Sunny and Share: Balancing Airspace Entitlement Rights Between Solar Energy Adopters and Their Neighbors

In an effort to ameliorate the effects of climate change, state and local governments have made increasingly large commitments to support solar energy adoption. For solar investments to be successful, however, solar adopters require unobstructed access to sunlight, which is directly at odds with the interests of neighbors and developers who value vertical development, especially in urban centers. To mitigate these looming conflicts, governments have enacted a variety of laws that assign airspace entitlements to either solar adopters or their neighbors. Unfortunately, these solutions are all poorly tailored for dense cities, which is where future airspace conflict is likely to concentrate. In response, this Note proposes a legal scheme designed to protect urban solar investments without ignoring neighbors' property interests: the creation of solar development options ("SDOs"). Under this proposal, the solar adopter would be entitled to unilaterally create a solar easement across his neighbor's airspace. But, in an important break from existing approaches, the owner of the neighboring property would receive a call option to retake her airspace entitlement along with an award of transferable development rights to compensate her for the encumbrance. The benefits of SDOs are numerous: they overcome the significant bargaining impediments plaguing urban stakeholders, properly compensate neighbors for valuable air rights without pricing out solar adopters, and preserve the autonomy of local governments to flexibly balance solar energy adoption and vertical development.

INTRODUCTION

In early 2008, a suburban spat between neighbors in Sunnyvale, California, garnered nationwide headlines after a couple was convicted of nuisance charges following a prolonged court battle.[1] Local property disputes are rarely so newsworthy, but the unprecedented nature of this neighborly conflict sparked intense interest. As Carolyn Bissett, one of the guilty homeowners, put it, "We are the first citizens in the state of California to be convicted of a crime for growing redwood trees."[2] Bissett and her husband were prosecuted under California's Solar Shade Control Act, a 1978 enactment that limits the amount of shade a property owner's vegetation can cast over a neighbor's solar collection device.[3]

Though Bissett's unusual predicament elicited calls for reform, solar access remains a pressing concern in California and elsewhere.[4] But the conflict is no longer limited to suburban skirmishes over redwood trees and other vegetation. Rather, the fighting has expanded

1. *See, e.g.*, Felicity Barringer, *Trees Block Solar Panels, and a Feud Ends in Court*, N.Y. TIMES (Apr. 7, 2008), http://www.nytimes.com/2008/04/07/science/earth/07redwood.html [https://perma.cc/G5XW-76HX]. The homeowners were convicted in December 2007. *Id.* Although a short-lived appeal was ultimately dropped due to the cost of continued litigation, the couple had already spent an estimated $37,000 during the course of the roughly three-year fight. *Id.*

2. *See* Paul Rogers, *Sunnyvale Homeowners Told to Cut Redwoods that Block Solar Panels*, MERCURY NEWS (Jan. 23, 2008, 8:33 PM), https://www.mercurynews.com/2008/01/23/sunnyvale-homeowners-told-to-cut-redwoods-that-block-solar-panels [https://perma.cc/YB7G-D9KE].

3. Solar Shade Control Act, ch. 1366, 1978 Cal. Stat. 4541 (codified as amended at CAL. PUB. RES. CODE §§ 25980–25986 (West 2018)).

4. After Bissett's conviction, the Act was amended to recharacterize violations as private, rather than public, nuisances. *See* K.K. DuVivier, *Solar Skyspace B*, 15 MINN. J.L. SCI. & TECH. 389, 402 (2014). This change is particularly problematic for plaintiffs, because the cost of bringing a case often exceeds the cost of installing and maintaining the solar collection device. *Id.* The 2008 amendments also added an exemption for existing vegetation. *See* PUB. RES. § 25984(a); Barringer, *supra* note 1. The Act, as currently written, deems planted vegetation that shades more than ten percent of a solar area to be a private nuisance. PUB. RES. § 25982.

to the urban battleground. In 2017, 3620 Cesar Chavez Street was an aging commercial property[5] on the fringe of San Francisco's fast-growing Mission District.[6] In a city with a shortage of housing—particularly affordable housing[7]—the lot appeared ripe for development. Unsurprisingly, a developer soon proposed a six-story building featuring twenty-four market-rate units.[8] The city granted multiple concessions to the project,[9] and development progressed as planned until a neighborhood meeting, hosted by the developer and the architect, turned hostile. One neighbor worried the new building would "rob his backyard of sunlight"; another demanded compensation because "the solar panels on his roof would be blocked by shadows."[10] Perhaps influenced by this opposition, the proposal was scrapped, and the property was listed for sale.[11]

Solar access disputes like this are not unique to California. In cities across the country, inherent conflict has long existed between developers who want to build taller buildings and residents who want to preserve unobstructed views.[12] What is relatively new, however, is the increased commitment many cities have made to support the

5. *See* Adam Brinklow, *'Too Tall' Cesar Chavez Development Asks $8 Million*, CURBED S.F. (Mar. 6, 2017, 1:44 PM), https://sf.curbed.com/2017/3/6/14834668/3620-cesar-chavez-sale [https://perma.cc/C24T-TT94] (describing the property's one-story office building and parking lot).

6. Eighty years ago, the Mission District was a working-class neighborhood. Recently, massive gentrification has sparked significant growth and development, and the area is "currently a favorite neighborhood for Silicon Valley shuttle bus commuters." *See Mission District: The City's Oldest Neighborhood*, BAY CITY GUIDE, http://baycityguide.com/en/mission-district/a1JU00000002Er0MAE (last visited Feb. 15, 2019) [https://perma.cc/VSH7-K6GN].

7. *See* Matthew Yglesias, *San Francisco Just Voted to Make Housing Less Affordable*, VOX (June 4, 2014, 10:44 AM), https://www.vox.com/2014/6/4/5778696/measure-b-san-francisco-will-reduce-affordability [https://perma.cc/VRQ9-87HY] (discussing the scarcity of affordable housing in San Francisco).

8. *See* Joe Rivano Barros, *Neighbors to Developer: Too Tall, Too Little Parking*, MISSION LOC. (Aug. 24, 2016), https://missionlocal.org/2016/08/neighbors-to-developer-too-tall-too-much-parking [https://perma.cc/NS9L-7B9M] (describing the proposed development).

9. *See* Brinklow, *supra* note 5 (noting that the developers were "exempt from having to complete an environmental impact report" and were "allowed to skip a Planning Commission hearing"). The San Francisco Planning Department also exempted the project from further environmental review otherwise required by the California Environmental Quality Act. Certificate of Determination: Exemption from Environmental Review, Case No. 2015-009459, at 4 (Apr. 14, 2016), http://sfmea.sfplanning.org/3620%20Cesar%20Chavez%20CPE%20CertificateSIGNED.pdf [https://perma.cc/F2A6-3GFZ].

10. Barros, *supra* note 8. Multiple neighbors demanded that the developers conduct a "shadow study" to measure the impact of the anticipated shading, even though the city did not require such a study in this case. *Id.*

11. *See* Brinklow, *supra* note 5.

12. *See* Emily Badger, *In the Shadows of Booming Cities, a Tension Between Sunlight and Prosperity*, WASH. POST: WONKBLOG (May 4, 2015), https://www.washingtonpost.com/news/wonk/wp/2015/05/04/in-the-shadows-of-booming-cities-a-tension-between-sunlight-and-prosperity [https://perma.cc/NL2C-2TVK] (discussing tensions stemming from vertical development in urban centers).

adoption of renewable energy sources as a tool for reducing carbon emissions and combating climate change.[13] The anticipated collision between the seemingly incompatible goals of vertical development and unfettered solar energy collection is expected to magnify disputes over solar access and airspace rights in the coming years. To mitigate these conflicts, municipalities will have to adopt legal frameworks that not only protect solar energy investments but also respect neighbors' property rights in their developable airspace.

To this end, state and local governments have considered myriad strategies, none of which is without flaw.[14] In particular, these solutions are ill suited for city centers. It is hard to imagine that solar access protections could actually facilitate a meaningful reduction in carbon emissions if such policies are inoperable in the most densely populated areas.[15] Although many factors contribute to this incongruity, current proposals are generally too costly, too restrictive of future vertical growth, or too inconsiderate of neighbors' property rights.[16] This Note aims to address such shortcomings by proposing the creation of solar development options as a tool for allocating airspace rights between rival uses. Under this Note's proposed framework, municipalities can protect an eligible solar adopter's access to sunlight by unilaterally granting an airspace easement across a neighboring property. In exchange, the neighbor would receive a solar development option to offset the encumbrance. This option, if exercised, would permit the owner of the encumbered property to remove the easement for a set price and reclaim her airspace rights. To compensate the neighbor for the use of her airspace during the life of the easement, the option would also be accompanied by a grant of transferable development rights that could be sold to developers for use in specially designated receiving areas. This proposal improves upon existing approaches and fashions a

13. For a discussion of some of these plans, see *infra* note 20.

14. See *infra* Part II for an overview of the main approaches.

15. Although solar farms provide a feasible alternative to urban siting, there are distinct drawbacks to constructing large-scale solar installations in more remote areas. *See, e.g.*, Matthew M. Gorman & Anthony Marinaccio, *Solar Rights and Shade in California: The Pending Conflict Between Solar Power, Property Rights, and Environmental Protection*, ALVAREZ-GLASMAN & COLVIN 2 (May 14, 2009), http://www.agclawfirm-alerts.com/files/Solar_Rights_and_Shade_in_California_2009_Alvarez-Glasman_Colvin_.pdf [https://perma.cc/KP7L-2L3U] (highlighting concerns that solar farms, which are often proposed in desert or wilderness areas, will impact the natural landscape and harm wildlife habitats). In contrast, "solar energy systems integrated within the built environment . . . confer the lowest environmental and land-use and land-cover change impacts, reduce energetic losses from . . . transmission, and are co-located with the energy needs of a growing population expected to be concentrated entirely in urban areas." Rebecca R. Hernandez, Madison K. Hoffacker & Christopher B. Field, *Efficient Use of Land to Meet Sustainable Energy Needs*, 5 NATURE CLIMATE CHANGE 353, 353 (2015) (footnote omitted).

16. See *infra* Part II for an overview of these issues.

solution more aptly suited for urban implementation, as it simultaneously protects investments in solar collection, compensates neighbors for property right infringements, and encourages vertical development in high-priority areas.

First, Part I frames the backdrop for current solar access conflicts by tracking the origin of the clean energy movement and outlining the soaring popularity of solar energy in recent years. It then examines the nature of airspace conflicts and explores the traditional legal doctrines for assigning airspace rights between neighboring properties. Part II analyzes the existing approaches to protecting solar access, including the prior appropriation doctrine, zoning ordinances, solar easements, and liability rules. This Part ultimately concludes that despite some positive features, these existing frameworks inadequately address the unique solar access issues that arise in densely populated cityscapes. Finally, Part III proposes the creation of solar development options—a union between call options and transferable development rights—and highlights how these solar options expand upon existing liability rule regimes to better align with the unique contours of urban property rights.

I. THE RIGHT TO LIGHT: CONFLICTING CLAIMS TO SUNLIGHT

Although environmentalism is not a modern concept, over the past decade the environmental movement has encouraged a heightened focus on the impact of climate change. In response to rising temperatures, governments across the globe have increasingly turned to renewable energy sources as one way to counteract the world's growing carbon footprint.[17] In 2016, for example, approximately $297

17. *See Paris Agreement*, EUR. COMMISSION, https://ec.europa.eu/clima/policies/international/negotiations/paris_en (last visited Feb. 15, 2019) [https://perma.cc/7RKC-6HWK] (giving an overview of the binding global climate agreement). The Paris Climate Agreement was originally adopted by 195 countries, and both Nicaragua and Syria have since signed on. Under the pact, each signatory has agreed to submit comprehensive national climate action plans outlining carbon-emission targets that support the agreement's goal of limiting global temperatures to well below two degrees Celsius above preindustrial levels. *Id.*; *see* Jonathan Ellis, *The Paris Climate Deal: What You Need to Know*, N.Y. TIMES (June 1, 2017), https://www.nytimes.com/2017/06/01/climate/paris-climate-change-guide.html [https://perma.cc/95EE-5MG4]. For example, although specific targets vary among member countries, the European Union has set a goal of increasing the percentage of energy produced by renewable sources to twenty percent of all energy consumed by 2020 and to twenty-seven percent by 2030. *Climate & Energy Targets*, CLIMATE ACTION NETWORK EUR., http://www.caneurope.org/energy/climate-energy-targets (last visited Feb. 15, 2019) [https://perma.cc/RNP4-NVH5]. Even oil-rich countries have embraced the promise of clean energy. In 2018, Saudi Arabia's sovereign wealth fund announced a $1 billion joint investment to finance "the world's biggest solar-power-generation project." Margherita Stancati & Michael Amon, *Saudis, SoftBank Announce Massive Solar Power Project*, WALL ST. J., https://www.wsj.com/articles/saudis-softbank-group-announce-worlds-largest-solar-power-project-1522214824 (last updated Mar. 28, 2018, 8:00 AM) [https://perma.cc/NE8C-GFYV].

billion was spent on renewables worldwide—more than twice the amount spent on new nuclear, coal, gas, and fuel oil power plants combined.[18] While the Trump Administration has largely scaled back federal executive branch support for clean energy adoption,[19] many state and local governments have enacted their own measures to facilitate the transition to renewable energy as part of a concerted effort to create a greener society.[20]

This Part frames the increased popularity of renewable energy and highlights the brewing conflicts between clean energy advocates, other environmentalists, supporters of affordable housing, property

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18. Russell Gold, *Global Investment in Wind and Solar Energy Is Outshining Fossil Fuels*, WALL ST. J., https://www.wsj.com/articles/global-investment-in-wind-and-solar-energy-is-outshining-fossil-fuels-1528718400 (last updated June 11, 2018, 4:59 PM) [https://perma.cc/K76C-E8P3].

