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Clean-Energy-Based Economic Development: Parallel Tracks for State and Local Policy

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Clean energy can support state and local economic development. Leaders can follow five tracks to leverage clean energy to accelerate economic growth.

KEY TAKEAWAYS

- State and local officials can promote clean energy-based economic development by offering incentives; nurturing tech-based start-ups; deepening clusters of related industries; substituting local energy resources for imports; and stimulating demand.
- State and local policymakers should take a long-term, asset-building perspective that leverages existing strengths and sets realistic expectations for job creation.
- Federal policymakers should support their state and local counterparts by providing steady backing for the national transition to clean energy, as well as timely information, technical assistance, and R&D funding.

State and local policymakers are constantly on the lookout for opportunities to accelerate economic growth in their jurisdictions. Clean energy is a dynamic industry group that has stimulated more than $300 billion in investment globally in each of the past five years, according to Bloomberg New Energy Finance.[1] It is not surprising clean energy is appearing with increasing frequency in state and local economic development strategies. Nearly half of the new governors elected in 2018, for instance, mentioned it in their plans.[2]

This report describes five tracks that state and local policymakers may follow as they pursue such strategies:

- Offering incentives to manufacturers and other investors
- Nurturing technology-based start-up companies
- Deepening existing clusters of related industries
- Substituting indigenous for imported energy resources
- Stimulating market demand for clean-energy products and services

The tracks are not mutually exclusive, and two or more are often pursued in parallel. Each track is briefly illustrated with examples, highlighting the interaction of the state and local levels with the federal government where appropriate. The discussion speaks to perennial debates in economic development policy as well as issues particular to clean energy at the moment.

The paper concludes with recommendations for policymakers at all levels. At the state and local level, policymakers should take a long-term, asset-building perspective that leverages existing strengths and sets realistic expectations. Federal policymakers should support their subnational counterparts by providing steady support for the national transition to clean energy, as well as timely information, technical assistance, and R&D funding.

INTRODUCTION: EXPORT-ORIENTATION AND THE FEDERAL ROLE

Every state and local economy needs imports. Although much trade occurs within each of these economies, many essential and highly valued goods and services must inevitably be sourced from without. Even the largest state economy in the United States, California, is highly dependent on goods imported from other states or countries, such as automobiles and petroleum.

To pay for such imports, state and local economies must receive income from the rest of the nation and the world. Although states and localities do not have their own currencies, their situations are somewhat analogous to nations. Like nations, states and localities typically must earn “foreign exchange” by exporting products customers outside their economy are willing to pay for. And, as is the case for national economies, such exports have a multiplier effect for state and local economies as earnings are spent on indigenous products as well as imports.

These considerations drive state and local governments to focus economic development (ED) policy on potential export industries as well as industries that substitute for imports.[3] The global transition to lower-carbon energy resources is creating opportunities to build new and rapidly growing export industries, while also undermining established fossil-fuel-dependent export sectors and opening the door to energy-import substitution. These industries have thus caught the attention of state and local ED policymakers.

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The federal government has little direct influence over state and local ED strategies, but it nonetheless plays an important role in shaping them, particularly those targeting clean energy industries. Federal regulatory, trade, tax, and other policies strongly influence the demand for the products and services offered by these industries. Federal R&D, technology transfer, and other policies, which state and local governments often seek to leverage, impact whether these industries' offerings are innovative and competitive.

In addition, the federal government is itself an important source of external income for many states and localities, lightening the burden on export industries. When the federal budget is in deficit, as it usually is, the balance of payments between the U.S. Treasury and most of the nation's regional economies is positive.[4] Even when these funds are spent only on current consumption, as federal health insurance and pension benefits typically are, they nonetheless allow regional imports to be paid for.

Federal programs that state and local ED policymakers draw upon to expand clean-energy exports have a baseline fiscal impact that should be accounted for, regardless of the programs' specific functions. The U.S. Department of Energy (DOE) is the most important federal agency affecting clean energy in this country. Its annual budget justification includes an estimate of expenditures, by state. While some of this spending is reallocated to other states through subcontracts and other channels, the tables provide a rough sense of DOE's fiscal impact.[5]

For instance, New Mexico, with its two large national labs, receives about $5 billion from DOE annually. New Mexico's gross state product is between $90 and $100 billion, so it is no surprise that the state government and its congressional delegation take a great interest in the DOE budget, regardless of how it is used. At the other end of the spectrum, Vermont collects the smallest amount of DOE funds of any state, receiving less than $2 million per year for weatherization and state energy programs.[6]

These federal expenditures are intended to serve national purposes, such as the creation of knowledge to foster progress in energy technologies. But they also support state and local economies, even when they make no other contributions to the creation of export-producing assets.

