ecologically healthy city . . . . [E]cocity development requires the comprehensive understanding of complete interactions between environmental, economic, political, and socio-cultural factors based on ecological principles."[363]

Leveraging the "Internet of Things," digital technologies will disrupt conventional customs and practices in realty development, property management and spatial regulation. Aspirations for ecocity-lifestyle attainment, however futuristic they seem today, animate urban planning and land use regulation in competitive cities toward mandates for carbon emissions reduction, resource efficiency, economic development goal-setting and built-environment designs. These mandates will promote healthy and socially sustainable communities.[364] Millennials will soon be running zoning and long-range planning administrations—older millennials already do. They continue to embrace technologies alien to their forbearers' cultural norms, merely in response to changed economic circumstances.[365] With those technologies in hand, and new tools of compliance powered by microprocessors and microsensors, facets of energy conservation and building performance increasingly will be measurable, maintainable, and susceptible to recalibration.[366] It will be possible to respond to increasing "big data" retrieval and analysis,[367] while forecasting new benchmarks of efficiency achievement.

Meyerson, *Top 10 Emerging Technologies of 2015*, SCI. AM. (Mar. 4, 2015), http://www.scientificamerican.com/article/top-10-emerging-technologies-of-20151/?page=1.

362. *See San Francisco Ecocity Declaration*, ECOCITY (May 15, 2008), https://ecocity.wordpress.com/2008/05/15/san-francisco-ecocity-declaration/.

363. *See id.* A sensible first step in this direction implements the EcoDistrict, improving sustainability through methods like district-wide heat recovery, distributed generation of electricity and reusing water between properties.

364. *See* Annissa Alusi et al., *Sustainable Cities: Oxymoron or the Shape of the Future*?, HARVARD BUSINESS SCHOOL ORGANIZATIONAL BEHAVIOR UNIT WORKING PAPER 11-062, at 2–3 (2011), http://www.hbs.edu/faculty/Publication%20Files/11-062.pdf.

365. Christopher Mims, *How Aging Millennials Will Affect Technology Consumption*, WALL ST. J. (May 17, 2015), http://www.wsj.com/articles/how-aging-millennials-will-affect-technology-consumption-1431907666.

366. *See* Denia Kolokotsa et al., *A roadmap towards intelligent net zero- and positive-energy buildings*, 85 SOLAR ENERGY 3067–84 (2011). In Singapore, officials of the National Research Foundation (together with other city stakeholders) currently are readying implanted sensors that will feed data into a dynamic online map that will store building dimensions, placement of building windows and types of construction materials used in erecting vertical improvements. *See* Hannah Furfaro, *Views from Above Inform Decisions Below*, WALL ST. J., Apr. 17, 2017, R3; Jake Maxwell Watts & Newley Purnell, *How Singapore is Reimagining the Smart City*, WALL ST. J., Apr. 25, 2016, R4.

367. *See* Rob Kitchin, *The Real-Time City? Big Data and Smart Urbanism*, 79 GEOJOURNAL 1, 3 (2014), http://www.maynoothuniversity.ie/progcity/wp-content/uploads/2014/02/GeoJournal-Real-time-city-2014.pdf.

New economic conditions and future financial uncertainty are institutional as well as personal, and land use officials must familiarize themselves, their professional colleagues, and private partners in new governance ventures leveraging these ground-breaking technologies.[368] In this open-sourced manner, the community increasingly trusts local administrators' management of infrastructure and their monitoring development's negative effects. Meanwhile, "those who own their own property will not have the heavy hand of local government deprive them"[369] of development options. Administrators of prescriptive zoning regulations (like Euclidean codes) are vulnerable to dynamic property development sustainability currents.[370] New approaches defy easy silo placement as permitted uses or even ancillary-to-primary uses under rigid, segregating zoning schemes. Part V explains why reaching desired sustainable development objectives entails rejuvenating American land use regulatory schemes integrating performance zoning principles.

V. TRUST BUT VERIFY: BUILDING THE SUSTAINABLE COMMUNITY

In respect to Smart Codes or form-based codes, Nicole Stelle Garnett recently urged local officials to "consider an option . . . previously defined as "[m]ixed-[u]se [z]oning without the [s]trings"—that is, simply amending zoning laws to permit a greater degree of land use diversity while eschewing the regulatory details that pervade most transect-zoning schemes. This would achieve a core goal of transect zoning—more mixing of land uses.[371]

If developers can mitigate entirely those negative outgrowths of new urban-core development—additional parking burdens, increased conflicting traffic movements, more ambient noise, enhanced carbon footprint and energy waste—then why should local governments specify most land use dimensions of their projects?[372] Sustainability concerns are paramount in cities with high growth

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"Big data" is a complex ecosystem comprised of numbers of NoSQL, large databases that store unstructured or partly structured data and Hadoop (that open source software for the distributed processing of large datasets running in the cloud computing environment). *See* Lucy L. Thomson & Robert Thibadeau, *Security Challenges of the Big Data Ecosystem Require a Laser-Like Focus on Risk*, 12 THE SCI. TECH. LAWYER 6, 7 (Winter, 2016).

368. *See generally* Gheorghe H. Popescu, *E-Commerce Effects on Social Sustainability*, 10 Econ., Mgmt. & Fin. Mkt. 80–85 (Mar. 2015).

369. *Cf.* Texas Governor Greg Abbot, quoted in Max B. Baker, *Governor Abbott signs Denton Fracking Bill*, FORT WORTH STAR-TEL. (May 18, 2015), http://www.star-telegram.com/news/business/barnett-shale/article21282813.html.