19. President Trump's position on the Paris Climate Agreement left the United States as the only country to disavow the agreement. *See* Brady Dennis, *As Syria Embraces Paris Climate Deal, It's the United States Against the World*, WASH. POST (Nov. 7, 2017), https://www.washingtonpost.com/news/energy-environment/wp/2017/11/07/as-syria-embraces-paris-climate-deal-its-the-united-states-against-the-world [https://perma.cc/3ZD5-W4K3]. President Trump also announced a thirty-percent tariff on Chinese-made solar panels, though the tariff's impact is uncertain. Some have claimed that the tariff, designed to protect American solar panel manufacturers, will have a net-negative effect on the solar market by increasing costs and stymying the dramatic rise in panel installations, a trend that has been driven, in part, by the falling costs of foreign-made products. *See* Salvador Rizzo, *Trump Says Solar Tariff Will Create 'a Lot of Jobs.' But It Could Wipe Out Many More.*, WASH. POST (Jan. 29, 2018), https://www.washingtonpost.com/news/fact-checker/wp/2018/01/29/trump-says-solar-tariff-will-create-a-lot-of-jobs-but-it-could-wipe-out-many-more [https://perma.cc/A9SA-RWFP] (interviewing solar company executives and industry analysts). The tariff's impact is largely dependent on the industry's response, however. Just one week after the tariff was announced, JinkoSolar, a leading Chinese solar panel producer, revealed plans to build a Florida plant. Jake Novak, *Trump's Solar Tariff Gamble Pays Off – For Now*, CNBC (Jan. 31, 2018, 9:28 AM), https://www.cnbc.com/2018/01/31/trump-solar-tariff-scores-a-big-win-commentary.html [https://perma.cc/KM2B-TKRF]. In addition to opening its first U.S. plant, Jinko agreed to provide roughly seven million solar panels to NextEra Energy over the next four years. Press Release, NextEra Energy, NextEra Energy and JinkoSolar Announce Deal for Millions of Solar Panels; JinkoSolar to Begin Manufacturing Solar Panels in Florida (Mar. 30, 2018), http://www.investor.nexteraenergy.com/news-and-events/news-releases/2018/03-30-2018-151037810 [https://perma.cc/VK5Z-QBF5].

20. *See* Steven Mufson, *These Titans of Industry Just Broke with Trump's Decision to Exit the Paris Accords*, WASH. POST (June 1, 2017), https://www.washingtonpost.com/news/energy-environment/wp/2017/06/01/these-titans-of-industry-just-broke-with-trumps-decision-to-exit-the-paris-accords [https://perma.cc/SDK7-KMVH] ("About 30 states have adopted mandates for utilities to increase their use of renewable energy, standards that will not change with Trump's withdrawal from the Paris accord or his effort to nullify the Clean Power Plan."). For example, New York governor Andrew Cuomo unveiled a plan to invest $1.5 billion in renewable energy, and the California State Senate voted to require utilities to use one hundred percent renewable energy by 2045. *Id.*; *see also Renewable Energy*, CAL. ENERGY COMMISSION 1, http://www.energy.ca.gov/renewables/tracking_progress/documents/renewable.pdf (last updated Dec. 2018) [https://perma.cc/U42R-95ZR] (describing California's goal of ensuring that renewable energy sources account for sixty percent of retail energy sales by 2030); *The Energy to Lead: 2015 New York State Energy Plan*, N.Y. ST., https://energyplan.ny.gov/ (last visited Feb. 15, 2019) [https://perma.cc/2BWF-W8UA] (outlining New York's goal of providing fifty percent of electricity from renewable sources).

owners, and developers. First, Section I.A reviews clean energy growth in the United States, concentrating on small-scale solar development. Section I.B then highlights some of the conflicts, both present and anticipated, between solar energy adopters and their opponents. Finally, Section I.C examines the property interests implicated by the proliferation of solar energy systems.

A. The Growth of Clean Energy

The call for widespread adoption and integration of clean energy is not a new one. Early efforts were motivated, however, less by environmental sustainability and more by geopolitical concerns. In fact, a majority of current state solar access laws were enacted in response to oil embargoes in the 1970s.[21] That economic crisis, and the corresponding price shocks it produced, sparked heightened interest in renewable energy, and many state governments responded in kind.[22] By the late 1970s and early 1980s, twenty-nine states had promulgated legislation—and thirty-two states had instituted financial-incentive programs—addressing solar energy access and adoption.[23] But once oil prices settled, both federal and local governmental support eroded.[24] Consequently, renewable energy remained a relative afterthought until crude oil experienced another price hike in the 2000s, reigniting public interest in nontraditional energy production.[25] This time, the federal government[26] made strong commitments that more firmly cemented its support for renewable sources.[27]

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21. Troy A. Rule, *Shadows on the Cathedral: Solar Access Laws in a Different Light*, 2010 U. ILL. L. REV. 851, 857.

22. *Id.*

23. *See* DuVivier, *supra* note 4, at 397–98 (reviewing law review articles from this time period to develop an overview of state responses to solar energy).

24. *See id.* at 410–11 ("In the late 1970s and early 1980s, twenty-seven cities or counties had some sort of solar access regulation, law, or ordinance that gained more than regional attention. Shockingly, thirteen, or almost half of the twenty-seven originally enacted, are now amended, repealed, or simply cannot be found." (footnotes omitted)); Rule, *supra* note 21, at 857 (noting that as "conventional energy prices settled . . . federal solar subsidies disappeared").

25. Rule, *supra* note 21, at 857; *see also Crude Oil Prices - 70 Year Historical Chart*, MACROTRENDS, http://www.macrotrends.net/1369/crude-oil-price-history-chart (last visited Feb. 15, 2019) [https://perma.cc/8PPX-B2FW].

26. Although legislative efforts have been largely concentrated in state governments, federal support is an important driver of solar investment. Financial incentives and tax credits can accelerate solar adoption by making panel installation more affordable, yet many states lack the necessary budget flexibility to support such programs. Indeed, eleven states have repealed their solar incentives, originally enacted in response to the oil embargo, which one commentator has suggested may be attributed to a "lack of funding." DuVivier, *supra* note 4, at 399 n.46.

27. *See* Rule, *supra* note 21, at 857. For example, the Energy Policy Act of 2005 established a federal tax credit for residential solar. *See* Energy Policy Act of 2005, Pub. L. No. 109-58, § 1335(a), 119 Stat. 594, 1033–36 (codified as amended at 26 U.S.C. § 25D (2012)). This tax credit has been

Currently, a majority of states (and some municipalities) protect or incentivize solar energy production to varying degrees.[28] And as research continues to emphasize the connection between air pollution and climate change, the scientific community almost unanimously supports clean energy development.[29] The alignment of government actors and academics with commercial stakeholders has firmly entrenched the fledgling solar power industry in the domestic landscape, as evidenced by exponential market growth over the past decade.[30] Solar energy accounted for forty percent of all new electrical generating capacity in 2016;[31] by the end of 2020, it is expected to constitute over three percent of total U.S. electrical generation.[32] Besides being "cleaner" than traditional fossil fuels, solar has some comparative advantages over other renewable energy sources[33] and has

amended and extended multiple times, most recently in 2018. *See* Bipartisan Budget Act of 2018, Pub. L. No. 115-123, § 40402(a), 132 Stat. 64. From a more policy-driven perspective, the U.S. Department of Energy created the Solar America Board for Codes and Standards ("Solar ABCs") in 2007. Rule, *supra* note 21, at 857. In 2008, Solar ABCs issued a comprehensive report examining then-existing solar access laws, outlining best practices, and proposing a model statute. *Id.* For more information on Solar ABCs, see SOLAR AM. BOARD FOR CODES & STANDARDS, http://www.solarabcs.org/index.html (last visited Feb. 15, 2019) [https://perma.cc/YU7P-YGCZ].

28. *See* JON W. BRUCE & JAMES W. ELY, JR., THE LAW OF EASEMENTS AND LICENSES IN LAND § 12:4 (2018) (noting that some states have legislatively provided for solar easements by recognizing the validity of private agreements between landowners); *Solar Rights and Easements by State*, COMMUNITY ASS'NS INST., https://www.caionline.org/Advocacy/StateAdvocacy/PriorityIssues/SolarRestrictions/Pages/default.aspx (last visited Feb. 15, 2019) [https://perma.cc/62FF-3YUU] (noting that twenty-five states have solar access laws that preclude homeowners' associations from preventing or unreasonably restricting solar panel installations, that fifteen states recognize solar easements, and that only ten states do not offer legal protection for solar panels).

29. *See generally Clean Energy*, UNION CONCERNED SCIENTISTS, http://www.ucsusa.org/clean-energy (last visited Feb. 15, 2019) [https://perma.cc/J24Z-GGW3] (advocating for a shift from coal and natural gas to wind and solar power and noting that renewable energy could provide up to eighty percent of U.S. electricity by 2050).

30. Over this time period, solar energy has experienced an average annual growth rate of fifty-nine percent. *Solar Industry Research Data*, SOLAR ENERGY INDUSTRIES ASS'N, https://www.seia.org/solar-industry-data (last visited Feb. 15, 2019) [https://perma.cc/23JZ-HM93]. This trend extends back even further. *See* Rule, *supra* note 21, at 854 (noting that the generating capacity of solar installations in 2008 was triple the amount installed in 2005 and more than ten times the amount installed in 2000).

31. *See Solar Industry Research Data*, *supra* note 30 (discussing the rapid pace of solar growth).

32. *See* John Weaver, *EIA: Wind and Solar Will Be Fastest Growing Sources of Electricity in 2019 and 2020*, PV MAG. (Jan. 21, 2019), https://pv-magazine-usa.com/2019/01/21/wind-and-solar-still-fast-growing-electricity-sources-in-contracting-markets-of-2019-2020 [https://perma.cc/WVN6-JT5C].

33. *See* DuVivier, *supra* note 4, at 390 (discussing the benefits of solar panels as compared to hydropower and industrial-scale solar thermoelectric power); Troy A. Rule, *Airspace in a Green Economy*, 59 UCLA L. REV. 270, 273 (2011) (noting that commercial wind projects have been opposed in rural areas due to "their potential to disrupt migratory bird populations, military radar systems, and competing wind farms" (footnotes omitted)). There has been some support, however, for small on-site wind generation turbines. For a discussion of some obstacles facing wind energy

benefitted from decreased costs in both the utility- and small-scale solar markets.[34]

While solar energy's ascent can certainly be attributed to these economic drivers, its increased popularity is not solely a byproduct of market factors. A number of states—including, importantly, California[35]—have taken more proactive approaches to accelerate solar energy adoption. With the passage of the Solar Shade Control Act in 1978,[36] California became one of the first states to recognize comprehensive solar access rights.[37] More recently, California passed a series of legislative proposals that, among other things, target a reduction in the state's greenhouse emissions to forty percent below 1990 levels by 2030,[38] require one hundred percent of the state's electricity to come from carbon-free sources by 2045,[39] ensure all new

installations, as well as an overview of measures taken by more supportive jurisdictions, see Edna Sussman, *Reshaping Municipal and County Laws to Foster Green Building, Energy Efficiency, and Renewable Energy*, 16 N.Y.U. ENVTL. L.J. 1, 26–28 (2008).

34. *See* David Roberts, *The Falling Costs of US Solar Power, in 7 Charts*, VOX (Aug. 24, 2016, 1:30 PM), https://www.vox.com/2016/8/24/12620920/us-solar-power-costsfalling [https://perma.cc/9ZS8-6RED] (discussing the expansion of solar power and its rapidly decreasing costs). Installation costs have decreased by an estimated seventy percent in recent years. *See* Kaya Laterman, *Is New York Ready for Solar Power?*, N.Y. TIMES (Sept. 30, 2016), https://www.nytimes.com/2016/10/02/realestate/is-new-york-ready-for-solar-power.html [https://perma.cc/RF3T-BDQU] (evaluating solar power's growing foothold in New York City).

35. Discussions of solar energy adoption and the general approach to combating climate change are incomplete without a focus on California. California is motivated to take an active role in addressing carbon emissions, due in no small part to it having the worst air quality in the country. *See* Shanika Gunaratna, *This State Has the Worst Air Quality in the Nation*, CBS NEWS (June 20, 2017), https://www.cbsnews.com/news/worst-air-quality-california/ [https://perma.cc/3SGU-FDHY] (noting that, according to the American Lung Association, more than ninety percent of California residents live in counties with unhealthy air). Critically, California's green policies also have a massive effect on the global market. In 2017, California's $2.7 trillion economy was the fifth largest in the world, trailing only the United States, China, Japan, and Germany. *See* Lisa Marie Segarra, *California's Economy Is Now Bigger than All of the U.K.*, FORTUNE (May 5, 2018), http://fortune.com/2018/05/05/california-fifth-biggest-economy-passes-united-kingdom [https://perma.cc/K7TE-YM4C].

36. Solar Shade Control Act, ch. 1366, 1978 Cal. Stat. 4541 (codified as amended at CAL. PUB. RES. CODE §§ 25980–25986 (West 2018)). For a discussion of the Act, including its provisions and impact, see *supra* notes 3–4 and accompanying text.

37. A "solar access right" is a landowner's legally recognized interest in restricting the use of his neighbor's airspace to ensure continued, unobstructed access to sunlight. For a discussion of the various legal theories underlying this concept, see *infra* Section I.C. For a discussion of the different stances that states have taken toward solar access rights, see *infra* Part II.

38. Chris Megerian & Liam Dillon, *Gov. Brown Signs Sweeping Legislation to Combat Climate Change*, L.A. TIMES (Sept. 8, 2016, 3:55 PM), http://www.latimes.com/politics/la-pol-ca-jerry-brown-signs-climate-laws-20160908-snap-story.html [https://perma.cc/NUW8-8M8P].