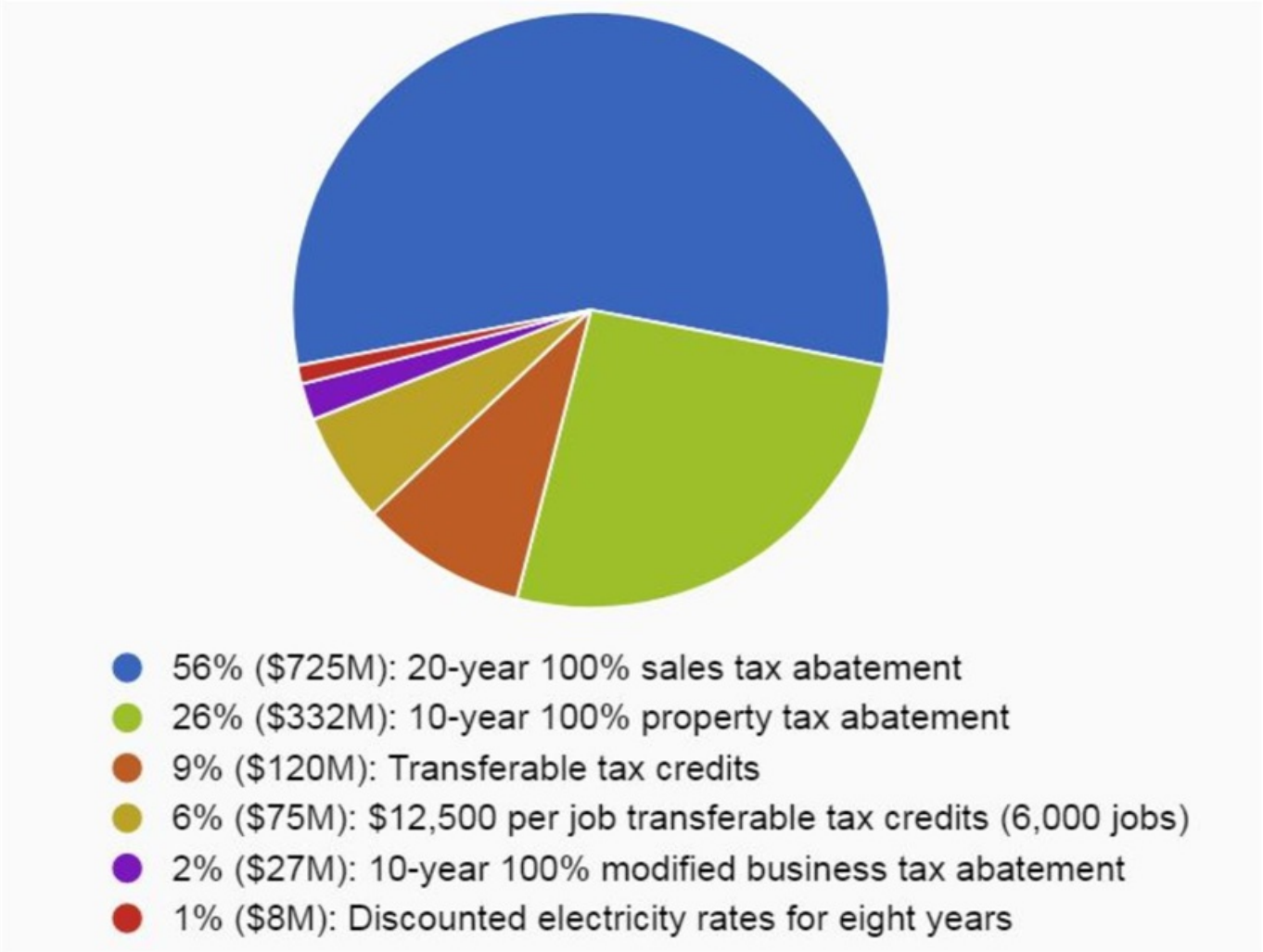
TRACK 1: LOCATIONAL INCENTIVES

The most widely-used ED policy tools in the United States are locational incentives. State and local governments cut taxes and make expenditures to induce external investment in new economic assets.[7] Manufacturing plants are the most common targets of incentives, but R&D laboratories and other economic assets may also be targeted.

Since the 1980s, foreign-owned auto manufacturing plants have been the object of intense competition among U.S. jurisdictions offering locational incentives. The center of gravity of the U.S. auto industry has shifted as southern states attracted the lion's share of these plants.

The electric vehicle (EV) industry, a cornerstone of the transition to cleaner energy, seems likely to be targeted in the same way as it expands. An early example is Tesla Motors' "gigafactory" for EV battery production, which was won by Reno, Nevada, with the help of a reported $1.25 billion incentive package after a national site selection process (see figure 1).

Figure 1: Breakdown of Tesla's Reported $1.25 Billion Incentive Package From Nevada [8]



Locational incentives have been widely criticized as unnecessary and even counterproductive giveaways.[9] Current officeholders get to cut the ribbon on any new plant they attract, while their successors must cope with reduced tax revenues. Companies typically state that other factors (such as Reno's proximity to Tesla's assembly plant in Fremont, California) outweigh incentives when making site selections, but they nonetheless play locations off one another to maximize offers. The federal government could in principle stop such "races to the bottom," but in practice it has chosen not to do so.[10]