370. *See* STOCKHAM, *supra* note 7, at 34–36.

371. Garnett, *supra* note 35, at 587 (quoting NICOLE STELLE GARNETT, ORDERING THE CITY: LAND USE, POLICING, AND THE RESTORATION OF URBAN AMERICA 200–01 (2010)).

372. I do not here (a) advocate abandoning plans review for fire and safety codes compliance nor (b) suggest that cities and developers are free to ignore in their projects the contextual dimensions of their projects, essentially, their *regional* impacts. Instead, my point affirms Isaiah Berlin's concept of "negative liberty" which states that individuals are to be protected from the state. *See* Isaiah Berlin, *Two Concepts of Liberty*, *in* ISAIAH BERLIN, LIBERTY 166 (Henry Hardy ed., 2002). Still, I do not propose abandoning all state control over

rates and competitiveness ambitions, and developers should be permitted far greater control of their projects so long as they satisfy articulated community energy usage and other environmental goals.

When performance zoning standards expressing community goals are met, the developer ought to decide what project uses to implement. But such an idea does not resonate well with stakeholders in zoning processes accustomed to the separation of uses.[373] Skeptics raise monitoring issues in performance zoning, doubting land use staff will surmount substantial learning curves before launching an ordinance. All this boils while community expenditures increase for personnel training and equipment.[374] Doubters argue that adopting a myriad of performance standards lengthens site plan administrative review processes, and that more administrative resources must be expended to conduct site inspections and investigate neighbor complaints concerning performance of a permitted project upon completion.[375] This last issue arises from doubts about agency follow-through with compliance checks and transparency of developers complying with performance standards, but local regulators can adopt President Reagan's advice to "trust but verify,"[376] for instance at the stage of project permits close-out. Performance standards' compliance can be confirmed by community representatives as a condition to releasing previously-posted developer security. Forms of security include cash bonds[377] or letters of credit. Collateral-at-risk in substantial sums will alert developers to the dangers of failing to deliver on performance standard promises.

Will the development industry circumvent or ignore the intent behind explicit community goals in performance zoning ordinances? Though some degree of cheating is inherent in human nature;[378] three responses have merit. First, it makes good economic sense for developers to invest in higher building performance standards compliance. Developers know that an increasing number of their occupants see sustainability as part of the mission and values of their

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development even if the developer "solves all identified problems" attached to its project under development; citizens expect more from their governments, especially where personal health and public safety are at stake.

373. *See* Fraietta, *supra* note 32.

374. *See supra* note 84 and text accompanying *supra* notes 127–29.

375. *See* Frew, *supra* note 46; RICHMOND RPDC, *supra* note 37, at 18–19; THOMAS L. DANIELS, JOHN W. KELLER & MARK B. LAPPING. THE SMALL TOWN PLANNING HANDBOOK (2nd ed., 1995); Jourdan et al., *supra* note 20, at 336–67. This skepticism may be overcome when the checking of building envelope design against design regulations becomes fully automated. *See* Xiangyang Tan et al., *Automated Code Compliance Checking for Building Envelope Design*, 24 J. Comput. Civ. Eng. 203, 211 (2010).

376. *See* Daryl G. Kimball, *Looking Back: The Nuclear Arms Control Legacy of Ronald Reagan*, ARMS CONTROL TODAY (Jul. 8, 2004), https://www.armscontrol.org/act/2004_07-08/Reagan.

377. *See* Bryan M. Seifert, *Sustainable Buildings and the Surety*, 33 REAL EST. ISSUES 47, 49–51 (2008). Int'l Harvester Co. v. Zoning Bd. App., 193 N.E.2d 856, 862 (Ill. App., 1963) affirmed that performance standards must continue to be satisfied after building permits are granted.

378. Piotr M. Patrzyk, *Would You Cheat? Cheating Behavior, Human Nature, and Decision-Making*, 6 STUDENT PULSE (2014), http://www.academia.edu/7982874/Would_You_Cheat_Cheating_Behavior_Human_Nature_and_Decision-Making.

businesses and seek sustainable workplaces for their employees.[379] Even if sustainable buildings were left vacant, however, savings on their energy and water usages are realizable through maintaining relatively inexpensive sustainability initiatives. These are costs that are quickly recaptured. Second, verification methods are applicable to new development, with ready sanctions available for defectors (cheats), either through forfeiture of developer-posted cash collateral, or by suspending certificates of occupancy pending full compliance. Indeed, verification methods will soon become sophisticated enough that concealment of facts represents no viable long-term option for commercial building operators.[380]

Third, a developers' temptation to defect is reduced when the opportunity exists to exchange stakeholder rights in respect to project performance standards. If the developer cannot meet certain community goals despite good faith endeavors, performance zoning's quantification of value enables a market in which "swapping" performance standards between the most affected neighborhoods and a developer can occur, especially when achieving particular standards defies design and construction techniques.[381] If neighbors do not mind the developer's compliance failure with a performance standard that is perceived to be less consequential, then exchanging compliance for satisfying a greater perceived neighborhood value may be sensible and highly advantageous—within certain constraints.[382] Trading away a performance standard potentially gives local authorities "cover" (it being the citizens' choice so to do) while satisfying the adjoining neighborhood and saving the developer the difficult decision

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379. *See* Rebecca C. Retzlaff, *Green Buildings and Building Assessment Systems: A New Area of Interest for Planners*, 24 J. PLAN. LIT. 3, 4 (2009) [hereinafter Retzlaff, *Greening*].