39. Ivan Penn, *California Lawmakers Set Goal for Carbon-Free Energy by 2045*, N.Y. TIMES (Aug. 28, 2018), https://www.nytimes.com/2018/08/28/business/energy-environment/california-clean-energy.html [https://perma.cc/7FFY-EXRR]. This constitutes an aggressive acceleration by the California legislature. The state had previously enacted legislation requiring at least fifty percent of electricity to come from carbon-free sources by 2030. Ivan Penn, *California Will Require Solar Power for New Homes*, N.Y. TIMES (May 9, 2018),

homes are net-zero energy by 2020,[40] and mandate solar panel installation on newly constructed homes beginning in 2020.[41] California's local governments have, in many cases, followed this lead and adopted aggressive measures to facilitate clean energy production. San Francisco, for example, expanded on the state's then-current "solar ready" policy and enacted the Better Roofs Ordinance, requiring solar devices to be installed on fifteen percent of the roof space on most new buildings.[42] Although California has taken one of the most proactive approaches to solar adoption, it is not alone. New York has also seen increased demand for commercial and residential solar power, due in part to the ambitious policies set forth by state and local officials.[43] Indeed, after New York governor Andrew M. Cuomo called for half of the state's electricity to come from renewable sources by 2030, New York City went even further, aiming for an eighty-percent reduction of greenhouse gas emissions by 2050.[44] Through a combination of legislative support; falling installation costs; and federal, state, and local incentives, the number of residential solar projects across New York City's five boroughs skyrocketed from only 186 in 2011 to more than 5,300 in 2016.[45]

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https://www.nytimes.com/2018/05/09/business/energy-environment/california-solar-power.html [https://perma.cc/EA44-Z4KD].

40. Katherine Tweed, *California Wants All New Homes to Be Net Zero in 2020*, GREENTECH MEDIA (June 10, 2015), https://www.greentechmedia.com/articles/read/California-Wants-All-New-Homes-to-be-Net-Zero-in-2020 [https://perma.cc/49HA-V5X4].

41. James Rainey, *California Becomes First State to Require Solar Panels on New Homes*, NBC NEWS (May 9, 2018, 2:29 PM), https://www.nbcnews.com/news/us-news/california-becomes-first-state-require-solar-panels-new-homes-n872531 [https://perma.cc/MMV4-D3ZE]. The new standards "apply to single-family homes and to apartment and condominium complexes of three stories or less." *Id.* Previously, California law required fifteen percent of the roof area on all newly built small- and mid-sized buildings to be "solar ready" (i.e., unshaded by the proposed building itself and free from other obtrusions). Scott Wiener, *Let's Require Solar Panels on New Buildings in California*, MEDIUM (Jan. 9, 2017), https://medium.com/@Scott_Wiener/lets-require-solar-panels-on-all-new-buildings-in-california-cb18fe9d9ec4 [https://perma.cc/6A4H-3ZRG].

42. *Zoning Administrator Bulletin No. 11: Better Roofs Ordinance*, S.F. PLAN. DEP'T 1 (Apr. 2017), http://default.sfplanning.org/publications_reports/ZAB_11_Better%20Roofs_051517.pdf [https://perma.cc/8CQ7-Y6ZB]. Pursuant to the Better Roofs Ordinance, developers have the option of instead dedicating thirty percent of the roof space to living roof (i.e., green or vegetated roof) or incorporating a combination of both solar and living roof elements. *Id.* The American Planning Association recognized the Better Roofs Ordinance as 2018's best "Sustainable Policy, Law, or Tool." Press Release, S.F. Planning Dep't, San Francisco Planning's Better Roofs Ordinance Receives National Recognition for Excellence in Sustainability (Apr. 25, 2018), https://sf-planning.org/article/san-francisco-planning's-better-roofs-ordinance-receives-national-recognition-excellence [https://perma.cc/MR25-G52T].

43. Laterman, *supra* note 34.

44. *Id.*

45. *Id.*

B. Conflicts over Airspace

While unified efforts from multiple stakeholders have created sustained interest in renewable energy, the greater prevalence of residential solar panels heightens the risk of airspace conflict. Given inherent inefficiencies in the capacity of current photovoltaic technology,[46] solar energy production is highly sensitive to shifting solar access.[47] Shading by a neighboring tree or structure of as little as four percent of a solar panel can greatly reduce the panel's efficiency and, in some cases, may even incapacitate the entire array of panels.[48] Unsurprisingly, once a property owner has undertaken the often-substantial investment[49] necessary to install a solar energy system, he is particularly sensitive to potential obstructions that could impede his capital recovery.[50]

Although the precise substance of neighborly disagreements varies tremendously, most solar disputes stem from conflicting land use preferences. Consider the following hypothetical. Homeowner *A* has installed an array of solar panels, which, at the time of installation, has unobstructed access to sunlight. One year later, however, Neighbor *B* purchases the adjacent parcel and wants to plant trees along her property line or, alternatively, add a second story to her home. These proposed uses will shade Homeowner *A*'s solar array, severely limiting the panels' energy production and preventing Homeowner *A* from realizing a return on his initial capital outlay. Consequently, either

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46. Photovoltaic technology refers to the process through which solar cells convert sunlight into electricity. *Solar Photovoltaic Technology Basics*, NAT'L RENEWABLE ENERGY LABORATORY, https://www.nrel.gov/research/re-photovoltaics.html (last visited Feb. 15, 2019) [https://perma.cc/RW8Y-LYMA]. Its technical details are beyond the scope of this Note.

47. *See* DuVivier, *supra* note 4, at 392.

48. *Id.* at 393. This problem is magnified by the fact that panels are often wired along a single circuit to limit costs. As a result, if one panel is shaded and thus unable to generate energy, the entire array of panels may be compromised. *Id.*

49. Accounting for applicable tax credits, the average cost of a six-kilowatt system in 2019 is $12,810. Sara Matasci, *How Much Do Solar Panels Cost in the U.S. in 2019?*, ENERGYSAGE (Feb. 1, 2019), https://news.energysage.com/how-much-does-the-average-solar-panel-installation-cost-in-the-u-s/ [https://perma.cc/V92A-65W9]. The actual cost can vary significantly from state to state, however. For example, even after applying incentives and tax credits, a forty-panel roof array cost a New York couple $41,800. The couple paid $5,000 upfront but had to take out two loans to pay off the outstanding bill. Laterman, *supra* note 34. Similarly, the average cost to install a residential solar panel array in Massachusetts is between $30,000 and $45,000. *See* David E. Missirian, *Let the Sun Shine In: An Examination of Solar Easements and a Proposed Statute*, 41 REAL EST. L.J. 303, 310 (2012).

50. Even when a solar energy system is able to operate unobstructed, it typically takes at least several years of power generation before the owner is able to fully recoup the upfront costs. Troy A. Rule, Legislating for Solar Access: A Guide and Model Ordinance 7 (Apr. 2012) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2530088 [https://perma.cc/65VR-L9YK].

Homeowner *A* or Neighbor *B* must concede his or her preferred use—it is impossible for both to enjoy their properties as desired. Indeed, versions of this exact dispute have arisen from California[51] to Washington, D.C.,[52] to Australia.[53] These ex post conflicts over competing land use choices directly implicate issues of as-of-right development and the assignment of legal entitlements.[54]

Some conflicts, however, are motivated less by incompatible use and more by aesthetic considerations.[55] For example, homeowners' associations ("HOAs") and subdivision developers may explicitly prohibit solar energy systems—or at least make it so difficult to install a compliant system as to render solar collection infeasible—purely because solar panels are considered a blight on neighborhood character.[56] Even where such restrictions are drafted "with financial gain, not solar access, in mind," they can still pose a meaningful barrier to solar adoption.[57]

While neighbors and developers are easily anticipated sources of conflict for solar adopters, another potential opponent may be less obvious: environmentalists. Although the environmental community

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51. *See* Barringer, *supra* note 1 (discussing a California lawsuit in which a couple was successfully sued under the California Shade Control Act after their redwood trees shaded their neighbor's solar panel, even though the trees had been planted prior to the installation of the panels).

52. *See* Ian Shapira, *It's Pop-Ups vs. Solar Panels on Shepherd Street NW in Columbia Heights*, WASH. POST (July 20, 2014), https://www.washingtonpost.com/local/its-pop-ups-vs-solar-panels-on-shepherd-street-nw-in-columbia-heights/2014/07/20/ae8f9f56-0dd8-11e4-b8e5-d0de80767fc2_story.html [https://perma.cc/H6P9-6MW6] (discussing a dispute between developers and residents over the construction of pop-up row houses that would potentially block existing solar panels from sunlight access).

53. *See* Damien Carrick & Tegan Osborne, *Solar Panels and the Law: Can You Stop Your Neighbour from Blocking Your Sunlight?*, ABC NEWS: L. REP. (May 17, 2017, 11:54 PM), http://www.abc.net.au/news/2017-05-16/solar-panels-and-the-law-is-there-a-right-to-sunlight/8526752 [https://perma.cc/32VC-BB72] (discussing a dispute between neighbors over the construction of a four-story building that would shade both solar collectors and a community garden).

54. In the hypothetical concerning Homeowner *A* and Neighbor *B*, deciding who has the prevailing legal entitlement plays an enormous role in adjudicating the dispute. If Neighbor *B* enjoys the legal right to use the airspace within the boundaries of her property, Homeowner *A* has the Herculean task of overcoming this initial allocation of legal rights in arguing that he has a right to restrict Neighbor *B*'s use, in furtherance of his solar access.

55. While the underlying conflict here can still be characterized as one of competing uses (i.e., the right to use solar energy versus the right to a view devoid of solar panels), it can be resolved without forcing one of the landowners to completely abandon his or her preferred land use.

56. *See* Sara C. Bronin, *Solar Rights*, 89 B.U. L. REV. 1217, 1232–33 (2009) (discussing the use of restrictive covenants to ensure aesthetic uniformity in developments, often at the expense of solar collection); Troy A. Rule, *Renewable Energy and the Neighbors*, 2010 UTAH L. REV. 1223, 1241 (noting that numerous HOAs have "adopted provisions that prohibit or severely restrict installation" of solar devices). Many states, however, have legislatively restrained the use of covenants as a mechanism for inhibiting solar energy systems. Bronin, *supra*, at 1232–33.

57. Bronin, *supra* note 56, at 1232.

widely prefers solar energy to fossil fuels, alternative land uses may, at times, provide a greener net outcome than solar installations.[58] To illustrate, the energy savings realized (e.g., from reduced air conditioning use) from planting tall shade trees near a large commercial building may outpace the energy generation of a small residential solar panel next door.[59] Accordingly, the trees would actually account for a greater net reduction in traditional energy consumption.

Environmental concerns regarding solar energy also exist on a broader policy level. In particular, some environmentalists worry that limiting vertical growth to protect solar access will have the perverse effect of promoting urban sprawl, which will consequently lead to increased energy consumption.[60] The benefits of sprawl reduction can be significant: concentrating housing in urban centers allows workers to reduce commute times and take advantage of shared municipal services.[61] In fact, one study estimated that the addition of ten thousand new housing units in downtown San Francisco would actually be three times more effective at reducing carbon emissions than a policy requiring solar panels on all buildings.[62] Cities across the country are increasingly confronting this tension: Protect solar installations from shade by restricting vertical development, or reduce urban sprawl by encouraging dense urban infill?[63]

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58. *See, e.g.*, Troy A. Rule, *Property Rights and Modern Energy*, 20 GEO. MASON L. REV. 803, 825 (2013) (noting that the installation of solar panels at the expense of shade trees may lead to "suboptimal use of the airspace at issue"); Gorman & Marinaccio, *supra* note 15, at 1 (providing examples of "solar spats," in which both parties consider themselves to be environmentalists). While this Note is primarily focused on small-scale solar installations, environmental concerns have also been raised regarding the construction of utility-scale solar farms. *See supra* note 15.

59. Rule, *supra* note 58, at 825.

60. *See, e.g.*, Rule, *supra* note 33, at 289 ("Sprawling development on the suburban fringe . . . can also result in . . . greater energy consumption."); Jesse L. Matuson, Note, *A Legislative Approach to Solar Access: Transferable Development Rights*, 13 NEW ENG. L. REV. 835, 868 (1978) ("The result of massively reducing densities so that there will be no shading of a neighbor's property, would be greater urban sprawl and increased energy waste."); Rule, *supra* note 50 (manuscript at 12) (noting that in densely populated urban areas, permitting vertical growth can be an important strategy to combat sprawl).

61. *See* Rule, *supra* note 33, at 289 (noting that dense urban infill projects tend to require less public infrastructure and result in shorter commutes as compared to suburban projects). *But see* Badger, *supra* note 12 (discussing the loss of sunlight that can result from urban concentration).

62. Brad Plumer, *San Francisco Is Requiring Solar Panels on All New Buildings. But Here's a Much Greener Idea.*, VOX (Apr. 20, 2016, 1:40 PM), https://www.vox.com/2016/4/20/11467110/san-francisco-solar-density [https://perma.cc/M5HJ-VJJG] (comparing estimates of carbon-emission reductions attributed to the two proposals).

63. *See* Badger, *supra* note 12. New York City has proposed adding eighty thousand units of affordable housing over the next ten years, while Boston has proposed an additional fifty-three thousand units. *Id.*; *see also* Rule, *supra* note 56, at 1224 ("Distributed renewable energy is vital to curbing energy sprawl[,] . . . [but a]s small-scale wind and solar power systems grow ever more cost-efficient, neighborhood battles over them will only increase.").

C. The Origins of Airspace Rights

As discussed previously, the increased emphasis on solar energy development has ignited intense debate among competing stakeholders.[64] But before addressing the various proposals that attempt to bridge this divide, it is important to understand the doctrinal underpinnings of airspace rights. The issue of airspace allocation and use is neither novel nor simple. Historically, the centrality of agriculture in society necessitated that a majority of airspace be treated as public commons to ensure adequate sunlight for crop growth.[65] As society shifted away from the concept of common airspace, however, two competing principles emerged.

First, the *ad coelum* doctrine recognizes property rights in airspace based on terrestrial parcel boundaries.[66] Simply put, a landowner owns the airspace directly above her property. This doctrine gained popularity throughout the sixteenth and seventeenth centuries and became the prevailing theory in U.S. common law.[67] The U.S. Supreme Court finally adopted the *ad coelum* approach in *United States v. Causby*, when it held that regular and repeated incursions into airspace above private land could constitute a taking in violation of the Fifth Amendment's Takings Clause.[68]

The second principle, which provides a limited exception to the *ad coelum* approach, is the English common law doctrine of ancient lights.[69] Under the ancient lights doctrine, an individual's long-term enjoyment of sunlight constitutes sufficient grounds for the creation of a prescriptive easement that indirectly limits the height of neighboring buildings.[70] The easement ossifies the individual's legal right to continued unobstructed solar access.[71] The doctrine of ancient lights, however, has been completely rejected in the United States.[72]

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64. *See supra* Section I.B.