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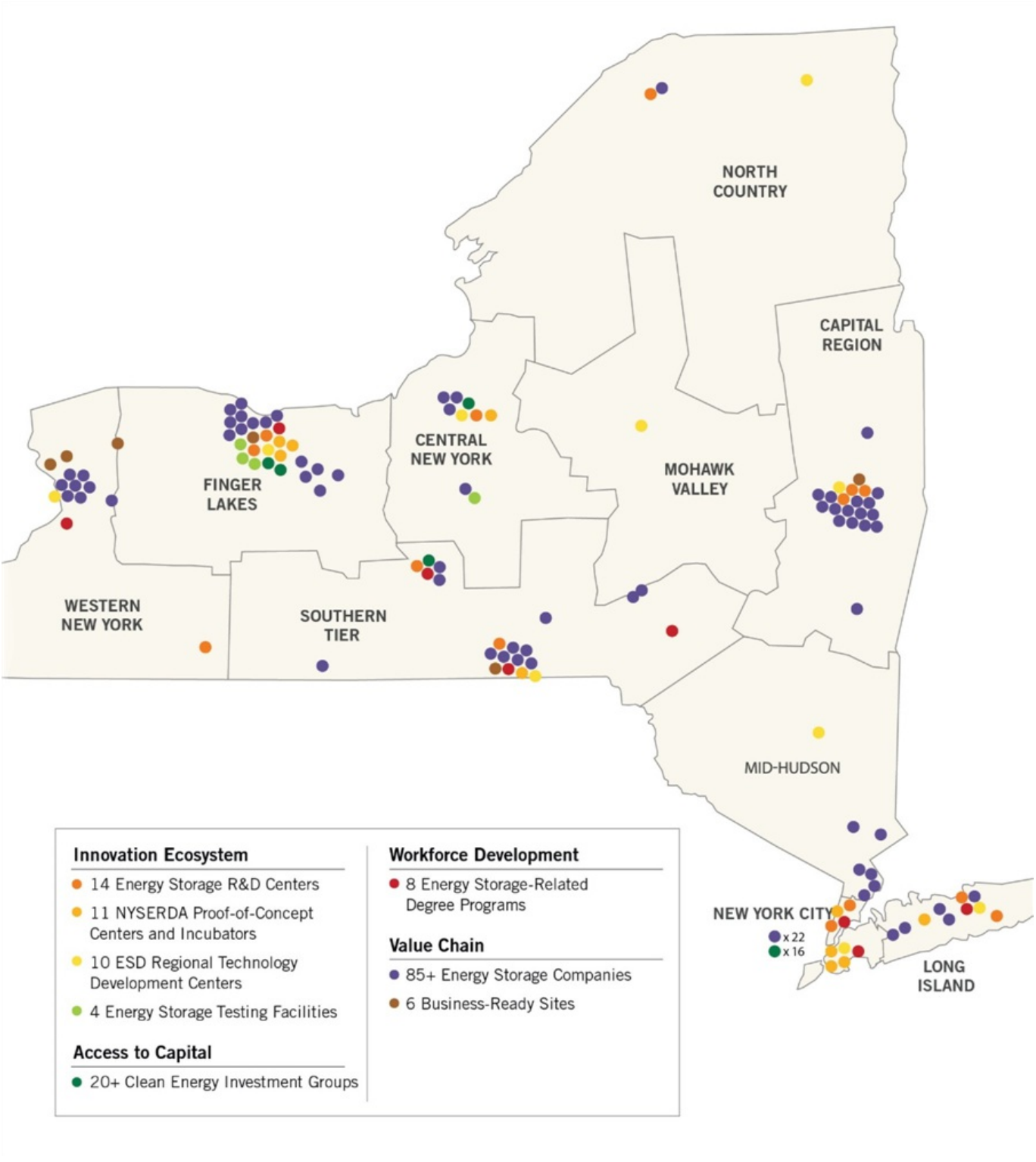
Research suggests incentives are usually economically irrational—their costs outweigh their benefits over time.[11] However, some large manufacturing plants provide benefits that spill over to suppliers and catalyze enough additional growth in the surrounding region to offset the cost of incentives. Auto suppliers may cluster around assembly plants, for instance, as has been the case in South Carolina near BMW's factory.[12] Reno is banking on a similar effect from its support for Tesla.

TRACK 2: R&D SPINOFFS

"Entrepreneurial" ED strategies are often contrasted with incentive-based strategies.[13.] Rather than trying to recruit one-time, large-scale investments from outside the region, these strategies seek to grow export-generating assets organically from within. Start-up firms that capitalize on ideas generated at universities and government laboratories are the key agents of development in this approach. Entrepreneurial strategies usually rely on outside investment in the form of federal R&D spending, accruing over a period of years. This spending provides an important part of the seed capital for asset creation (as well as having a fiscal impact).

Several regional economies, including San Francisco, San Diego, Seattle, New York City, and Washington, D.C., have leveraged federally funded biomedical R&D to create biotechnology industries.[14] Federally funded energy R&D has spawned fewer conspicuous state and local ED success stories. The state of New York's effort to build an energy storage manufacturing industry across several regions may become one. The state is drawing on the materials and systems expertise of the Brookhaven National Laboratory as well as six DOE-funded Energy Frontier Research Centers as part of its strategy. It has also made significant investments of its own in energy storage through the New York State Energy Research and Development Authority (NYSERDA), one of the few dedicated state-level energy R&D organizations (figure 2).