380. *See, e.g.*, Peng Zhou & Nora El-Gohary, *Domain-Specific Hierarchical Text Classification for Supporting Automated Environmental Compliance Checking*, 29 J. COMPUT. CIV. ENG. (2015). New technology amplifies the capacity of its users to determine building performance metrics without hacking into a property manager's cloud-based datasets over the manager's objections. One example is New Bounce Imaging's "tactical spheres" that, equipped with multiple cameras, enter unwelcoming spaces to gather pictorial evidence of conditions from disparate images knitted together to make full panoramic portraits transmitted to a smartphone. *See* Rob Matheson, *Alumnus's throwable tactical camera gets commercial release*, MIT NEWS (Jun. 26, 2015), http://news.mit.edu/2015/throwable-tactical-camera-bounce-imaging-0626. These Explorers (brand name) and similar "spying devices" will soon be affordable to consumers who will use these "indoor drones" to investigate interiors' temperatures and air-flows. If machine agents are precluded from verification, then self-appointed "watchdogs'" stealthly supported within the workforce and enabled by technologies that "spy" (like low-altitude drones), will stymie all but the most sophisticated methods of cheating. Communities have surveillance allies among their populations, if deceit is suspected.

381. *See* Ottensmann, *supra* note 19, at 41–42. It may be possible for developers to use PACE credits for offsetting mitigation measures benefitting neighborhoods negatively impacted by the developer's underperformance of a performance standard.

382. *See id.* Ottensmann acknowledges that negotiating standards compliance between neighbors may result in outcomes harmful to more distant property owners in the broader community or to passers-by. *Id.* at 41. Building sustainability is a public good subject to trading away by private parties; accordingly, Ottensmann concedes maximum limits on rights to be exchanged are proper for any specific development location. *Id.* For a discussion of whether neighbors appropriately can be compensated directly for "selling" their rights via rezoning their properties. *See* Leaf & Lewyn, *supra* note 25, at 346–50.

whether to revise a new project or postpone operation of the project until shared compliance is achieved—if it ever is.

Chicago's recent experience proves that cities can monitor sustainable outcomes of development.[383] It behooves competitive communities to structure performance zoning codes for verifiability by readings of precise sensors and meters (whether through examination of utility bills[384] or otherwise). To the extent cities lack first-hand information, citizens can cooperate in verification through smartphone apps that measure internal building temperature, air flow, humidity, light intensity, and other metrics of building performance.[385] Cities today can stream building performance data on their websites to display, publicly, how companies and building managers attain sustainability goals, thereby emphasizing "best practices" and innovation.[386] Community regulators can sanction uncooperative persons by forfeiting developer performance bonds. Additionally, regulators may choose to convert those forfeited sums into collateral by supporting the issuing of new municipal "green bonds."[387] Under such an approach, cheating developers will subsidize the energy efficiency of later-arriving commercial buildings, including some developed, perhaps, by a defector's competition for tenants or investors. Such sanctions themselves should be publicly displayed, further promoting transparency and open government, while emphasizing corporate citizens' ownership of energy efficiency.

In considering spatial regulators' options to institutionalize sustainability in commercial project development, should performance zoning replace Euclidean ordinances in commercial districts? Perhaps an incremental or hybrid approach,[388] more appealing to all land use regulation stakeholders, would render performance zoning the developer's election, analogous to a Planned Unit Development alternative.[389] If a developer seeks to emphasize sustainability,

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383. *See supra* notes 100–105 and accompanying text.

384. Many municipalities own their water and sewer companies and electric utilities. *See e.g.*, *Overview: Municipal Enterprise*, COMMUNITY-WEALTH, http://community-wealth.org/strategies/panel/municipal/index.html (last visited Nov. 4, 2017).

385. Catherine L. Muller et al., *Crowdsourcing for Climate and Atmospheric Sciences: Current Status and Future Potential*, 35 INT. J. CLIMATOLOGY 3185 (2015); Aart Overeem et al., *Crowdsourcing Urban Air Temperatures from Smartphone Battery Temperatures*, 40 GEOPHY. RES. LETTERS 4081–85 (2013); Kitchin, *supra* note 367, at 5.

386. *See* Chicago's experience in tracking building performance, *supra* notes 100-105 and accompanying text.

387. *See Green Grow the Markets, O*, THE ECONOMIST (Jul. 4, 2014), http://www.economist.com/news/finance-and-economics/21606326-market-green-bonds-booming-what-makes-bond-green-green-grow. The World Bank proposed, and other banks have drawn up, shared principles governing this category of bonds. *See id*.

388. *See* Frew, *supra* note 46, at 247–48; PERFORMANCE STANDARDS FOR GROWTH MANAGEMENT, APA PLAN. ADVISORY SERVICE REP. NO. 461 (Douglas R. Porter ed., 1996).

389. *See* AMERICAN PLANNING ASSOCIATION, UNDERSTANDING PLANNED UNIT DEVELOPMENT, PAS QuickNotes No. 22, https://www.planning.org/pas/quicknotes/pdf/QN22.pdf. This approach is being taken by the City of College Station, Texas under its Unified Development Ordinance (UDO). After adopting its Comprehensive Plan in 2009, the city identified fifteen zoning districts for creation and conversion (from old standards),

then greater development latitude in siting, design, and intensity should accompany compliance with express community standards for parking availability ratios, stormwater retention, and efficient energy use. In this manner, communities enable innovations at the design phase of development by reducing municipal micromanagement. "Controls" will still be available to land use administrations using social media and community Web pages to update the public about a new project's intended siting and design parameters,[390] and by requiring forfeitable collateral from developers to ensure they toe their marks. Such sanctions are a quid pro quo for freedom from myriad inflexible code requirements under Euclidean ordinances.