65. *See* Rule, *supra* note 33, at 278.

66. *Id.* at 278–79. The full Latin phrase, *cujus est solum, ejus est usque ad coelum*, dates to the 1300s and translates as: "[To] whomsoever the soil belongs, he owns also to the sky." *Id.* at 278 (alteration in original).

67. *Id.* at 278–79.

68. 328 U.S. 256, 261 (1946). There exists, however, a navigable public commons for aviation above which the subjacent property owner has no claim. *Id.* at 263.

69. *See* Rule, *supra* note 33, at 278.

70. *See* John William Gergacz, *Legal Aspects of Solar Energy: Statutory Approaches for Access to Sunlight*, 10 B.C. ENVTL. AFF. L. REV. 1, 6 (1982); Rule, *supra* note 33, at 278.

71. *See* Gergacz, *supra* note 70, at 6; Rule, *supra* note 33, at 278.

72. *See* Gergacz, *supra* note 70, at 6 (noting that while a few state courts permitted prescriptive easements in the nineteenth century, this was a minority position and has since been repudiated). Professor Gergacz attributes this rejection to the fact that "prescriptive creation was unsuitable for rapidly growing, ever-changing conditions in communities which existed in the

Given the clear judicial adoption of the *ad coelum* doctrine—and the corresponding rejection of ancient lights—traditional airspace rights and the associated legal entitlements certainly seem to cut against the solar adopter, at least at common law. Under an *ad coelum* regime, rights in the airspace above one's parcel are firmly protected, and a solar adopter has no cognizable claim to make use of his neighbor's airspace for a competing purpose. Because no prescriptive right exists, neighboring property owners are free to develop their airspace to the extent permitted by law, regardless of whether doing so will effectively block sunlight from adjacent parcels. The absence of common law protection means property owners seeking to guard their solar investments against obstruction from neighboring parcels must rely on voluntary market transactions or legislatively enacted solutions.[73] This latter option remains possible under the *ad coelum* doctrine because landowners' common law rights are not absolute—local governments' power to regulate the use of airspace has long been accepted.[74]

II. UP IN THE AIR: ALLOCATING AIRSPACE ENTITLEMENTS

Over the past forty years, states have enacted a variety of legislation to address the conflicting land use policies implicated by solar energy collection.[75] Despite the wide range of experimental approaches, no generally accepted policy has emerged. This lack of legal uniformity has been cited as one explanation for solar energy's ongoing struggle to attain even greater market penetration.[76] But the failure to settle on a comprehensive policy for the allocation and protection of airspace rights between landowners is not surprising—each proposal has clear drawbacks. Moreover, individual communities' specialized needs make it exceedingly difficult to formulate a proposal that is not

United States" and the fact that the mere enjoyment of sunlight that flowed across a neighboring property did not constitute adverse use. *Id.* at 6–7.

73. A potential judicial remedy may exist in very limited circumstances. Notably, despite clearly rejecting solar prescriptive easements, the Wisconsin Supreme Court held that private nuisance—based on the reasonable use doctrine—established a claim for relief by the owner of a solar-heated residence to enjoin his neighbor's proposed construction. *See* Prah v. Maretti, 321 N.W.2d 182, 191 (Wis. 1982).

74. For example, local governments may impose use restrictions, building setbacks, and zoning ordinances. For a discussion of various state regulatory approaches, see BRUCE & ELY, *supra* note 28, § 12:4; Bronin, *supra* note 56, at 1237–50.

75. See DuVivier, *supra* note 4, at 397–414, for an overview of early state solar access legislation as well as a discussion of the subsequent erosion of some such protections.

76. *See* Bronin, *supra* note 56, at 1220 ("At least in part because of the muddled legal regime, and despite numerous technological advances that have reduced the cost of solar collectors, only one percent of our nation's energy currently comes from the sun.").

only broad in its application but also tailored in its approach to local concerns.[77]

This Part highlights the benefits of some existing regulatory approaches and identifies the key deficiencies of these plans. First, Sections II.A and II.B introduce the prior appropriation doctrine and solar zoning, respectively. Both schemes modify the neighboring property owner's legal entitlement by restricting her ability to use her airspace, thereby ensuring unobstructed sunlight for the solar collector. Other jurisdictions, however, have attempted to legislate solar access not by altering the contours of the legal entitlement but rather by changing how that entitlement is protected. While no model is without flaw, many scholars appear to favor a liability rule approach over a property rule approach, as outlined by Judge Calabresi and Professor Melamed in their 1972 Cathedral Model.[78] Property rules contemplate that the legal entitlement at stake will change hands only as a result of voluntary bargaining between the interested parties.[79] Solar easements, discussed in Section II.C, provide a clear illustration of such a property rule approach as applied to solar access. In contrast, liability rules facilitate involuntary transactions between landowners by permitting one party to purchase the legal entitlement at a price set by a third-party appraiser.[80] Section II.D examines Iowa's liability rule system. Ultimately, this Part concludes that while a liability rule is preferable to a property rule to balance the interests of the solar adopter against his neighbor, current liability rule proposals are still ill suited for resolving conflicts in the setting most likely to generate airspace disputes: dense urban cores.[81]

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77. *See* Rule, *supra* note 56, at 1250–53 (discussing the benefits of individualized regulation and the drawbacks of preempting local power over distributed renewables).

78. *See, e.g.*, Rule, *supra* note 21, at 891 (recommending a liability rule approach to solar entitlements). *See generally* Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972) (articulating the concept of liability rules and their counterpart, property rules). Simply put, the Cathedral Model involves a determination of who should hold a scarce legal "entitlement" and whether to protect that entitlement with a property rule or a liability rule. Calabresi & Melamed, *supra*, at 1093. Under the Cathedral Model, there are four possible outcomes of a solar energy airspace dispute: (1) the entitlement is held by the solar adopter and protected by a property rule; (2) the entitlement is held by the solar adopter and protected by a liability rule; (3) the entitlement is held by the neighbor and protected by a property rule; and (4) the entitlement is held by the neighbor and protected by a liability rule. For a general overview of the Cathedral Model, including a discussion of how it corresponds to solar access, see Rule, *supra* note 21, at 858–61.

79. *See* Calabresi & Melamed, *supra* note 78, at 1106–10.

80. A liability rule approach allows the party that was not initially awarded the entitlement to purchase the entitlement at a price equal to its objective value, as determined by a third party. *Id.*

81. *See supra* Section I.B.

A. Prior Appropriation Doctrine

Under the prior appropriation doctrine, an individual obtains a legal right of use by becoming the first person to physically appropriate a particular resource and put that resource to a beneficial use.[82] This doctrine was originally intended to settle disputes over water rights but has since been extended to govern the initial allocation of entitlements to other resources. Accordingly, a solar adopter can protect his solar access by unilaterally obtaining a "solar right" based on his first-in-time beneficial use of the sunlight.[83] Prior appropriation doctrine has not, however, been widely applied to solar access issues; New Mexico and Wyoming are the only states to explicitly adopt this approach.[84] Under these states' general statutory frameworks, a landowner may acquire a solar right—essentially a restrictive easement across his neighbor's property—if he installs a qualifying solar device and complies with various ministerial recordation and notice requirements.[85] The landowner does "not 'own' the sunlight, but ha[s] a right to divert it for a beneficial use."[86] This aggressive model of allocating legal entitlements strongly favors the solar adopter but conversely ignores the neighbor's property rights in her own airspace.[87]

Massachusetts and Wisconsin have similar statutes that, while not explicitly incorporating prior appropriation, "give rise to the same practical consequences."[88] Although Massachusetts and Wisconsin do not recognize a solar right predicated upon first use, both establish "permit" systems that enable local jurisdictions to issue solar rights

82. *See Prior Appropriation Law*, COLO. DIVISION WATER RESOURCES, http://water.state.co.us/SurfaceWater/SWRights/Pages/PriorApprop.aspx (last visited Feb. 16, 2019) [https://perma.cc/W6P7-75N5]. The doctrine is commonly known as "first in time, first in right." In the water-use context, the first person to apply the water to some type of beneficial use has the first right to use that water within a particular stream. *Id.* For example, consider two farmers whose properties sit atop an underwater aquifer. Both landowners have a claim to the water, and it is easy to imagine conflicts over the apportionment of this water supply, especially during droughts. In this scenario, prior appropriation doctrine makes more sense—the first landowner to put the water to beneficial use becomes the senior right holder over the aquifer, ensuring that in the event of a shortage, his needs will be prioritized. *Id.*

83. *See* Rule, *supra* note 33, at 310.

84. N.M. STAT. ANN. § 47-3-4 (West 2018); WYO. STAT. ANN. § 34-22-103 (2018). Under both statutes, the solar rights are freely transferrable once granted. N.M. STAT. ANN. § 47-3-4; WYO. STAT. ANN. § 34-22-103. Wyoming exempts certain de minimus obstructions and sets limits on where the solar collector can be placed, WYO. STAT. ANN. § 34-22-104, and New Mexico provides a process through which the solar right can be contested, N.M. STAT. ANN. § 47-3-9(C).

85. Rule, *supra* note 33, at 310.

86. DuVivier, *supra* note 4, at 420.

87. *See supra* Section I.C (discussing background principles of a landowner's airspace rights).

88. Rule, *supra* note 33, at 311; *see* MASS. GEN. LAWS ch. 40A, § 9B (2018); WIS. STAT. § 66.0403 (2018).

permits upon application by solar adopters.[89] Like the statutory schemes in New Mexico and Wyoming, the permitting process grants what effectively amounts to a negative easement[90] over adjacent property.[91]

Prior appropriation doctrine—including the permitting variation—has incited criticism from legal commentators. First, the relevant statutory systems do not provide a compensatory mechanism for the burdened neighbor. Because the neighboring landowner held legal title to the now-encumbered airspace prior to the recognition of the solar right, many commentators have suggested this approach may effect a violation of the Takings Clause.[92]

Further, the analogy between physical resources—like water, oil, and natural gas—and sunlight is inherently strained. Because the "supply" of sunlight is infinite, solar energy production should not, at least in theory, implicate the same rival-use concerns[93] as would a dispute over physical resources.[94] Indeed, the conflicts in this setting are "rarely disputes over competing solar access easements" and instead pit solar users against neighbors who have "no interest in installing solar collectors" and "who seek only to preserve existing airspace rights."[95] Plainly put, "the resource at issue in these conflicts

89. *See* MASS. GEN. LAWS ch. 40A, § 9B; WIS. STAT. § 66.0403. The local agency has more discretion in granting a permit than it would under a strict prior appropriation approach. For example, under Wisconsin law, the agency may deny a solar permit request if, at the administrative hearing, a neighbor demonstrates that she has present plans to build a structure that would create an "impermissible interference." WIS. STAT. § 66.0403(5)(a)(2). Some cities have also enacted unique permitting regimes in the absence of statewide policy. *See* Bronin, *supra* note 56, at 1240 (discussing permit programs in Portland, Oregon; Ashland, Oregon; and Boulder, Colorado).

90. The owner of a negative easement may "prevent the possessor of the land from doing acts upon it which, were it not for the easement, [the possessor] would be privileged to do." RESTATEMENT (FIRST) OF PROP. § 452 (AM. LAW INST. 1944).

91. Once a permit is granted under Wisconsin's scheme, "[a]ny person who uses property which he or she owns or permits any other person to use the property in a way which creates an impermissible interference . . . shall be liable to the permit holder or applicant for damages." WIS. STAT. § 66.0403(7)(a).

92. *See, e.g.*, Bronin, *supra* note 56, at 1242 ("[T]he possibility of takings claims presents a real challenge to the wide-scale enactment of solar permitting systems."); Gergacz, *supra* note 70, at 15 ("[T]he New Mexico Act ignores the property rights of adjoining landowners in a manner which may violate the fifth amendment to the United States Constitution."). *But see* Peter R. Mounsey, Comment, *Solar Access Rights in Wyoming*, 19 LAND & WATER L. REV. 419, 437 (1984) (concluding that the Wyoming statute is not a taking but noting the issues are still uncertain and "a challenge to some local government's solar access scheme would seem inevitable"). The Fifth Amendment's Takings Clause provides that private property shall not "be taken for public use, without just compensation." U.S. CONST. amend. V.

93. Rivalry concerns are implicated when consumption by one party necessarily reduces the ability of another party to consume that same good.

94. *See generally* Michael Pappas, *Energy Versus Property*, 41 FLA. ST. U. L. REV. 435, 465–74 (2014) (discussing the historic treatment of oil and gas interests under property law).

95. Rule, *supra* note 21, at 877.

is not sunlight but airspace."[96] And despite the fact that the doctrine assigns the initial entitlement based on first use by a solar adopter, the neighbor will nearly always be "first in time" with respect to the airspace because she already has property rights to that airspace under common law.[97]

B. Zoning

In light of the inherent inequity stemming from a solar access approach that conceptualizes sunlight as a finite resource, some jurisdictions have attempted to craft a more democratic solution to solar access problems. Indeed, local governments have utilized their general zoning power to enact broad-reaching solar access protections.[98] Even though solar access zoning falls within the accepted limits of the state's police power,[99] only thirteen states explicitly authorize the practice, and a few more have weaker provisions that contemplate solar access but are not explicitly incorporated into zoning mandates.[100] Within the zoning context, Professor Sara Bronin posits two ways in which localities might protect solar rights: (1) by granting variances, exceptions, and other individualized determinations or (2) by creating new "solar zones."[101] Variances, exceptions, and the like operate the same as under conventional zoning schemes, without required

96. Rule, *supra* note 33, at 311.

97. *Id.*; Rule, *supra* note 21, at 877.