Figure 2: New York State's Energy Storage Industry Assets [15]



The impediments to entrepreneurial ED strategies that seek to leverage DOE R&D spending have been extensively debated. A large portion of DOE spending is devoted to nuclear weapons, environmental remediation, and basic science projects that rarely spin off promising growth companies. DOE regulations and practices often create disincentives for would-be entrepreneurs.

Energy start-ups tend to be capital-intensive and slow to mature, and have difficulty differentiating themselves from incumbent commodity producers—making them poor prospects for venture capital investors who provide significant capital for rapid growth in other industries.[16]

New York's energy storage manufacturing strategy seeks to bridge this "commercialization valley of death" by supporting "state-of-the-art prototyping, product development, commercialization, and testing facilities" that complement DOE's basic and applied research funding.[17] Whether its strategy (and similar strategies pursued by other states such as Colorado) will succeed in the face of intense competition from China and other international locations—as well as Nevada and other domestic locations offering incentives—remains to be seen.[18]

TRACK 3: CLUSTER DEEPENING

The third track that may lead to clean-energy-based ED involves deepening existing state and local strengths, rather than recruiting assets from the outside or growing new ones. Geographical clusters of related industries have been observed since the days of Alfred Marshall in the late 19th century. The natural spillovers into adjacent growth sectors of skills, knowledge, reputation, and capital that have accumulated through prior clustering may be accelerated by state and local ED policies.[19.]

Figure 3 displays clusters in clean energy and other "clean economy" industries as defined by the Brookings Institution's Metropolitan Policy Program in 2011. Solar-panel manufacturing relies on many of the same materials and processes as semiconductor manufacturing, so it is not surprising that Silicon Valley in California was a hotspot for this sector (although most solar panels are now imported into the United States). Raleigh, North Carolina, has leveraged its electronics manufacturing and systems-integration expertise into an emerging "smart grid" cluster.

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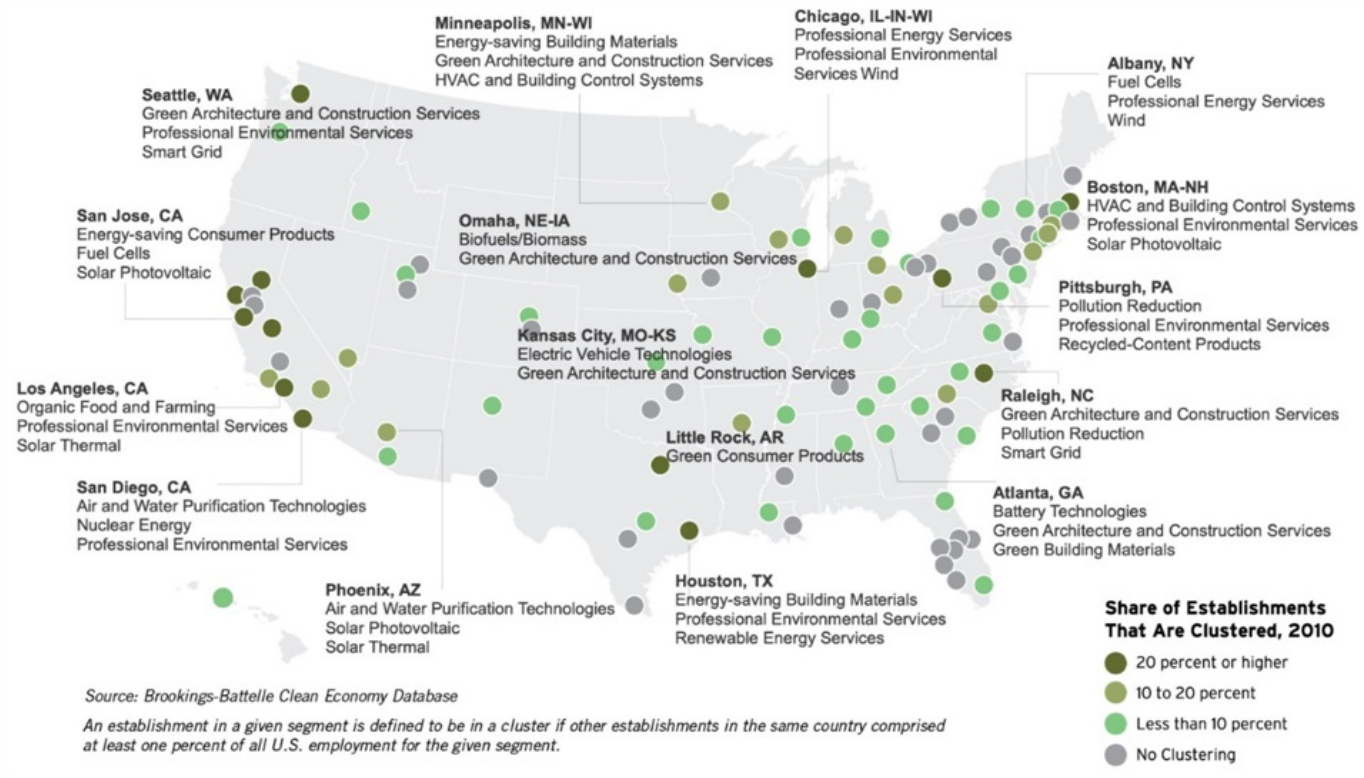
Figure 3: Clean Energy and Other "Clean Economy" Clusters [20]