The urban form sustainability endgame is democratic access to light, air, public space, and related elements undergirding the citizen's "quality of life."[391] For the most part, however, our urban fabric remains shackled by prescriptive regulations predetermining building mass, siting and form unhelpful to neighboring parcels and open spaces while ignoring energy consumption.[392] In the United

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including seven non-residential zoning districts adopted by Ordinance in 2012: Natural Areas Preserved, Suburban Commercial, Business Park, Business Park Industrial, Office, General Commercial and Commercial Industrial. *See New Zoning Districts: New Non-Residential Zoning Districts,* CITY OF COLLEGE STATION, http://cstx.gov/index.aspx?page=3800 (last visited Nov. 4, 2017). These zoning districts are fundamentally use-based, but contain new performance standards for stormwater retention among other things. *See id*. In 2014, the city added a Mixed-Use district to the UDO. *See id*. In so-called Growth Areas, where future development is deemed to have little initial impact on neighborhoods, greater market flexibility and expanded development options have led to developers proceeding via "Planned Development District" applications for new projects consistent with the Comprehensive Plan. *See id*. The city intends to adopt future districts specific to individual Growth Areas to maintain flexibility and "to reduce the number of steps in the zoning process." *See id*. One such district is the BioCorridor Planned Development District created in 2012, *see* COLLEGE STATION, TX., ORD. No. 2012-3449 (forming a multi-jurisdictional zoning district involving College Station, the City of Bryan and Texas A&M University). *See* COLLEGE STATION, TX., UNIFIED DEVELOPMENT ORD. §§ 12-2.7 (B), 12-2.11. Augusta, Maine's zoning ordinance gives commercial developers the option to proceed via either "conventional zoning" or "performance zoning" routes, particularly under the city's Planned Development Districts (two in number). *See* AUGUSTA, ME., C. chap. A (3), § 3.6.1.5 and § 3.6.1.9. This incremental approach to district standards' development allows more community inputs *en route*, likely increasing stakeholders' credibility through the full regulatory process.

390. Administrations always will need to build public support for commercial projects of substantial scale. Neighbors are not going to abandon the "defense" of their territory simply because of new zoning regimes. It will not serve to merely announce one's development plans and "see what happens." Involving the public early and affording numerous opportunities for inputs is not just the job of public officials, but it further lessens public suspicion and weakens inelastic initial opposition to anything unknown. *See, e.g.*, Steven Hale, *Dean, Undone: Once Again, the Mayor Stumbles when he Needs to Build Public Support for Projects*, NASHVILLE SCENE (Jun. 4, 2015), http://www.nashvillescene.com/news/article/13059472/once-again-the-mayor-stumbles-when-he-needs-to-build-public-support-for-projects (describing Mayor Karl Dean of Metro Nashville facing public resistance to projects he supports, in part due to his administration's frequent "minimalist public campaigns" leading to public misunderstanding and mistrust of his office's plans.).

391. *See* John Hong, *Simulating Interdependent Complexity: Beyond Prescriptive Zoning*, *in* ECOLOGICAL URBAN ARCHITECTURE: QUALITATIVE APPROACHES TO SUSTAINABILITY 140–49 (Thomas Schropfer ed., 2012).

392. *See id.* To be clear, prescriptive standards tell a developer what to do *and how* to do it; performance-based standards describe the end goal but grant the developer latitude to decide the means to reach each stated goal. *See* Schindler, *supra* note 23, at 308 n. 93, 333–34; STOCKHAM, *supra* note 7, at 7 (standards do not dictate design). Giving the developer discretion to innovate, with neighborhood inputs and perhaps exchanging

States, the most prevalent way of imposing urban form and program on new development is through inflexible Euclidean zoning.[393] In order for zoning to bring about egalitarian sustainability relationships, computation belongs at the center of urban design.[394] By employing performance-based zoning standards instead of prescriptive rules, planners will be able to implement software tools and microprocessor-enabled sensors to temper the focus solely on the relationship between project density and the quality of our urban spaces. Daylight access, building cores siting, proximity to parks and other open spaces, and myriad additional factors can be simultaneously and rapidly evaluated, affording immediate feedback to designers, planners, and other land planning stakeholders—including everyday citizens attuned to the digital, open government era.[395]

Performance zoning criteria are community goal-oriented, surpassing mere quantitative regulation. Despite its promised high level of accountability to environmental principles,[396] performance zoning has little traction among spatial regulators today. It requires community administrations to vet development proposals to determine whether less-familiar and complex sustainability criteria are met, when regulators' desires to maintain high levels of decisionmaking certainty are prevalent.[397] Moreover, some definitions of many performance standards, perhaps clearer at the architectural scale, are elusive at the larger-grained level of urban design.[398] But these standards can be analyzed and implemented simultaneously through parametric urban design tools and the data they generate.[399]

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neighbor rights inhering under the standards seems better calculated to achieve a timely and successful project, with reduced friction, than forcing a project to toe the line under prescriptive standards or to obtain variance relief.

393. *See* Hong, *supra* note 391, at 140–49.

394. *See id.*

395. *See id.;* Retzlaff, *Greening*, *supra* note 379, at 10; Kitchin, *supra* note 367, at 12.