98. *See* Matuson, *supra* note 60, at 846 ("The power to zone is derived from the police power of the state and is delegated to local governments by means of enabling legislation."); Rule, *supra* note 56, at 1227 (noting that most states have empowered local land use regulation by enacting versions of the State Zoning Enabling Act). Zoning ordinances face three constitutional requirements: they "must bear a rational relationship to the health, morals or general welfare of the community" to comply with due process standards; they must not be so "arbitrary and discriminatory" to be a denial of equal protection; and they must not "reduce the value of land as to constitute a taking" in violation of the Fifth Amendment. Matuson, *supra* note 60, at 846.

99. The authority to zone for solar access under state enabling statutes is thought to emanate from provisions authorizing localities "to provide for 'safety, morals or general welfare' and 'adequate light and air.' " Bronin, *supra* note 56, at 1242 (citing multiple scholars for this proposition).

100. *Id.* at 1243–44 (noting that a few states require solar access to be considered during the design of ordinances and comprehensive plans). Some states take an alternative approach and, rather than mandate solar access zoning, prohibit localities from affirmatively inhibiting solar installation. *Id.* at 1244. For an overview of state zoning enabling statutes, see *id.* at 1243–44, 1243 n.107, which highlights Arizona, Colorado, Connecticut, Indiana, Iowa, Minnesota, Nebraska, New York, Oregon, Tennessee, Washington, Wisconsin, and Wyoming.

101. *Id.* at 1245.

consideration of the unique problems presented by solar access conflicts.[102]

Solar zoning, on the other hand, provides added flexibility, because a locality can establish solar rights either "as of right or by individual petition."[103] Consider, for example, approaches to solar zoning in Boulder, Colorado, and Ashland, Oregon. Boulder's comprehensive policy, which has elicited praise from commentators,[104] comprises "solar envelopes"[105] and "solar fences"[106] that are tailored to function in tandem across the city's three "Solar Access Areas."[107] In effect, Boulder's zoning has produced a coordinated interplay of setback and height restrictions that limit both density and vertical development. Ashland, by comparison, adopted similar solar setback requirements but supplemented this "as of right" zoning with "individual petitions" in the form of a solar access permit system to address shade created by vegetation.[108]

Solar zoning, when done well, has clear benefits. First, it places the specific siting decisions in the hands of local communities, who are often "in a better position than state officials to estimate the likely costs of distributed renewables within their jurisdictions."[109] Second, the general population may consider the outcome more equitable compared to a system that assigns entitlements based on first use or permit

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102. *Id.* In general, these individualized determinations require landowners to petition a local municipal body for permission to use their property in a way that is not permitted as of right by the zoning regime.

103. *Id.* Professor Bronin further notes that several commentators "have argued that a separate, specific solar ordinance is preferable." *Id.* at 1245 n.112. For a more detailed discussion of the two methods of solar zoning, see *id.* at 1246–47.

104. *See id.* at 1247 (citing particularly laudable elements of the Boulder plan).

105. The solar envelope creates a three-dimensional skyspace above a parcel in which no construction or vegetation can legally occur. *Id.*

106. The solar fence is "a vertical plane along a property line that casts an imaginary shadow that cannot be exceeded in length by the shadows cast by any building or tree on the neighboring property." *Id.*

107. S.F. DEP'T OF THE ENV'T, PROTECTING SOLAR ACCESS 4 (2012), https://sfenvironment.org/sites/default/files/fliers/files/protecting_solar_access.pdf [https://perma.cc/4XL6-3PNH]. The size of the solar fence changes between access areas. *Id.* In addition, Boulder has instituted new-development siting requirements to ensure buildings are capable of supporting solar collection. *Id.*

108. *See* Alexandra B. Klass, *Property Rights on the New Frontier: Climate Change, Natural Resource Development, and Renewable Energy*, 38 ECOLOGY L.Q. 63, 100 (2011).

109. Rule, *supra* note 56, at 1264 (noting that the majority of recent scholarship suggests communities are the "best choosers" in evaluating the costs and benefits of local adoption of renewable energy); *see* Rule, *supra* note 50 (manuscript at 10) ("Because the significance of the solar access problem varies dramatically across jurisdictions, the costs of implementing aggressive solar access laws to address the problem are more justifiable in some communities than in others.").

applications.[110] Additionally, by generally restricting development, zoning preserves solar access for future solar adopters.[111]

Each of the benefits associated with solar zoning, however, can be reframed as an equally compelling downside. First, enhancing the independence of local jurisdictions can pose significant costs to states hoping to maintain a uniform solar policy.[112] Indeed, as state lawmakers make increasingly large financial and legislative commitments in support of renewable energy,[113] they may be hesitant to entrust implementation to local governments. Significant changes are likely necessary to ensure compliance with state-established renewable energy targets,[114] and if local communities are unwilling to make the requisite investments, they can "undermine[ ] federal and state efforts to promote sustainability, arguably imposing costs on the nation and the world."[115]

Second, broadly applied zoning ordinances may actually be less fair than individualized determinations.[116] By adopting a "one-size-fits-all" approach, a zoning regime may unnecessarily restrict development, even where there is no present risk of solar obstruction.[117] In such a scenario, a municipality would bear the economic cost of restricted development yet would fail to realize the full benefit of the ordinance because many affected properties will never take advantage of the provided-for solar protections.[118]

Growth restrictions also increase city housing costs and compound urban sprawl.[119] The implementation of height restrictions and setback requirements leaves horizontal expansion as the only

110. S.F. DEP'T OF THE ENV'T, *supra* note 107, at 5.

111. *Id.* Restrictive zoning measures may also increase property values, an attractive proposition for existing homeowners, by limiting the supply of available housing. *See* Rule, *supra* note 56, at 1230–31 (discussing how sustainability measures that increase property values are more readily embraced by citizens). Professor Rule draws on Professor William Fischel's Homevoter Hypothesis to frame the community reception to various green measures. For a discussion of the Homevoter Hypothesis, see *id.* at 1228–29.

112. *See* Rule, *supra* note 56, at 1250 (arguing that the financial cost and time necessary to align the estimated twenty-five thousand local zoning jurisdictions across the United States are prohibitive).

113. See *supra* Section I.A for examples.

114. For an overview of some of these ambitious targets, see *supra* note 20.

115. *See* Rule, *supra* note 56, at 1235 (discussing siting issues).

116. *See* Bronin, *supra* note 56, at 1249 (arguing that zoning ordinances may not account for site variations and expressing concerns that landowners could be inequitably burdened, giving rise to colorable takings claims).

117. S.F. DEP'T OF THE ENV'T, *supra* note 107, at 5.

118. *Id.*

119. *See* Rule, *supra* note 33, at 273 n.5 ("[Z]oning ordinances 'limiting use, density, area and height' have caused 'much greater sprawl than existed previous to [their] imposition[.]' " (second alteration in original) (quoting Bernard H. Siegan, *Smart Growth and Other Infirmities of Land Use Controls*, 38 SAN DIEGO L. REV. 693, 733 (2001))).

viable development option.[120] If solar zoning accelerates urban sprawl, the negative environmental effects could offset any benefits attributable to increased solar access.[121] Finally, conventional zoning does not usually result in the creation of tradeable property rights.[122] This eliminates the potential for bargaining and precludes efficient market transactions between neighbors. But perhaps more importantly, it reflects the fact that solar access is not protected in a meaningful way; zoning restrictions can be adjusted by granting an exception or variance to a neighboring property or by amending the zoning provision itself.[123]

C. Solar Easements

Given the risk that a broadly applicable zoning regime will be overprotective of solar access rights to the detriment of desirable policy goals, many jurisdictions simply allow neighboring property owners to craft their own solar protections through negotiated easements. Although state legislatures generally codify the existence of express solar easements in an effort to avoid ambiguity, the free market often controls the creation and disposition of such easements.[124] Indeed, a majority of states formally recognize solar easements and permit the conveyance of these interests through voluntary, private transactions.[125] As compared to the approaches discussed previously, a hands-off solar easement regime better protects property rights of both solar adopters and their neighbors.[126] Through voluntary bargaining, the neighbor is able to sell her airspace entitlement to the solar adopter. In the end, the solar adopter secures an unobstructed path to sunlight,

120. *See id.*

121. *See* Bronin, *supra* note 56, at 1249 ("Comprehensive ordinances that create building envelopes that enable the passage of light . . . may, in effect, mandate sprawl."). See also *supra* Section I.B for a discussion of the harmful effects of urban sprawl.

122. *See* Rule, *supra* note 56, at 1245 ("Rights held collectively by residents under zoning restrictions are not 'ordinary, property-rule-protected entitlement[s] that [residents] can alienate to any willing buyer or on mutually agreeable terms.' " (alterations in original) (quoting LEE ANNE FENNELL, THE UNBOUNDED HOME 72 (2009))).

123. *See* Bronin, *supra* note 56, at 1249–50 ("Because it does not provide an enduring, secure property right, zoning is among the least effective means of securing solar access."); Dale D. Goble, Comment, *Solar Rights: Guaranteeing a Place in the Sun*, 57 OR. L. REV. 94, 123 (1977) ("In addition to the lack of a property interest, another major impediment to the use of zoning to secure solar access is the ease and frequency with which such ordinances are modified.").

124. *See* Bronin, *supra* note 56, at 1226 (discussing legislative recognition of solar easements).

125. *See id.* at 1226 & n.28 (providing an overview of state statutes that allow for the creation and recording of express solar easements).

126. *Id.* at 1228 (noting that the parties "voluntarily bargain[ ] to a mutually agreeable result").

and the neighbor is compensated for her encumbered airspace.[127] Voluntary easements can also eliminate unnecessary bureaucratic costs by concentrating the bargaining in private parties.[128] Thus, in principle, solar easements seem to be the preferred mechanism for protecting solar rights.

Unfortunately, solar easements present practical concerns. While many states explicitly allow for the creation of solar easements, these statutes have been derided as an "inexpensive form of legislative cheerleading."[129] In fact, there are no federal or state cases dealing with express solar easements.[130] The glaring lack of case law could indicate any number of phenomena: that there was no demand for solar easements in the first place,[131] that easements are in place but have generated no legal disputes, or that barriers to formation have prevented voluntary easements from becoming a viable solution.[132] The third option—bargaining impediments—seems intuitive, given the weight of scholarship addressing bargaining breakdowns in similar settings.[133] For example, the existence of a "bilateral monopoly" can increase transaction costs because the parties are unwilling, as a result of substantial prior investment, to walk away from the bargaining table.[134] Unlike in a competitive market, neighbors negotiating solar rights are stuck with each other and cannot seek new deal partners.[135] Conversely, if the solar user needs to obtain entitlements from multiple

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127. *Id.*

128. *Id.*

129. *See id.* at 1229 (quoting Donald N. Zillman, *Common-Law Doctrines and Solar Energy*, *in* LEGAL ASPECTS OF SOLAR ENERGY 25, 32 (John H. Minan & William H. Lawrence eds., 1981)); DuVivier, *supra* note 4, at 404 (same).

130. *See* Bronin, *supra* note 56, at 1229 (conducting several searches of case law); *see also* S.F. DEP'T OF THE ENV'T, *supra* note 107, at 7 (finding no examples where voluntary easements have occurred). The author also conducted a search and similarly was unable to locate any examples.

131. *See* S.F. DEP'T OF THE ENV'T, *supra* note 107, at 2 (reporting that the San Francisco Planning Department is only aware of a few cases in the city where new development has shaded solar systems); *see also* MARIANNE M. JENNINGS, REAL ESTATE LAW 46 (9th ed. 2018) (citing recent surveys finding that ninety-five percent of solar owners have not obtained protective easements).

132. *See* Bronin, *supra* note 56, at 1229 (discussing potential transactional barriers to solar easements).

133. For a general overview of impediments to voluntary Coasean bargaining, see Rule, *supra* note 21, at 883–86.

134. *Id.* at 884 ("A 'bilateral monopoly' exists whenever two opposing parties' 'previous investment in their present position [is] sufficiently substantial and irreversible' such that bargaining with each other is 'a better solution than simply picking up stakes and moving elsewhere.' " (alteration in original) (quoting Herbert Hovenkamp, *Rationality in Law & Economics*, 60 GEO. WASH. L. REV. 293, 298 (1992))); *see also* Klass, *supra* note 108, at 97 ("The availability of solar easements may be limited, however, because they are voluntary in nature and servient owners may overcharge because of bilateral monopoly problems.").

135. Rule, *supra* note 21, at 884.

neighbors, there is an incentive for one neighbor to hold out in an attempt to extort a greater sum for her entitlement.[136]

Further, the cost of the easement may be so prohibitively high as to deter bargaining altogether. These price pressures could be attributed to the "endowment effect," which occurs when an individual demands an excessively high price because of an "irrational aversion to losing a personally held entitlement."[137] Or, more likely,[138] inflated prices may simply reflect market realities. Although parties are free to negotiate their own terms, the cost of an airspace easement is typically the difference between the fair market value of the underlying burdened property with and without the encumbrance.[139]

In urban settings, this difference is often massive. Because vertical growth is frequently the only remaining option for developers in crowded cityscapes, airspace can be quite valuable.[140] Consequently, the high-end market for air rights can place the cost of an easement far beyond the solar adopter's financial means.[141] When air rights are significantly more expensive than both the expected energy savings and the cost of the solar collection system itself, it makes no economic sense for a solar user to negotiate and purchase an easement.[142] In other

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136. For example, if the solar user needs to obtain three entitlements to ensure unobstructed solar access, the third entitlement holder may be aware that the solar user has already invested time and resources to obtain the first two. Since the solar array cannot function without all three entitlements in place, the third right holder may demand a higher price because she knows she holds the final piece to the puzzle. In practice, however, it is uncertain how often this scenario will arise, if it does at all, since most solar users do not need to obtain solar access entitlements from more than a small group of neighbors. *Id.* at 885 (discussing the holdout problem).

137. *Id.* at 885–86 ("An endowment effect is manifest when an individual's irrational aversion to losing a personally held entitlement causes the individual to demand an excessively high price to sell it[,] . . . [which] can impede parties from reaching a Coasean bargain.").