DOE has aided the deepening of the Raleigh smart grid cluster by funding PowerAmerica in collaboration with state, local, and private contributors. PowerAmerica, a node in the federal interagency Manufacturing USA network of innovation institutes, carries out R&D, workforce development, and other activities to accelerate the next generation of power electronics—which control the flow of electrical energy in smart grids.[21]

Wyoming (one of the few blank spots on the Brookings map) is hoping to stretch its existing assets much further than North Carolina by positioning itself as a future center for carbon capture, utilization, and storage (CCUS) technology.[22] However, the capabilities required for coal extraction, in which Wyoming leads the United States, are not obviously connected to the chemical separation and transformation capabilities needed to succeed in CCUS. The state's investment in CCUS R&D has not (yet) been complemented by federal dollars.

TRACK 4: ENERGY IMPORT SUBSTITUTION

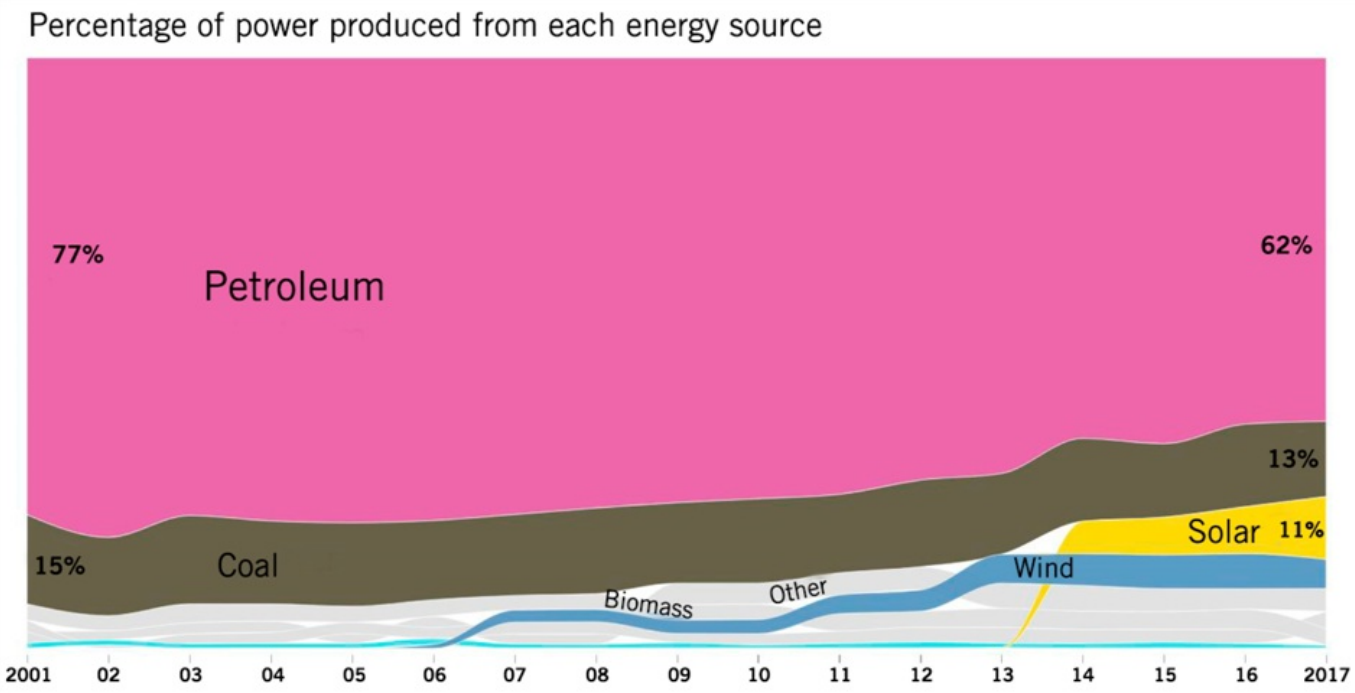
Although it is commonly discussed at the national level, the possibility of improving the balance of trade by substituting domestic resources for imported energy is typically overlooked at the state and local levels.[23.] Many states have actually pursued this track, albeit not usually within the frame of ED policy. Wind, solar, and other renewable resources that are intrinsically indigenous, for instance, may displace imported fossil fuels. More than half of the states have adopted renewable portfolio standards that aim to hasten such displacement.[24.]

Improved efficiency may cut the demand for imported energy as well. State spending on utility energy efficiency reached $8 billion in 2017. DOE provides energy efficiency services directly through programs such as the Industrial Assessment Centers, and also funds state energy programs.[25]

Capital equipment, such as solar panels and wind turbines, usually need to be imported to take advantage of indigenous resources. The cost and risk of such equipment imports, properly accounted for, may be equal to or greater than those of imported fuels.