396. *See* NAT'L ACAD. PUB. ADMIN., *supra* note 79, at 19; Brown, *supra* note 26, at 59 (noting endless opportunities for creative performance-based targets promoting biophilic design).

397. *See* Frew, *supra* note 46, at 250.

398. *See id.;* NAT'L ACAD. PUB. ADMIN., *supra* note 79, at 19.

399. *See* Frew, *supra* note 46, at 250. Today's parametric technology is more than merely a drafting tool. Not only can it model a building and many of its attributes in three dimensions, it can revise a model instantly. Thus, if an architect wants to alter the pitch of a roof, for example, the walls then follow the revised roofline automatically. The designer sets the rules and parameters, with the computer doing the iterations, affording designers more flexibility to explore designs and their impacts on all the parameters dictated by the owner. *See* Allison Arieff, *New Forms that Function Better*, MIT TECH. REV. (Jul. 31, 2015), http://m.technologyreview.com/review/517596/new-forms-that-function-better/#.VYF76JphJCg.mailto. An illustration of parametric application to energy efficiency in commercial buildings is Ecotect Analysis software that models everything from thermal performance to daylighting (*i.e.*, placing windows or other openings in such a way that natural light can illuminate the interior). As architects address design with a computer, it calculates and analyzes such properties as the building's floor area, its volume, and the required quantities of materials, simulating thermal performances of different wall, roof, and window assemblies and evaluating their performance against their costs. *Id.* They study how different types of glazing would perform—not just in general but on its northeast wall at the building's exact geographic location, under conditions suggested by long-term weather data. *Id.* Parametric modeling can also take human proportions and movement into account. A company called AnyBody

In short, consider the advantage of when software platforms designed to examine numerous urban form conditions simultaneously and to receive constant feedback are aided by computation. Here, non-linear design employs computers as tools to explore variations in the functional requirements of a building.[400] Instead of resorting to design rhetoric describing generalized development intentions (suspicious to land use stakeholders),[401] employing a parametric platform providing immediate spatial feedback on outcomes vastly advances the regulatory negotiation process.[402] These design tools combine early stage architectural design with energy-efficiency engineering. If energy consumption is an objective function of design parameters, building energy performance is improved by controlling other design parameters or the function-relationship itself.[403] This leads to elevating performance-driven design over the traditional, performance-based, architectural form focus.[404]

Underwriters Laboratories' Erin Grossi argues that the sustainable building movements in Europe and the United States have led the developed world to the cusp of optimized building performance.[405] If Grossi is correct, innovative local legislation addressing new construction and development processes accelerating efficiencies is overdue.[406] That land use legislation must advance performance zoning so communities can set goals to eliminate or severely staunch negative impacts, enabling the development industry to address those goals on its own terms while accepting sensible bureaucratic verification. Goal-orientation is more likely to result in sustained environmental benefits than prescriptive standards can advance in commercial development.[407]

Technology, for example, does full-body physical simulations for the design of cockpits or workspaces, collaborating on R&D with architects so that a parametric model can simulate a body walking through a given space, allowing optimization of walking distances or ergonomics. *See id.*

400. *See id.*; Ziwei Li et al., *Optimizing the Building Form by Simulation—a Parametric Design Methodology Study with Integrated Simulation at Schematic Phase*, PROC. 13TH CONF. OF INTERN'L BUILDING PERFORMANCE SIMULATION ASS'N, CHAMBERY, FRANCE 877 (Aug. 26–28, 2013), ibpsa.org/proceedings/BS2013/p_2480.pdf; Retzlaff, *Greening*, *supra* note 379, explains that subjectivity fails to connect complementary issues within building assessment systems, ignoring the relationships among disparate sustainability elements. *See id.* at 11.

401. *See* Frew, *supra* note 46, at 240, 250.

402. *See* Hong, *supra* note 391.

403. *See* Li et al., *supra* note 400, at 877.

404. *See id.* In the realm of HVAC systems especially, this leads to the approach known today as Commissioning, where building system performance requirements set by the owner are expressed clearly and the design consultants audit different judgments and designs to reach the performance criteria before the building is built. *See* IEA-ECBCS ANNEX 40, COMMISSIONING OF BUILDING HVAC SYSTEMS FOR IMPROVED ENERGY PERFORMANCE 9 (J.C. Visier ed., 2004) www.ecbcs.org/docs/Annex_40_Commissioning_Tools_for_Improved_Energy_Performance.pdf.

405. Grossi, *supra* note 234, at 4.

406. *See* Alusi, *supra* note 364, at 17 (in the case of ecocities, *supra* notes 382–83, initiatives spearheaded by private companies must be matched by innovative governance structures and frameworks for coordination).

407. *See* Schindler, *supra* note 23, at 334; Mattie Lemmens, *Re-Zoning Alberta: Smart Regulation for Smart Growth*, 5 MCGILL INT'L J. SUSTAINABLE DEV. L. & POL'Y 115, 132–35 (2009).

CONCLUSION: BETTER INTEGRATING SUSTAINABILITY INTO THE LOCAL LAND USE REALM

The inability of land planners to quantify and confirm performance standards in the 1980s and early-to-mid 1990s (prior to the Internet's robustness) means performance zoning's "inventors" like O'Harrow and Kendig were ahead of their time. Now is the day for spatial regulators to frame performance standards via metrics into community sustainability goals through local zoning regimes. Their administrators must integrate newly minted experts in sustainable engineering and design, using big data analytics, into planning and development staffs. These professionals' understanding of the details of standards-setting and their verification, properly approached, will hone the current focus on the environmental ramifications of development.[408] Community competitiveness, evaluated by the measures demonstrated above, demands that human-capital investment.