138. The endowment effect, while possible, is not anticipated to be an overly strong force in negotiations over airspace rights. *Id.* at 886.

139. Larry J. Smith et al., *Over and Under: A Practical Guide to the Condemnation of Aerial Guideway Easements and Tunnel Easements*, MILLER NASH GRAHAM & DUNN LLP 11, http://www.millernash.com/files/Uploads/Documents/Z%20201.1%20-%20smith_beaver_white_hiatt_dec2005.pdf (last visited Feb. 16, 2019) [https://perma.cc/P2TZ-V9FX] (noting that the valuation of easements is complex and difficult since there is generally no public market).

140. *See* Rule, *supra* note 50 (manuscript at 12) ("Particularly in densely-populated urban areas, the airspace above land can be highly valuable . . . .").

141. *See* S.F. DEP'T OF THE ENV'T, *supra* note 107, at 7–8:

> In San Francisco, if a solar system owner were to compensate her neighbor for the lost rights to develop his property[,] . . . she could easily pay many times more for the easement than the cost of the solar system due to the high value of real estate and development rights in the city.;

see also Sara C. Bronin, *Modern Lights*, 80 U. COLO. L. REV. 881, 915 (2009) ("For higher-density areas, the compensation mechanism is more complicated.").

142. A new residential solar system generally costs, after accounting for tax credits and other incentives, between $10,000 and $30,000. Matasci, *supra* note 49. Comparatively, in 2016 developers in New York City paid an average of $292 per square foot for air rights in Manhattan. Lois Weiss, *City Saw Fewer, but Larger Air-Rights Deals Last Year*, N.Y. POST (Feb. 7, 2017,

settings, however, fair-market compensation may be economically feasible.[143] For example, if the area is low density or if the solar user installs only a small panel, "compensation may be relatively small because the award of a solar right might not actually create significant burdens" for neighboring parcels.[144] Similarly, if the easement only restricts a relatively low-value use—such as vegetation growth or the construction of a treehouse—the required compensation may be minimal.[145]

Finally, even if obtained, an easement can still produce inefficient outcomes. Easements are typically perpetual in nature, unless the parties agree to a term of years or to termination upon the occurrence of some other triggering event.[146] Increased adoption of solar easements could result in the piecemeal, long-term burdening of property, leaving both property owners and local governments unable to respond to changing land use needs and handcuffing their ability to reallocate entitlements to more productive uses.[147]

D. Moving Toward a Liability Rule: The Iowa Model

As discussed in the preceding Sections, there are significant flaws with the prior appropriation and solar zoning approaches.[148] Any benefits that accrue to landowners through the clear assignment of airspace entitlements are lost when the interests of the burdened

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10:12 PM), https://nypost.com/2017/02/07/city-saw-fewer-but-larger-air-rights-deals-last-year/ [https://perma.cc/54KC-YSWQ]. Certain areas, however, saw air rights trading for $750 to $800 per square foot, and the aggregate sum paid for Manhattan air rights in 2016 was $469,200,000. Konrad Putzier, *Manhattan Air Rights Got More Expensive in 2016*, REAL DEAL (Feb. 8, 2017, 10:06 AM), https://therealdeal.com/2017/02/08/manhattan-air-rights-got-more-expensive-in-2016/ [https://perma.cc/T36M-4SVU]. At those rates, a solar user requiring anything more than de minimis protection would quickly be priced out of a market-rate solar easement.

143. *See* Bronin, *supra* note 141, at 914 ("Compensation schemes must necessarily differ depending on the characteristics of the benefited and burdened properties.").

144. *Id.* at 915.

145. *Id.* Of course, this assumes a market-valuation approach. In reality, the burdened party may subjectively value her loss at a much higher rate, which could prevent the consummation of an agreement. *Id.*; Bronin, *supra* note 56, at 1229 (noting that "[s]ervient owners may overcharge for easements . . . because they overvalue their interests").

146. *See* Bronin, *supra* note 56, at 1226 ("These enforcement powers endure, and remain with the land for subsequent purchasers, until and unless some event or condition renders them unenforceable.").

147. See *supra* Section I.B for a discussion of some alternative land uses that may produce even greener results than solar energy installations.

148. Some states with property rule approaches have shifted somewhat toward a liability rule system by establishing damages as the remedy for infringement. For example, statutes in California and Wisconsin assign the initial entitlement to the solar user but provide that a neighbor can pay damages to compensate for the reduced productivity caused by shading rather than abandoning the conflicting use altogether. *See* Rule, *supra* note 21, at 860 (outlining the four-part matrix of property and liability rules).

property owner are undervalued or when an approach fails to provide flexibility in addressing future environmental and land use issues.[149] Although solar easements can help mitigate the former issue, the associated transaction costs of voluntary bargaining "are too great for policymakers to expect Coasean bargaining to consistently and efficiently allocate competing airspace rights."[150]

As an alternative, Iowa has statutorily created a liability rule approach that is praised for being well balanced and considerate of both solar adopters' and neighbors' property rights.[151] First, like many other states, Iowa allows property owners to voluntarily create solar easements.[152] Iowa's statutory framework deviates, however, in its resolution of breakdowns in the bargaining process. To limit the risk of holdouts, Iowa authorizes local "solar access regulatory boards" to unilaterally create easements across a neighboring property if the solar applicant demonstrates his reasonable need for the easement and affirms that he has attempted to negotiate for a voluntary conveyance.[153] In a particularly important departure from other models, the Iowa statute mandates that a local solar access board, if it grants an easement, require the successful solar applicant to compensate the burdened property owner "based on the difference between the fair market value of the property prior to and after granting the solar access easement."[154] Unlike the systems adopted in Wisconsin,[155] Wyoming, and New Mexico, this compensation requirement ensures the solar user will "only choose to compel such sales when the neighboring airspace at

149. See *supra* Sections II.A, II.B for a more detailed discussion of the downsides to these approaches.

150. Rule, *supra* note 21, at 860–61.

151. *See* Bronin, *supra* note 56, at 1231 ("The Iowa approach reflects a sensible statutory solution to the holdout problem."); Rule, *supra* note 33, at 313 ("Iowa's approach respects and largely preserves landowners' long-held airspace rights." (footnote omitted)); Rule, *supra* note 21, at 892 ("Iowa's solar access statute as currently drafted goes a long way in balancing the goal of promoting solar energy development against the airspace rights of Neighbors . . . ."). *But see* Klass, *supra* note 108, at 115 ("[A] forced easement conveyance system, such as exists in Iowa, may run risks that outweigh any benefits associated with greater solar development in the short term.").

152. IOWA CODE § 564A.7(1) (2019) ("Persons, including public bodies, may voluntarily agree to create a solar access easement.").

153. *Id.* § 564A.4.

154. *Id.* § 564A.5. This compensation award must be deposited with the board by the owner of the dominant estate within thirty days of the decision. Once the compensation is received, the board will issue an order granting the solar easement. If the owner of the dominant estate declines to deposit compensation, the board will not issue the solar easement. *Id.*

155. Wisconsin's statute does not mandate compensation, but it permits local agencies to grant the solar permit subject to a requirement that the solar user compensate the burdened party. WIS. STAT. § 66.0403(5)(b) (2018).

issue is best suited for solar access protection and other nonrival uses."[156]

Despite its positive traits, Iowa's statutory framework is not immune from criticism. First, the easements created by local boards are perpetual in nature, which, as discussed in Section II.C, allows solar adopters to "acquire more rights than are necessary to protect an investment in solar collectors" and limits the flexibility of future land use planning.[157] In response, commentators have proposed modifications[158] to the Iowa approach that would incorporate an explicit restriction on the length of the easement.[159] These proposals are a step in the right direction but do not go far enough. Even if an easement regime incorporated the suggested modifications, the servient estate would remain burdened for decades.[160] Solar energy is a rapidly developing technology, and future innovation might allow solar collection in a manner that requires a smaller swath of unobstructed

156. Rule, *supra* note 33, at 314 (assuming both that the landowner is rational and that the fair market valuations are correct). This helps to avoid some of the perverse overdevelopment incentives that exist without forced compensation:

> Such approaches promote solar energy development by motivating Solar Users to install solar collectors quickly before Neighbors make use of the airspace needed for solar access. They may also, however, encourage opportunistic landowners to install solar panels with ulterior motives of acquiring a view easement across Neighbors' property or of preventing or delaying Neighbors' more productive uses. The rules might also motivate Neighbors to overdevelop their properties with trees or structures to avoid forfeiting their airspace rights to new Solar Users.

Rule, *supra* note 21, at 877–78 (footnote omitted).

157. Rule, *supra* note 21, at 893. Iowa does provide for the removal of a solar easement if the servient estate applies to the local board or petitions the district court. Removal is warranted if the solar collector is not installed and made operational within two years of recording the easement, if the dominant estate owner ceases to use the solar collector for more than one year, or if the solar collector is destroyed or removed and not replaced within one year. IOWA CODE § 564A.6(1).

158. In addition to durational limits, *see infra* note 159, these proposals also seek to simplify or reduce ministerial requirements in an attempt to mitigate transaction costs. *See, e.g.*, Rule, *supra* note 21, at 892–93 (proposing that parties be allowed to describe the easement in a less costly manner and that provisions be added to dissuade frivolous applications).

159. *See, e.g.*, Rule, *supra* note 21, at 892–93 (proposing that the statute cap the term of the access right to the life expectancy of the solar collector); Rule, *supra* note 50 (manuscript at 24) (proposing that, unless terminated earlier, a solar easement created pursuant to the application process should automatically terminate forty years after the date of recordation); Erik J.A. Swenson, *Model Solar Energy Access Legislation*, NORTON ROSE FULBRIGHT 5 (2010), http://www.nortonrosefulbright.com/files/us/images/publications/20100421SolarLegislation.pdf [https://perma.cc/YM26-SDFM] (proposing that the easement terminate after twenty years of not producing energy).

160. Even tying the duration to the life of the solar collector, *see supra* note 159, does not significantly reduce the length of the burden, since a solar panel can last for approximately thirty-five years. *Warranty*, TESLA, https://www.tesla.com/support/energy/own/solar-panels/warranty (last visited Feb. 16, 2019) [https://perma.cc/3P92-WHTB].

airspace.[161] Echoing concerns over the potentially entrenching effect of solar easements, Professor John William Gergacz has proposed that the servient tenant be provided with a procedural right to "petition the board for alteration of the easement . . . or for termination of all or a part of the easement."[162]

More fundamentally, whether the Iowa approach is in fact more effective at addressing competing property interests remains to be seen. It has been suggested anecdotally that the Iowa statute has led to some voluntary solar easement agreements,[163] but recent evidence is noticeably hard to come by.[164] Further, easements granted by a local agency under a liability rule approach raise the same concerns as voluntary easements—they may be cost prohibitive, especially in areas with high property values.[165] Thus, while the Iowa approach admirably avoids the transaction costs associated with bargaining for voluntary easements, its forced-compensation mechanism makes the prospect of obtaining a solar easement economically unreasonable for many solar users, particularly those living in dense cityscapes. Additionally, perpetual easements may crowd out competing green land uses and accelerate the harmful effects of urban sprawl. This program's efficacy as a means of encouraging renewable energy adoption may therefore be limited, because any model purporting to resolve the key issues in the solar access debate must prove workable in urban centers.

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161. *See* Gergacz, *supra* note 70, at 34 ("Solar energy collection is a new technology; it may be that the amount and location of open space needed for solar collection may change as new collection devices are developed."). Indeed, these technological shifts may be coming sooner rather than later. Over the past few years, companies have introduced a variety of innovative solar collection objects, including paint, windows, and roof tiles. *See* Patrick Caughill, *A New "Solar Paint" Lets You Transform Your Entire House into a Source of Clean Energy*, FUTURISM (June 15, 2017), https://futurism.com/a-new-solar-paint-lets-you-transform-your-entire-house-into-a-source-of-clean-energy/ [https://perma.cc/7666-MKGN] (citing research conducted at the Royal Melbourne Institute of Technology that produced a paint that can generate clean energy from sunlight); Glenn Meyers, *Chicago Skyscraper to Generate Solar Electricity*, REUTERS (Mar. 28, 2011, 11:48 AM), https://www.reuters.com/article/idUS252721771420110328 [https://perma.cc/YNE2-RVN9] (discussing an experimental program to install photovoltaic glass on the fifty-sixth floor of Chicago's Willis Tower); *Solar Roof*, TESLA, https://www.tesla.com/solarroof (last visited Feb. 16, 2019) [https://perma.cc/LAX4-X9XD] (describing new product that incorporates solar collection technology into glass roof tiles).

162. Gergacz, *supra* note 70, at 35. Under this proposal, the servient tenant would be required to compensate the solar user for the loss of the easement or for costs associated with relocating or modifying the solar collection device to conform to the terms of the modified easement. *Id.*

163. *See* Kenneth James Potis, Note, *Solar Access Rights in Florida: Is There a Right to Sunlight in the Sunshine State?*, 10 NOVA L.J. 125, 142 n.130 (1985) (interviewing one of the cosponsors of the Iowa solar access legislation).

164. The author was unable to find more contemporary evidence of solar easements directly attributable to Iowa's system of local solar access boards.

165. *See supra* note 142.

III. THE AIR APPARENT: RETHINKING SOLAR PROTECTIONS

Society has a collective interest in promoting solar energy, and mitigating airspace conflicts will be a critical component of any successful policy.[166] Yet current mitigation strategies often miss the mark by failing to address roadblocks to solar access protection or, conversely, by overprotecting solar collection at the expense of neighboring landowners. These shortcomings[167] are instructive in designing a better framework: an effective solar access policy should be adaptable to urban areas,[168] compensate burdened property owners without pricing out solar adopters,[169] and have durational malleability to avoid entrenching development restrictions.[170] This Note proposes to create such a system by pairing existing land use mechanisms—namely, transferable development rights ("TDRs") and call options—and doing so within a liability rule framework.