Hawaii promises to be an interesting case to watch on this track in the future. Hawaiian consumers pay a high cost to import fossil fuels to their remote location, which is blessed with rich solar, wind, geothermal, and marine energy resources. Hawaii was the first state to commit to generating 100 percent of its power from renewable resources, setting a 2045 deadline to complete its transition. Since 2001, the share of electricity generation fed by fossil fuels in the state has declined from over 90 percent to 75 percent (figure 4).

Figure 4: How Hawaii Generated Electricity from 2001 to 2017 [26]



The lens of fuel substitution alone, however, is too narrow to provide an adequate analysis of the import substitution track. Capital equipment, such as solar panels and wind turbines, usually need to be imported to take advantage of indigenous resources. The cost and risk of such equipment imports, properly accounted for, may be equal to or greater than those of imported fuels.

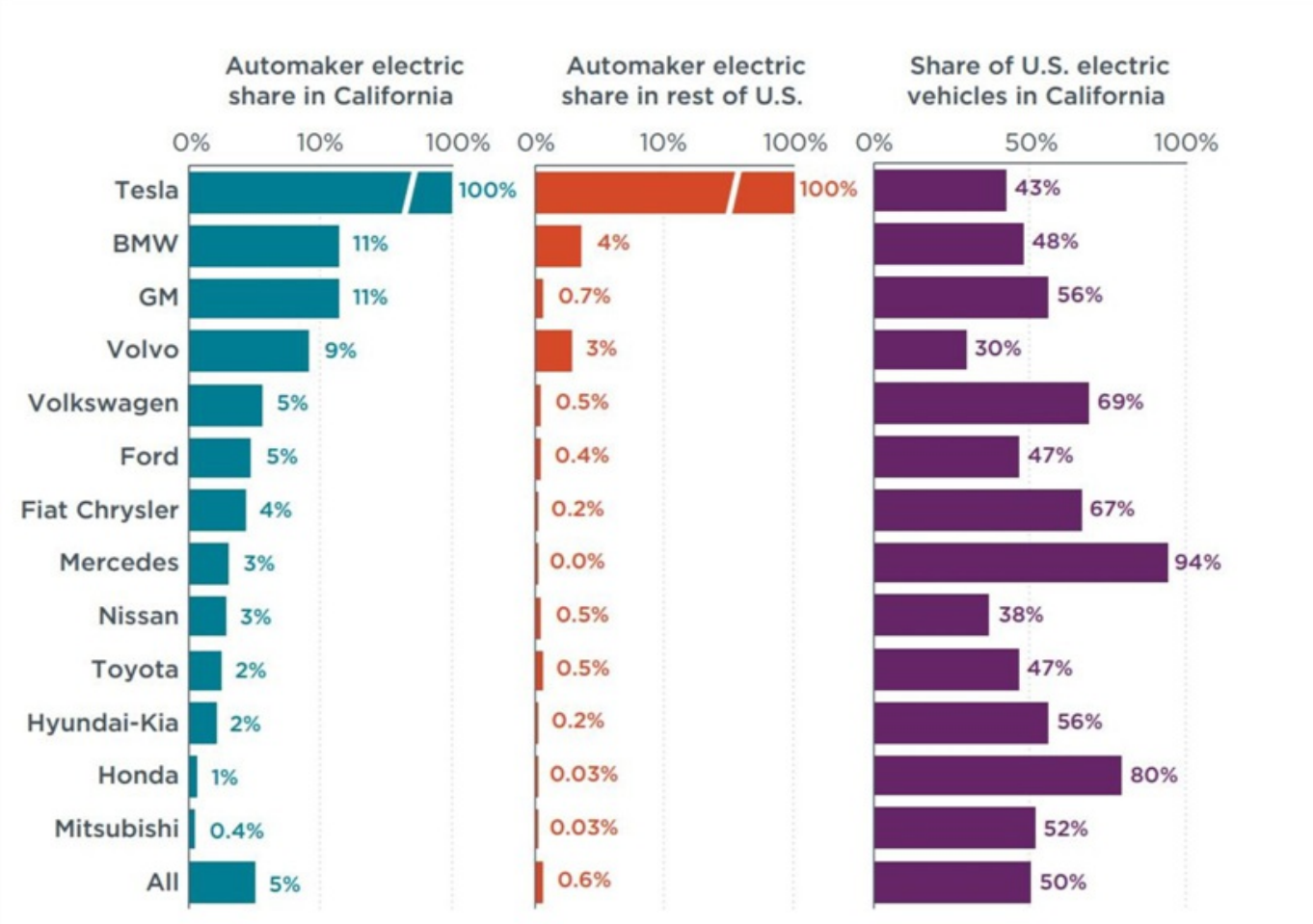
This track might have an unexpected side benefit if it enhances the state's or locality's attractiveness to other outside investment. Companies that seek to fulfill their own climate and energy commitments may view comparable commitments from the region as a positive factor in site selection. The attraction will undoubtedly be more powerful if energy costs are competitive. Power-hungry facilities have long been drawn to low-energy-cost locations, which have developed their resources to serve these facilities, such as large hydroelectric projects for aluminum smelters in Washington.[27]

TRACK 5: MARKET DEMAND

The final track for clean-energy-based ED strategies aims to use demand from within the region to build an export platform. In Michael Porter's "diamond model" of regional competitiveness, for instance, forward-leaning local customers are sought to purchase cutting-edge products. Such customers provide rapid and sophisticated feedback to producers, supporting continuous innovation and enabling them to be competitive in other markets as a result.[28.]