The still greater challenge for local governments is gradual devolution of authority in the spatial realm, recasting the land development process as an open system governed jointly by government officials, private sector developers, and citizen scientists. Sustainability in property development and project operation depends mightily on private institutions committing to improving commercial indoor workplaces and the global environment. Yet the private sector, traditionally motivated by profits, still questions the impact on gross rental revenues of commercial development sustainability.[409] Community leaderships must urge business to demonstrate to investors that corporate sustainability strategy positively impacts revenue data and performance measures that inform investment decisions.[410] Not all sustainability strategies impact key financial objectives. But by focusing on sustainability's value proposition, investors and market analysts, in time, will recognize advantages that many companies currently deliver by embracing sustainability.[411]

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408. *See id.* at 135.

409. *See* KRISTIAN PETERSON & PETER GAMMILL, THE ECONOMICS OF SUSTAINABILITY IN COMMERCIAL REAL ESTATE 21 (2010), https://foundation.ifma.org/docs/default-source/Whitepapers/foundation-economics-of-sustainability-in-commercial-real-estate.pdf?sfvrsn=2; Hollie Deese, *Building Green in a Red Hot Market*, 39 LEDGER 1, 28 (Jun. 19, 2015), http://www.tnledger.com/editorial/Article.aspx?id=81992 (citing Jeff Gowdy, sustainability consultant); *see generally* INST. FOR MARKET TRANSFORMATION & APPRAISAL INST., GREEN BUILDING AND PROPERTY VALUE: A PRIMER FOR BUILDING OWNERS AND DEVELOPERS 8–9 (2013), http://www.imt.org/uploads/resources/files/GreenBuildingAndPropertyValue_Guide.pdf (describing four components of value in "green" appraisal); Franz Fuerst & Patrick McAllister, *Green Noise or Green Value? Measuring the Effects of Environmental Certification on Office Values*, 39 REAL EST. ECON. 45 (2011), http://immobilierdurable.umapresence.com/medias/sites/5/2014/09/Fuerst-article-autoris%C3%A9.pdf. *See generally* DAINTREE NETWORKS, UNLOCKING ROI+: UNDERSTANDING THE COMPLETE RETURN ON SMART BUILDING INVESTMENTS, http://www.cees.ingersollrand.com/CEES_documents/Daintree_Ebook_final.pdf.

410. *See* David A. Lubin & Daniel C. Esty, *Bridging the Sustainability Gap*, MIT SLOAN MGMT. REV. 18, 19 (2014), https://www.eli.org/sites/default/files/media/14-10-21-DC/esty-bridging-sustainability-gap.pdf.

411. *See id*. at 19–20; Retzlaff, *Greening*, *supra* note 379, at 4.

As municipalities know, the development community has the deepest experience in scalability of capitalizing infrastructure,[412] and that experience must be leveraged into green infrastructure implementation in new urban development projects.[413] For instance, the Seattle 2030 District, an alliance of property owners, managers, and developers, has committed to good-faith efforts to meet building performance goals within that district, benchmarking participating buildings against Architecture 2030 Challenge planning standards.[414] The City of Seattle joined the district as a community stakeholder, public property owner, and improvements manager.[415] Among the district's performance goals for existing buildings and other infrastructure is to reduce energy consumption at least ten percent below the national average by 2015 and fifty percent below that average by 2030.[416] This type of joint governance undermines conventions of centralized control by bureaucracies dominated by elected officials and politicization of data control.[417]

Recognizing the need for superior energy performance in public buildings, the National Institute of Building Sciences (NIBS) and Royal Institution of Chartered Surveyors held a roundtable on using Public Private Partnerships (P3) in the United States in 2015, addressing construction of high-performance buildings.[418] In the summary report of that roundtable, attendees concluded that the P3 process affords opportunities for efficiency gains when the private partner has an incentive to factor in operations and maintenance costs during the building's useful life. Using P3s will require ongoing leadership by and advocacy of many stakeholders across building planning, design, and construction sectors.[419] A proposed partnership model calls for the private partner to take on the full costs to design and construct the new structure, with the public entity paying a contracted-for (fixed) price for use of the space, incorporating amortization of design and

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412. *See* Clark, *supra* note 246 (citing Prof. Dodd Galbreath of the Institute for Sustainable Practice at Lipscomb University).

413. *See, e.g.*, Abigail Hauslohner, *D.C. Will use Roof Gardens — Among Other Things — to Clean City Waterways,* WASH. POST (May 20, 2015), http://www.washingtonpost.com/local/dc-politics/dc-will-use-roof-gardens—among-other-things—to-clean-city-waterways/2015/05/20/0dcbf9f4-ff1b-11e4-805c-c3f407e5a9e9_story.html ("Green infrastructure" means publicly-financed project elements like porous pavement, cisterns, rain gardens and roof gardens meant to capture and clean rainwater while also cooling temperatures and sometimes improving aesthetics).

414. *See About Seattle 2030 District*, SEATTLE 2030 DISTRICTS, http://www.2030districts.org/seattle/about (last visited Aug. 31, 2017) [hereinafter *About Seattle*].

415. *See City of Seattle*, SEATTLE 2030 DISTRICTS, http://www.2030districts.org/company/city-seattle-0 (last visited Aug. 31, 2017).

416. *See About Seattle*, *supra* note 414.