First, Sections III.A and III.B frame the basic tools for this proposal by outlining the structure of TDRs and call options, respectively. Next, Section III.C discusses how these elements attach to a liability rule framework to form solar development options ("SDOs"). SDOs contemplate that after the solar adopter obtains an airspace easement pursuant to the liability rule, the municipality will award the burdened neighbor not only a TDR package but also a call option to remove the easement prior to the end of its stated term for a predetermined price. While local concerns will undoubtedly generate structural wrinkles, the SDO proposal is still preferable to existing approaches, as highlighted in Section III.D.

A. Transferable Development Rights

TDRs were first utilized in the early 1960s to aid in the preservation of historic properties.[171] Historic-landmark designation foreclosed future development, which understandably created severe

166. *See supra* Sections I.A, I.B.

167. *See supra* Part II.

168. *See supra* Section II.B (discussing the sprawl-inducing effects of restrictive zoning).

169. *See supra* Section II.C (discussing cost concerns as a weakness of solar easements).

170. *See* Klass, *supra* note 108, at 115–16 ("[S]uch a forced easement system still may result in creating fixed property rights that become obsolete or must be reconfigured to address changing energy needs, technology development, or transmission development."); Matuson, *supra* note 60, at 868 ("[T]here is a danger that in protecting the solar access of a given property, redevelopment will be discouraged in areas where times and community needs change requiring the possible upgrading of densities to provide for greater economic as well as energy efficient use.").

171. *See, e.g.*, Christopher Serkin, Penn Central *Take Two*, 92 NOTRE DAME L. REV. 913, 917 (2016) (providing an overview of the creation of TDRs as part of New York City's comprehensive landmarks law); Matuson, *supra* note 60, at 853–54 (discussing the origins of TDRs).

financial hardship for the owners of designated buildings.[172] In response, cities began awarding TDRs to the burdened properties. A TDR is a development right—"the right[ ] the owner has to develop unused space within the applicable zoning laws"[173]—that can be transferred from the burdened property to a specially designated receiving area.[174] A developer in the receiving area who purchases a TDR can effectively use the landmarked building's unrecognized development potential to build higher or denser than would otherwise be permitted under existing zoning regulations.[175] TDRs may fetch steep prices on the open market, which can make them quite valuable to the burdened property owner.[176]

Today, cities and counties nationwide employ TDRs to support both historic and environmental conservation initiatives.[177] This increased popularity is unsurprising in light of the advantages a municipality can accrue from a well-managed TDR program. First, thoughtful designation of TDR receiving areas can complement both existing zoning policies and future development goals.[178] Consider a municipality attempting to balance the competing interests of development and preservation. A finely tuned receiving area can direct development to specific lots in a way that broad zoning regulations cannot: permitted TDR transfers expand a given lot's development potential without otherwise modifying the general zoning scheme

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172. *See* Matuson, *supra* note 60, at 855 ("The designation as an historical landmark . . . might result in the bankruptcy of a building's owners.").

173. *Id.* at 853.

174. *See* Serkin, *supra* note 171, at 918. The receiving area for the TDRs can often be quite limited, and municipalities enjoy a good deal of freedom in setting the parameters of the transfer program. *Id.* at 919.

175. *See* Matuson, *supra* note 60, at 853–54.

176. For example, TDRs in New York City sell for astronomical prices. Weiss, *supra* note 142. In fact, one 2016 deal generated a price per square foot of $1,258. *Id.*

177. *See, e.g.*, Memorandum from Carlos A. Gimenez, Mayor, Miami-Dade Cty., to Bd. of Cty. Comm'rs, Miami-Dade Cty. (Jan. 23, 2017), http://www.miamidade.gov/mayor/library/memos-and-reports/2017/01/01.23.17-Report-Evaluating-Existing-and-Potential-Development-Density-Transfer-Programs-Directive-152550.pdf [https://perma.cc/7UQA-9LKU] (discussing TDR programs in Miami); Memorandum from Daniel A. Sider, Planning Dep't Staff, S.F. Planning Dep't, to Historic Pres. Comm'rs, S.F. Planning Dep't (July 11, 2013), http://commissions.sfplanning.org/hpcpackets/HPC_TDR_Packet_2013_07_11.pdf [https://perma.cc/9M5T-CC4U] (providing an overview of San Francisco's TDR program for historic preservation); *Providence, Rhode Island*, SMARTPRESERVATION, http://smartpreservation.net/providence-rhode-island (last visited Feb. 16, 2019) [https://perma.cc/BDL6-9NXJ] (discussing historic preservation TDR program in Providence, Rhode Island); *TDR Marketplace*, KING CTY., https://www.kingcounty.gov/services/environment/stewardship/sustainable-building/transfer-development-rights/market-info.aspx (last updated Jan. 10, 2017) [https://perma.cc/VR56-GNGX] (discussing the TDR marketplace in King County, Washington).

178. *See* Matuson, *supra* note 60, at 872 ("[T]he use of TDR must coincide with a comprehensive land use plan, since designated transfer districts would have to be provided.").

applicable to adjacent properties.[179] The benefits of this tailoring can be realized on a larger scale as well. For example, King County, Washington, which includes the Seattle metropolitan area, operates a countywide TDR program through which owners of rural "sending sites" are able to sell their development rights to eligible urban "receiving sites."[180] King County is thus able to create "more efficient development patterns" by shifting growth "away from critical rural and resource areas."[181]

Second, the cost of awarding TDRs can be passed from the municipality to the marketplace.[182] That is, the government does not pay the property owner directly; a TDR's value wholly depends on what private parties are willing to purchase it for on the open market. As a result, TDRs can facilitate desirable land use outcomes, such as environmental conservation, where the city would otherwise be unlikely to engage in a cash transaction.[183] Indeed, King County, listing the benefits of its TDR program, proclaims that "[t]he County—and its taxpayers—do not pay the high price to buy land outright."[184] But as some commentators point out, TDRs are not truly "free."[185] While the short-term burden may be minimal, residents bear future costs due either to increased congestion in the receiving area or to inefficient zoning undertaken to prop up the TDR regime.[186] It also remains unclear whether TDRs represent constitutional "just compensation" for purposes of the Fifth Amendment's Takings Clause, since they provide no fungible value to the property owner until exchanged in a second-step transaction.[187] While the Supreme Court has not squarely

179. *See* Serkin, *supra* note 171, at 919 (describing the famous Grand Central TDRs and noting that the original receiving area was limited only to adjacent lots, though the area was subsequently expanded to include twenty-one potential lots).

180. *See Program Overview - Transfer of Development Rights*, KING CTY., https://www.kingcounty.gov/services/environment/stewardship/sustainable-building/transfer-development-rights/overview.aspx (last updated Jan. 10, 2017) [https://perma.cc/V5ZL-4H64] [hereinafter *Program Overview*].

181. *Id.*

182. *See* Matuson, *supra* note 60, at 875 (discussing how "the developer's market" could cover the cost of the TDR).

183. *See* Serkin, *supra* note 171, at 926 ("TDRs are a kind of off-balance-sheet benefit that can be created spontaneously at no obvious expense to the public.").

184. *Program Overview*, *supra* note 180.

185. Serkin, *supra* note 171, at 926 (pointing out the hidden costs of TDR regimes).

186. *Id.* (noting that "there is little political accountability" associated with TDR creation, which may lead governments to "give them away too freely," since costs can be kicked down the road). In fact, the need to maintain stability in the TDR program itself could produce adverse effects. Because prices are correlated to both the number of receiving areas and the number of TDRs outstanding, overissuance could depress prices. In response, a government could "impose greater restrictions on the receiving area to enhance the value of the TDRs." *Id.*

187. U.S. CONST. amend. V; *see* Serkin, *supra* note 171, at 917 n.21 (discussing the "unresolved" question whether TDRs count as compensation or merely "blunt[ ] the regulation's

addressed the issue, its reasoning in *Penn Central*[188] is generally understood to support the proposition that TDRs can prevent a property restriction from effecting an unconstitutional taking.[189]

B. Call Options

Liability rule approaches like Iowa's promote entitlement shifts by minimizing the high transaction costs associated with voluntary bargaining. But even though liability rules largely avoid the potential for impasse inherent in property rules, inefficient transfers can still occur if the property owner's subjective valuation of the entitlement is not aligned with the appraised value of the entitlement shift.[190] This risk can be mitigated, however, by incorporating call options—the option to purchase the legal entitlement at stake—into the transaction.[191] In fact, call options are already implicit in traditional liability rules.[192] To illustrate how the preliminary option works, consider a prospective solar adopter in a liability rule jurisdiction like Iowa. Initially, the legal entitlement to use the airspace belongs to the neighboring property owner. But by unilaterally creating easements upon application, Iowa's scheme effectively creates a call option that the solar adopter can exercise to "purchase" the entitlement for an amount determined by the solar access regulatory board.

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impact such that there [is] no taking"); Goble, *supra* note 123, at 128 (discussing potential constitutional issues); Matuson, *supra* note 60, at 858–61 (analyzing the constitutionality of TDRs). Indeed, there are also concerns that the issuance of too many TDRs could reduce the value of existing TDRs or that subsequent zoning changes could undermine confidence in the system, thereby further calling into question the compensatory value of this regulatory property. *See* Serkin, *supra* note 171, at 926.

188. Penn Cent. Transp. Co. v. City of New York, 438 U.S. 104 (1978).

189. *See* Serkin, *supra* note 171, at 917 ("According to the Court, the landmarking of Grand Central was not a taking, in part, because of the offsetting benefits that Penn Central received from transferable development rights. . . . Because they were sufficiently valuable, the landmarking did not effect an unconstitutional taking."). *But see* Suitum v. Tahoe Reg'l Planning Agency, 520 U.S. 725, 747–48 (1997) (Scalia, J., concurring in part and concurring in the judgment) (characterizing the decision to put TDRs on the taking, rather than the just compensation, side of the analysis as stemming from the "peculiarity" of the Takings Clause jurisprudence).

190. *See* Lee Anne Fennell, *Revealing Options*, 118 HARV. L. REV. 1399, 1404 (2005). A liability rule keeps parties from strategically overrepresenting their true valuations—thus blocking an otherwise efficient transfer—by "allowing unilateral transfers at a price established by a third party." *Id.* Inefficiency is still possible, however, if the cost of the entitlement shift is set too low by the third-party appraiser. In such a case, the original right holder would "lose her entitlement . . . at a price that is far lower than her true subjective valuation." *Id.*

191. *Id.* at 1404 n.14; *see* Ian Ayres & J.M. Balkin, *Legal Entitlements as Auctions: Property Rules, Liability Rules, and Beyond*, 106 YALE L.J. 703, 731 (1996) ("A put is an option to sell, while a call is an option to buy.").

192. *See* Fennell, *supra* note 190, at 1404 n.14 ("[T]he party who is not originally assigned the entitlement holds a 'call option' to obtain the entitlement at a price established by a third party.").

It is also possible to create a "higher-order" liability rule by assigning a second option, contingent on the initial legal entitlement changing hands.[193] Here, the neighbor who had her original entitlement "called" will in turn receive a call option to "retake" the entitlement for a higher predetermined exercise price.[194] Adding multiple levels of call options can reshape a liability rule to more closely mimic an auction, where each subsequent taking or retaking of the entitlement represents a bid.[195] By expanding the bargaining parameters, this regime enables the parties to more effectively reveal their subjective valuations, which, in turn, provides greater autonomy to decide how to allocate the disputed entitlement between themselves.[196]

Professor Lee Fennell has considered options in the solar energy context and proposed the creation of a solar "option exchange."[197] She contends that governments can better facilitate voluntary solar rights transfers by purchasing options from property owners who minimally value their development potential, then selling those options to property owners who highly value solar access.[198] After purchasing an option, the property owner would hold the right to exercise the option and obtain a solar easement at a predetermined strike price.[199] While this innovative proposal may be attractive in some situations, it lacks a mechanism for addressing property owners who place a high subjective value on their air rights and accordingly refuse to convey a solar easement to a prospective solar adopter. This scenario is particularly worrisome in urban settings, where there is a much greater likelihood that a solar adopter will need to obtain easements from multiple property owners to secure uninterrupted solar access. In such a case, a market failure is possible if one individual property owner holds out

193. *See* Ayres & Balkin, *supra* note 191, at 715–16 (providing examples of higher-order liability rules); Fennell, *supra* note 190, at 1407 n.32 (discussing the origins of the "callable call").

194. *See* Fennell, *supra* note 190, at 1408 (providing an example of a callable call). It may be possible to further mitigate the risks of "holdout problems and undercompensated transfers" by forcing the parties to set their own exercise prices instead of relying on third-party appraisals. *Id.* at 1407, 1433–44 (describing proposed Entitlements Subject to Self-Made Options, or "ESSMOs").

195. *See* Ayres & Balkin, *supra* note 191, at 711. This volley of options allows the parties to inch closer to approximating their subjective valuations and steers the transaction toward a more efficient outcome. *Id.*

196. *See* Fennell, *supra* note 190, at 1405 (arguing for greater information revelation in transactions).

197. *See* Lee Anne Fennell, *Property and Precaution*, 4 J. TORT L., no. 2, art. 3, 2011, at 24–27.

198. *Id.*

199. *Id.* This proposal would also have ex ante benefits by enabling prospective solar users to review, when considering a move to that particular locality, which properties have sold access options. *Id.*

and irrationally values her airspace in an attempt to extort above-market compensation.[200]

C. Solar Development Options: A Comprehensive Approach

This Part has so far focused on TDRs and call options as standalone instruments. This Section combines these elements within a liability rule framework and proposes the creation of SDOs. Like Iowa's liability rule approach, an SDO regime would vest a local body with the power to unilaterally grant a solar easement after weighing the necessity and reasonableness of the request.[201] At this point, SDOs deviate from the Iowa framework along a few key dimensions. First, the solar easement in the SDO system would automatically terminate after a predetermined number of years. While localities can exercise discretion in limiting the easement's duration, an average length of fifteen to twenty years would suffice. This range would provide ample time for most solar users to recoup their initial financial outlay, since the typical solar payback period in the United States is between six and eight years.[202] Ultimately, the duration of the solar easement should also be short enough to avoid overentrenching solar rights at the expense of potentially beneficial development.[203]

The SDO system is further differentiated by its unique compensation structure, which, like the Iowa approach, awards payment to the owner of the encumbered neighboring property. But SDOs go even further: they move the responsibility for compensation from the solar adopter to the municipality itself.[204] Instead of merely calculating the compensation owed and serving as an intermediary for the capital exchange, the municipal agency would award an allotment

200. See *supra* note 136 for a discussion of the holdout problem. But even absent a holdout scenario, it could be appropriate to override the idiosyncratic preferences of an individual property owner if the municipality determines that solar access is a beneficial public good.