An example of this track is California's Zero Emission Vehicle (ZEV) mandate. Although it was justified primarily on environmental grounds, it had an economic purpose as well: to expand vehicle production by growing ZEV demand. The mandate, initiated in 1990, required that ZEVs comprise a growing fraction of each manufacturers' sales, and provided for trading of ZEV credits among them. Although the path was hardly linear, California customers now dominate the U.S. market for EVs (figure 5), and northern California-based Tesla, founded in 2003, has the third-largest market capitalization in the global automotive industry. Tesla has derived a significant portion of its revenue over time from selling state emissions credits to non-compliant competitors.[29]

Figure 5: California and United States Electric Vehicle Sales [30]



California's successful ZEV strategy (such as it is at the moment) is the exception that proves the rule: Demand-driven clean-energy ED strategies usually fail. State and local markets rarely provide the sophistication or economies of scale required for producers to become nationally or globally competitive. Unless the state or locality already has production assets that can be leveraged through a parallel cluster-deepening track, ED policymakers are likely to have to resort to protectionist measures to ensure the demand they create is supplied by preferred producers. Such measures are difficult to sustain without the powers of the federal government—as numerous unsuccessful efforts to use state renewable portfolio standards to build solar panel manufacturing clusters show—and may retard producers' competitiveness in any case.

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Powering Ohio, a 2018 report produced by a coalition of companies and NGOs, along with the city of Cleveland, illustrates the challenges. The analysis places significant weight on regional demand

for EVs, renewables, and smart grid services. It also describes Ohio's strengths in R&D and manufacturing. But it does not systematically link the two in a coherent strategy in which the demand components will perform the functions that Porter's model envisions to aid the producers.[31]

CONCLUSION: MULTIPLE TRACKS AND FEDERAL NUDGES

This brief review suggests several recommendations.

State and local policymakers pursuing clean-energy-based ED strategies should consider:

- Refraining from offering economically irrational incentive packages,
- Taking a long-term, asset-building perspective that leverages each region's existing strengths and sets realistic expectations over time,
- Making investments that fill gaps in the innovation chain between federally funded basic and applied research and full commercialization,
- Identifying and strengthening potential clean-energy clusters, including through targeted university and federal laboratory R&D and commercialization strategies,
- Conducting careful analyses of import-substituting clean energy strategies to determine their effectiveness, and implementing them when appropriate, and
- Treating local demand as a complementary component, rather than core element, of clean-energy-based ED strategy.

Federal policymakers should seek to complement state and local clean-energy ED strategies by:

- Supporting a steady and predictable national energy transition,
- Providing timely information and analysis about national and global energy markets,
- Catalyzing regional ED strategic planning with financial and technical assistance,
- Encouraging federal laboratories and regional offices to participate in such planning,
- Developing easy-to-use, web-based data and models for state and local ED policy development,
- Improving technology transfer mechanisms at federal laboratories, and
- Expanding investment in use-inspired R&D and cluster-deepening programs, such as ARPA-E and Manufacturing USA.

ENDNOTES

1. .Bloomberg New Energy Finance, "State of Clean Energy Investment 2018," https://about.bnef.com/clean-energy-investment/.

2. .State Science and Technology Institute (SSTI), "20 New Governors To Take Office Following Election," November 8, 2018, https://ssti.org/blog/20-new-governors-take-office-following-election

3. .Nations may also adopt such strategies, and many of the same considerations apply. The focus for this paper is the United States and its federal system, and the term "export" refers to state and local rather than national boundaries. On export-driven regional development, see Douglass C North, Location Theory and Regional Economic Growth," *Journal of Political Economy* 63:243-258 (1955).

4. .According to the Rockefeller Institute of Government, in fiscal year 2016, only 10 states had a negative balance of payments with the federal government. Rockefeller Institute of Government, "Giving or Getting? New York's Balance of Payments with the Federal Government," January 2019, https://rockinst.org/issue-area/new-yorks-balance-of-payments-with-the-federal-government/

5. .It is worth bearing in mind here as well that most of DOE's activity is not devoted to energy, but rather to basic scientific research, environmental remediation, and nuclear weapons.

6. .U.S. Department of Energy, *FY 2019 Congressional Budget Request State Tables Preliminary*, DOE/CF-0146; U.S. Bureau of Economic Analysis, Total Gross Domestic Product for New Mexico NMNGSP., retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/NMNGSP, December 27, 2018.

7. .Incentives may also be employed to retain or expand existing assets.