417. *See* Kitchin, *supra* note 367, at 11.

418. *See* NATIONAL INSTITUTE OF BUILDING SCIENCES AND ROYAL INSTITUTION OF CHARTERED SURVEYORS, RESULTS FROM AN EXPERT ROUNDTABLE ON UTILIZATION OF PUBLIC-PRIVATE PARTNERSHIP TO PROMOTE HIGH-PERFORMANCE PUBLIC BUILDINGS IN THE UNITED STATES (Jan. 13, 2016), http://c.ymcdn.com/sites/www.nibs.org/resource/resmgr/Docs/NIBS-RICS_P3_Summary.pdf.

419. *See id.*

construction costs. This means that if there are overages in operation and maintenance budgets due to inefficiencies, the private partner's profitability is impacted (unlike the typical model, under which the taxpayer bears the final costs of operation in the event of such overages).[420]

In recent years, developers have learned the American office market, for one, is highly dependent on the strength of the host local economy. Leading occupancy and rent growth metrics belong to regions suffused with technology sector[421]—workplaces that increasingly are populated by millennial knowledge workers. Sufficient financial incentive exists today to enhance energy performance by incorporating Internet and communications technologies into the workspace and building maintenance environments of new projects. One approach to allow "greener" buildings to leverage superior worker satisfaction and energy efficiency is to implement land use regulations featuring performance zoning platforms.[422] Incorporating requirements for green building standards into such regulatory schemes is not unprecedented; some cities already require certain types of projects to support building assessment systems.[423] Siting and infrastructure can sometimes impact communities more than will the individual performance of one building, and integrating planning regulations into green building conventions is therefore instrumental.[424]

Not only will ICT-embedded cities deploying performance zoning schemes model competitiveness and sustainability in their communities,[425] but they will advance the social paradigm of open government.[426] In this environment, citizens dialog and interact in innovative and real-time debates with their representatives, directly creating and evaluating municipal policies, including those affecting sustainable development.[427] Citizens participate in devising sustainability targets

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420. *See id.*

421. *See, e.g.*, Eliot Brown, *Office Market is on a Slow Roll*, WALL ST. J. (Jul. 1, 2015), http://www.wsj.com/articles/office-market-is-on-a-slow-roll-1435698048?tesla=y (noting that Seattle and San Francisco were leaders in the preceding year).

422. *See* Retzlaff, *Greening*, *supra* note 379, at 15–16.

423. *See id.*; Rebecca C. Retzlaff, *Green Building Assessment Systems: A Framework and Comparison for Planners*, 74 J. AM. PLAN. ASS'N 505, 507, 517 (2008), http://jordangbc.org/uploads/main_gbc/2e2240658de25ef85c9f1f3ef4bef1e5.pdf.

424. *See* Retzlaff, *Greening*, *supra* note 379, at 5.

425. *See* Kitchin, *supra* note 367, at 1–2.

426. *See* Matthew Kassel, *Philadelphia Goes Transparent*, WALL ST. J., Apr. 25, 2016, R4 (quoting Tim Wisniewski, Philadelphia's Chief Data Officer: "Open data brings us toward a more open government: knowing what it does, who it is, how it works. That leads to more trust in government, more confidence."); Marc Garriga-Portola & Julia Lopez Ventura, *The Role of Open Government in Smart Cities*, *in* 4 PUB. ADMIN. & INFO. TECH. 205, 205–06 (Mila Gasco-Hernandez ed., 2014); Hans Wiklund, *A Habermasian analysis of the deliberative democratic potential of ICT-enabled services in Swedish Municipalities*, 7 NEW MEDIA & SOC. 701, 702 (2005) (noting that information and communications technologies have improved the deliberative qualities of democratic governance).

427. *See, e.g.*, JEFFREY D. SACHS, THE AGE OF SUSTAINABLE DEVELOPMENT, 4, 503–04 (2015) (noting that good governance principles include transparency and direct citizen input in decision-making); NAT'L ACAD. PUB. ADMIN., *supra* note 79, at 19 (noting that local officials must "ensure that state agencies adequately assess

and establishing project values through participation and knowledge exchange with the full spectrum of stakeholders.[428] Meanwhile, millennials desire participation in decision-making and free exchanges of information.[429] Open government interpolates elements within the big-data realm, leveraging all aspects of the community's competence (whether bureaucratic-, business-, or citizen-derived) to attain holistic and collaborative urban planning.[430] The European Union has created "Community Led Local Development" ("CLLD"), a tool mobilizing and engaging local communities and organizations to enhance contributions to smart, sustainable, and inclusive growth.[431] Initiatives in CLLD include community-led

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and address localized adverse impacts and that the state agencies solicit perspectives of community residents and address their concerns before approving permits."). *Id.* at 19, Recommendation 9. A further Academy recommendation is that local governments ensure that citizens "affected by environmental decisions receive fair treatment and are involved in a meaningful way." *See id.* at 20, Recommendation 10.

428. *See* Retzlaff, *Greening, supra* note 379, at 10.

429. *See* NAT'L CHAMBER FOUND., THE MILLENNIAL GENERATION: RESEARCH REVIEW 21, 26 (2012).