201. In practice, this process could operate quite similarly to the Iowa system. *See supra* Section II.D. Of course, parties should attempt to voluntarily bargain for an easement before availing themselves of this system.

202. *See How to Calculate Solar Panel Payback Period (ROI)*, ENERGYSAGE, https://news.energysage.com/understanding-your-solar-panel-payback-period/ (last visited Feb. 16, 2019) [https://perma.cc/F9NA-AAFG]; *supra* note 159 (discussing proposals in favor of a longer duration).

203. *See, e.g.*, Matuson, *supra* note 60, at 872 ("Again, the ideal situation is not to freeze development for all time, but to encourage and advocate the use of solar energy wherever possible.").

204. The solar adopter will, of course, incur some costs during this process. For example, it would be reasonable to expect the solar adopter to pay for any necessary surveys and to be assessed an application fee to defray the administrative costs associated with processing the solar easement request.

of TDRs to the burdened property owner.[205] Under a typical TDR program, the owner of the encumbered property receives a TDR allotment equivalent in value to the property's lost development potential.[206] When development is restricted in perpetuity (e.g., as a result of historic preservation), the value of the TDR package must account for the property's permanent diminution in value. Under the SDO system, however, the easement is only temporary in nature, so development rights are not lost forever—they are merely "frozen" for the duration of the easement.[207] When valuing temporary easements, the "rental return" method is most commonly used; as such, the awarded TDRs would not reflect the full expected future development potential of the encumbered airspace.[208] Rather, the TDR allotment can be conceptualized as an aggregated upfront payment reflecting the "rent" for the duration of the easement.[209]

In addition to TDRs, the burdened neighbor would receive a call option—a form of the "higher-order" liability rule[210]—that, if exercised, would entitle her to reclaim the airspace entitlement at a predetermined strike price.[211] The strike price should be constructed to include the total amount invested in the solar collection device, less the value of the attributable energy savings. The strike price would therefore decrease the longer the easement remained in place, reflecting the diminished need to make the solar adopter "whole" once he has realized an economic return on his investment. Further, at the local board's discretion, a standardized fee could be applied to help cover

205. The use of TDRs has been previously suggested, but this proposal charts a broader course by adding call options and tailoring the approach for use in urban centers. *See* Goble, *supra* note 123 (proposing a TDR solar program in 1977); Matuson, *supra* note 60 (proposing a TDR solar program in 1978).

206. *See supra* Section III.A (discussing the mechanics of TDRs).

207. Although structured as an easement, in some senses the encumbrance contemplated acts more like a lease. As a result, the compensable value will be substantially less than under a perpetual easement.

208. *See, e.g.*, Portland Nat. Gas Transmission Sys. v. 19.2 Acres of Land, 195 F. Supp. 2d 314, 322 (D. Mass. 2002) ("A landowner must be compensated for the loss of use of property taken by a temporary easement[,] and . . . [s]ome courts have held that the damages are equal to the rental value of the property for the period of occupation."); *see also* Troy Byers, *Appraisal of Temporary and Permanent Easements*, AM. ASS'N ST. HIGHWAY & TRANSP. OFFICIALS 16, http://sp.rightofway.transportation.org/Documents/Meetings/2015 Meeting Presentations/ Appraisal of Temporary and Permanent Easements-GA-presented by Byers,Troy.pdf (last updated Apr. 28, 2015) [https://perma.cc/M8LX-8YHC].

209. Because TDRs only have value when they can be bundled and sold, the allotment must be made at the outset rather than on an incremental yearly basis.

210. *See supra* note 193 and accompanying text.

211. *See* Ayres & Balkin, *supra* note 191, at 713 ("[U]nder a higher-order liability regime, the entitlement holder might have her entitlement taken at any time without her consent.").

the relocation of the solar panels to an unobstructed location or, alternatively, fund the buy-in cost of a community solar project.[212]

Although the strike price would steadily decrease as a function of the solar adopter's cumulative energy savings, it would also increase by the value of any TDRs not yet "earned" by the neighboring property owner. If the initial TDR allocation is conceptualized as equivalent to the net present value of the rental fees due over the entire life of the easement, it is clear that a burdened property owner who exercises the second-level call option and prematurely terminates the easement could end up with a potential windfall. For example, if TDRs are awarded in contemplation of a fifteen-year easement but the easement is removed after only five years, the property owner would be compensated with TDRs for ten years during which there was no actual encumbrance on her property. Therefore, there is a risk that property owners will attempt to double-dip by quickly selling their allotted TDRs before prematurely terminating the easement, reclaiming their air rights, and commencing development. In such a case, the property owner could realize the full development potential of her airspace and also reap the benefits from selling TDRs that were awarded to offset a burden she never actually bore.

To avoid such an outcome, the value of the TDRs attributable to the posttermination period can be incorporated into the strike price so that the net compensation paid to the property owner reflects only the time during which the easement was in effect. Thus, returning to the previous example, the strike price would increase by the value of the TDRs attributable to the remaining ten years of the easement. Alternatively, if the TDRs have not yet been sold, the property owner can elect to instead cede any "unearned" TDRs back to the municipality.[213] By structuring the entitlement in this manner, the

212. *See* S.F. DEP'T OF THE ENV'T, *supra* note 107, at 8–9. Community solar projects are coop-like arrangements through which individuals can purchase a portion of the power generated, which they receive as a credit on their utility bills. *See, e.g.*, S.F. DEP'T OF THE ENV'T, COMMUNITY SHARED SOLAR (2012), https://sfenvironment.org/sites/default/files/fliers/files/community_shared_solar.pdf [https://perma.cc/MAE7-42Z5] (discussing community solar in San Francisco); Jeff Coltin, *Reaching for the Sun: Cuomo Needs New York to Step Up Its Solar Act*, CITY & ST. N.Y. (Apr. 19, 2017), https://www.cityandstateny.com/articles/policy/energy-and-environment/cuomo-new-york-solar-act.html [https://perma.cc/F4UT-P5HF] (discussing community solar in New York). Of course, the local board could also exercise its discretion to reduce the strike price based on the totality of the circumstances. For example, if the solar panels in question are no longer operable or the solar adopter's expenses are suspiciously inflated, it would be proper to apply a downward adjustment to the strike price. While extreme circumstances could justify a strike price of zero dollars, this Note proposes that, at the very least, the price reflect an amount sufficient to cover the administrative costs associated with the easement's removal.

213. Mandating the return of unsold TDRs can help mitigate the fact that "governments may already have a tendency to give them away too freely." *See* Serkin, *supra* note 171, at 926. Indeed,

municipality can be more confident that the owner of the burdened property will only exercise the call option if there is a viable, profitable development opportunity on the table—a tradeoff that should be prioritized as net beneficial to the community at large. If no such opportunity exists, the property owner should be content to hold and sell her TDRs.[214]

D. The Comparative Advantage of SDOs

The core elements of SDOs—liability rules, TDRs, and call options—improve upon existing solar access proposals and better address the needs of solar adopters by focusing on urban centers, balancing compensation rights against cost constraints, and preserving land use flexibility.

First, SDOs can be effectively applied in densely populated cityscapes.[215] Existing approaches that require solar adopters to pay full market value for easements render solar access protection dead on arrival—the exorbitant cost of acquiring air rights in the urban core prices out any solar adopter hoping to recoup his investment.[216] The SDO system avoids this problem by shifting compensation responsibilities to the municipality through a TDR regime funded by the developer market, at little upfront cost to the city.[217]

Second, SDOs compensate burdened property owners without making solar easements cost prohibitive. It is now fairly well established that landowners have property interests in their airspace,[218] yet many solar rights regimes seemingly overlook this inconvenient fact.[219] The SDO system, on the other hand, recognizes the burdened neighbor and compensates her for the temporary encumbrance of her airspace. Despite promising compensation, SDOs are also structured to minimize the total cost of the program. As a preliminary matter, many municipalities already have some form of a TDR regime in place, which will reduce the administrative costs of starting and maintaining the program.[220] Developers are also familiar

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oversaturation of the TDR market can lead to undesirable congestion in the receiving area or a decline in the value of existing TDRs. *Id.*

214. Once the easement expires, the burdened property owner would again be free to use her property as of right.

215. For a discussion on the importance of cities to the green movement, see *supra* Section II.B.

216. *See supra* note 142.

217. *See supra* notes 182–186 and accompanying text.

218. *See supra* Section I.C.

219. *See supra* note 92 and accompanying text.

220. *See supra* note 177 and accompanying text.

with, and comfortable using, TDRs in these localities. Further, the temporary nature of the easement reduces the number of TDRs that must be provided to offset the encumbered landowner's diminution in property value.[221] In fact, there may even be cases where easements can be granted without issuing TDRs at all since TDRs only compensate for *unused* development potential—if a building is already built to permissible zoning limits, it will not have any additional development potential to transfer.[222]

Although there may be some concern over the adequacy of TDRs as a compensatory mechanism, the prevailing view accepts them as a tool for offsetting the risk of takings liability.[223] The Fifth Amendment, however, requires not only the provision of "just compensation" but also that the acquired property interest be "for public use."[224] Whether the SDO program provides a public benefit is a much closer call. In contrast to a broadly applicable regulation, solar easements only directly benefit individual solar users. But given the immense importance governments have placed on combating climate change, they may assert that "the use of solar energy by a substantial number of individuals conveys benefits to the public, including decreased reliance on foreign oil and decreased pollution from the acquisition and burning of fossil fuel."[225] Despite presenting novel legal considerations, this argument conceivably fits within the Supreme Court's fairly broad interpretation of the "public use" requirement.[226]

Third, SDOs protect solar access rights while simultaneously preserving land use flexibility. Notably, the backlash against urban sprawl[227] has left vertical growth as the best option for expanding cities. If, as contemplated by other proposals, a solar adopter is granted a perpetual easement, little can be done to terminate this easement without his consent. Even though the community may be better off permitting the solar adopter's neighbor to build taller, the perpetual easement unfortunately forecloses this beneficial alternative. In contrast, SDOs not only cap the easement's duration but also promote early termination if an economically preferable option arises. They

221. This should help preserve the longevity of the program by limiting the number of new TDRs issued. *See* Serkin, *supra* note 171, at 926.

222. If so, the solar adopter would be unlikely to even need the protection of an easement. If the lot were upzoned, however, the solar adopter could initiate the SDO process.

223. *See supra* note 189 and accompanying text.

224. U.S. CONST. amend. V; *see* Gergacz, *supra* note 70, at 23 ("Statutory land use restrictions based on the police power must be for the public benefit.").

225. Gergacz, *supra* note 70, at 23.

226. *See, e.g.*, Kelo v. City of New London, 545 U.S. 469, 484 (2005) (holding that use of eminent domain to further an economic development plan satisfied the "public use" requirement).

227. *See supra* note 60 and accompanying text.

uniquely incorporate second-level call options that enable the original entitlement holder (i.e., the burdened neighbor) to reclaim her airspace rights at a set exercise price, thereby promoting efficient market transactions and guarding against the entrenchment of inefficient land use policies.

Further, municipalities can build on existing zoning enactments to create "solar receiving areas" for the TDRs.[228] The parameters of the solar receiving areas are flexible and could be adapted to meet the needs of individual municipalities. For example, a city could create receiving areas in neighborhoods that, given existing shade levels, would not be conducive for future solar adoption. Alternatively, receiving areas could be used to encourage the development of other green projects—such as large-scale solar installations—that current zoning restrictions might otherwise preclude.[229] An ambitious city could even forge a countywide solar program that permits the transfer of solar TDRs between urban and suburban stakeholders.[230] Ultimately, this Note need not enumerate the universe of possibilities; what matters is that municipalities will have flexibility to design programs suited for their individualized needs.

CONCLUSION

In the face of rising global temperatures, state and local governments around the country have increasingly committed to sustainable development and renewable energy sources, including solar power. Solar devices, however, require unobstructed access to sunlight and have consequently sparked airspace disputes between neighboring property owners. Unfortunately, none of the current approaches are particularly well suited for mitigating these disputes in an urban setting, a glaring drawback given that sustainability efforts in densely populated cities will be a focal point in combating climate change.

The SDO approach outlined in this Note aims to sustain the positive elements of existing liability rule protections while adding mechanisms—TDRs and call options—that better reflect development

228. *See* Goble, *supra* note 123, at 128 (proposing the sale of TDRs from residential areas to commercial areas in order to enable greater development beyond a specified level of insolation).

229. Indeed, there is something pleasingly cyclical about this potential symbiotic relationship. The development burdens required to support solar adoption in one area could be monetized and sold to allow solar expansion in other areas. The transfer zones could also conceivably extend countywide or statewide, though this would obviously require an enhanced degree of intergovernmental cooperation. *See TDR Marketplace*, *supra* note 177 (providing an overview of a countywide TDR marketplace).

230. For an example of such a countywide initiative, see *supra* notes 180–181 and accompanying text.

realities in urban centers and that more equitably balance the needs of competing stakeholders. Indeed, the SDO system contemplates the unilateral grant of an easement to protect the solar adopter yet respects the neighbor's airspace rights and compensates her with TDRs. Further, through the combination of temporary easements and second-level call options, SDOs recognize solar adopters' interests in recouping their capital investments while simultaneously accounting for the risk of potentially inefficient land use entrenchment. The fight against climate change necessitates action now, and governments must provide effective legal protections to facilitate widespread adoption of renewable energy. The SDO system should, by no means, be the sole method of encouraging solar access, but given the failure of current approaches, SDOs' future looks bright.

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