8. .Anjeanette Damon, "Inside Nevada's $1.25 Billion Tesla Tax Deal," *Reno Gazette-Journal*, September 4, 2014, https://www.rgj.com/story/news/2014/09/04/nevada-strikes-billion-tax-break-deal-tesla/15096777/ ; Jeffrey J. Cook, "Clean Energy-Related Economic Development Policy across the States: Establishing a 2016 Baseline," National Renewable Energy Laboratory, NREL/TP-6A20-67656, January 2017, https://www.nrel.gov/docs/fy17osti/67656.pdf.

9. .See, in general, the organization Good Jobs First, led by Greg LeRoy, https://www.goodjobsfirst.org/

10. .The federal Select USA program seeks to induce foreign direct investment in the United States and advises state and local economic development organizations, but does not try to control or channel competition among them.

11. .Michael Greenstone, Richard Hornbeck, and Enrico Moretti, "Identifying Agglomeration Spillovers: Evidence from Winners and Losers of Large Plant Openings," *Journal of Political Economy,* 118:536-598 (2010).

12. .Lindsay Chappell, "How the Car Industry Is Changing South Carolina," *Automotive News*, February 22, 2016, https://www.autonews.com/article/20160222/OEM01/302229984/how-the-car-industry-is-changing-s-carolina

13. .David M. Hart, "The Politics of 'Entrepreneurial' Economic Development Policy of States in the U.S.," *Review of Policy Research,* 25:149-168 (2008).

14. .Lynne G. Zucker, Michael R. Darby and Marilynn B. Brewer, "Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises," *American Economic Review* 88:290-306 (1998).

15. .American Jobs Project, "The New York Jobs Project," December 2018, 26, http://americanjobsproject.us/wp/wp-

content/uploads/2018/12/The-New-York-Jobs-Project.pdf

16. .Matthew Stepp et al., "Turning The Page: Reimagining the National Labs in the 21st Century Innovation Economy," (Information Technology and Innovation Foundation, Heritage Foundation, and Center for American Progress, 2013), https://itif.org/publications/2013/06/19/turning-page-reimagining-national-labs-21st-century-innovation-economy ; Benjamin Gaddy, Varun Sivaram, and Francis O'Sullivan, "Venture Capital and Cleantech: The Wrong Model for Clean Energy Innovation," MIT Energy Initiative working paper, July 2016, http://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf ; Stephen Ezell and Scott Andes, "Localizing the Economic Impact of Research and Development: A Primer for the Trump Administration and Congress," (Information Technology and Innovation Foundation and Brookings Institution, December 2016), https://itif.org/publications/2016/12/07/localizing-economic-impact-research-and-development-policy-proposals-trump .

17. .American Jobs Project, 20-21.

18. .David M. Hart, "To Build a Battery Industry, New York Needs Help from Washington," Syracuse.com, February 6, 2018, https://www.syracuse.com/opinion/index.ssf/2018/02/to_build_a_battery_industry_new_york_needs_help_from_washington_commentary.html

19. .Ricardo Hausmann et al., Atlas of Economic Complexity, http://atlas.cid.harvard.edu/

20. .Mark Muro, Jonathan Rothwell, and Devashree Saha, "Sizing The Clean Economy A National And Regional Green Jobs Assessment," (Brookings Institution, 2011), https://www.brookings.edu/wp-content/uploads/2016/06/0713_clean_economy.pdf

21. .David M. Hart and Peter L. Singer, "Manufacturing USA at DOE: Supporting Energy Innovation," (Information Technology and Innovation Foundation, May 2018). The U.S. Department of Commerce has also supported some programs that support clean-energy-based ED, such as the i6 Green Challenge.

22. .SSTI, "20 New Governors."

23. .ITIF president Rob Atkinson has emphasized this point to me in various conversations.

24. .North Carolina Clean Technology Center, "DSIRE – Renewable Portfolio Standards," http://www.dsireusa.org/resources/detailed-summary-maps/ , accessed February 4, 2019.

25. .American Council for an Energy Efficient Economy, "Energy Efficiency Portals," https://aceee.org/energy-efficiency-portals , both accessed January 9, 2019.

26. .Nadja Popovich, "How Does Your State Make Electricity," *New York Times*, December 24, 2018, https://www.nytimes.com/interactive/2018/12/24/climate/how-electricity-generation-changed-in-your-state.html

27. .Northwest Power and Conservation Council, "Aluminum," accessed January 2, 2019, https://www.nwcouncil.org/reports/columbia-river-history/aluminum

28. .Michael E. Porter, "Clusters and the New Economics of Competition," *Harvard Business Review*, November-December 1998, 77-90.

29. .William Fulton and Morris Newman, "The Charge of the Electric Car," *Governing*, June 1994, 40-45; Edward Peter Strigham, Jennifer Kelly Miller, and J.R. Clark, "Overcoming Barriers to Entry in an Established Industry: Tesla Motors," *California Management Review*, Summer 2015, 85-103.

30. .International Council on Clean Transportation, "California's Continued Electric Vehicle Market Development," May 2018, 6, https://www.theicct.org/sites/default/files/publications/CA-cityEV-Briefing-20180507.pdf

31. .Asa Hopkins, Thomas Vitolo, and Spencer Fields, "Powering Ohio," Synapse Energy Economics, May 2018, http://www.poweringohio.org/files/2018/05/Powering-Ohio_FINAL-WEB.pdf

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