430. *See* Mike Weston, *'Smart Cities' Will Know Everything about You*, WALL ST. J. (Jul. 13, 2015), http://www.wsj.com/articles/smart-cities-will-know-everything-about-you-1436740596. If doubt about transparency's inevitability persists, it is dispelled by inserting private enterprise into the mix of data-sets generation, analysis and distribution. *See id.* IBM and Cisco Systems are not the lone players integrated into the Smart Cities movement. *See, e.g.*, ANTHONY TOWNSEND, SMART CITIES: BIG DATA, CIVIC HACKERS AND THE QUEST FOR A NEW UTOPIA 24–32, 44–49, 62–69 (2014); Katie Fehrenbacher, *Google's New Startup Needs to Go Far Beyond Tech*, FORTUNE TECH (Jun. 11, 2015), http://fortune.com/2015/06/11/google-city-sidewalk-startup/ (Cisco, IBM, and GE are developing sensors, wireless networks and algorithms to make city infrastructure operate more efficiently). In June, 2015, Google's Larry Page announced the establishment of Google's Sidewalk Labs (www.sidewalklabs.com), purposed to incubate urban technologies at the sub-multinational corporate level to address issues like efficient transportation and energy usage. *See* LARRY PAGE, GOOGLE+ POST (Jun. 10, 2015), plus.google.com [hereinafter "Page post"]. CEO of Sidewalk Labs Dan Doctoroff said that "when the concerns about urban equity, costs, health and the environment are intensifying, unprecedented technological change is going to enable cities to be more efficient, responsive, flexible and resilient." *See* Steve Lohr, *Sidewalk Labs, a Start-Up Created by Google, Has Bold Aims to Improve City Living*, N.Y. TIMES (Jun. 11, 2015), http://www.nytimes.com/2015/06/11/technology/sidewalk-labs-a-start-up-created-by-google-has-bold-aims-to-improve-city-living.html?_r=0. Page added that once the big picture view of city life is described, communities can develop the "partnerships you need to make a difference." *See* Page post, *supra*. Naturally, private enterprise intends to exploit such partnerships by leveraging their existing technology platforms; for instance, Waze (a Google application) undoubtedly will morph to adapt its maps service to address broader city transportation issues, as will Urban Engines, a 2014 startup. *See e.g.,* Totty, *supra* note 129, at R2 (Boston partnering with Google to leverage Waze, reading road conditions in real time). Other startups like FirstFuel, WegoWise and Retroficiency will tackle building energy efficiency performance through data rich software technologies. *See* Fehrenbacher, *supra*. Capitalism functions optimally when private enterprises adapt their resources to address the public's perceived needs as articulated by governments, in the process generating revenue. The private sector's gains from such "crucial partnerships" in applying system dynamics and cybernetics to analyzing and improving urban life should not impel communities to avoid those partnering opportunities. Business will increasingly adopt open-source approaches to engage other businesses and local government. *See* David A. Lubin & Daniel C. Esty, *The Sustainability Imperative*, HARV. BUS. REV. (May 2010), https://hbr.org/2010/05/the-sustainability-imperative.

431. *See* Opinion of the European Economic and Social Committee on 'Community Led Local Development (CLLD) as a Tool of Cohesion Policy 2014-20 for Local, Rural, Urban and Peri-Urban Development,' Exploratory Opinion, 2015 O.J. (C 230), http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1440516707260&uri=CELEX%3A52014AE3156. The Economic and Monetary Union and Economic and Social Cohesion (ECO) section of the EESC that drafted the 2014 exploratory opinion is charged with policy development in

climate change and sustainability actions, developed in concert with the Europe 2020 strategy, applying the principles of partnership and of leadership from the bottom up.[432] Aided by technology and citizen scientists, open governments inevitably will reduce suspicion and mistrust of flexible regulations like performance zoning standards, reducing fear of the development community's design options.

Eventually land development politics may evolve from a more traditional "aggregation of private interests into policy" mode[433] to one where issues of common interest (such as stewarding the environment) are publicly debated, considering views of all stakeholders, and seeking consensus about their optimal resolutions.[434] We need not dread the future of land use planning if regulators cede some authority and openly share accumulated data and its interpretations (and incorporate returning information streams in planning conventions) with the public in the interest of community.[435]

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spatial planning, urban policy and metropolitan areas. *See* ECO, http://www.eesc.europa.eu/sections-other-bodies/sections-commission/economic-and-monetary-union-and-economic-and-social-cohesion-eco (last visited Nov. 8, 2017).

432. *See id.* at §§2.1, 6.1. Europe 2020's triple objectives are smart, sustainable and inclusive growth, *see* EU Urban Agenda, 2015 O.J. (C 291) § 3.5, http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1476800342224&uri=CELEX%3A52014AE5226. Indeed, the European Economic and Social Committee considers the basic principles of this Community Led Local Development method (pooling the expertise of social and economic stakeholders, civil society representatives and local and national governments) so crucial that implementing partnerships involving the local community is a pre-condition to obtaining EU grants to address urban issues such as the environment and preserving a community's cultural and natural heritage under the Common Strategic Framework Funds. *See id.* at §§5.4-6.2.

433. *See* Kenneth Janda, *Interest Aggregation and Articulation*, THE ENCYCLOPEDIA OF POLITICAL SCIENCE (George Thomas Kurian ed., 2011), http://www.janda.org/bio/parties/articles/Janda%202011a.pdf.

434. "Optimal" outcomes speak to sufficiency of solutions, not the ideal solution for each problem. Success in land use planning in the frame of sustainability is measured by reaching the best alternative among choices of many ways forward.

435. *See* Kassel, *supra* note 426 (acknowledging that when a government agency makes data available to its residents, entrusting them with it and incorporating their feedback, "this is a mind-set that leads to a more open government and enables government to adopt the innovations of the public"); Kitchin, *supra* note 367, at 12.