THE CASE FOR CLEAN ENERGY TECHNOLOGY MANUFACTURING: TEN STEPS BUSINESS AND INDUSTRY MUST TAKE TO OPTIMIZE OPPORTUNITIES IN THE EMERGING CLEAN ENERGY ECONOMY

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INTRODUCTION

Energy is at the heart of economic growth and development. Consumers, businesses, and policymakers are seeing a market shift toward clean energy technologies and solutions. The country that can gain an advantage in the clean energy field will capture significant and sustained new market opportunities. As developed nations transition from fossil fuel-based infrastructure to clean energy technologies and developing nations begin to attain primary energy needs from highly distributed, renewable clean energy sources, clean energy policy will become increasingly crucial. Clean energy policy choices will be critical both for economic vitality within the United States and for international competitiveness in the race to improve clean energy technology and capture emerging markets. With legislative solutions losing momentum, business and industry leaders will be the key drivers in reorienting American policy, discourse, and economics in the clean energy economy. The problem, however, is that many political and business leaders are unaware of the job-creating potential and economic benefits in the clean energy sectors. These benefits could be realized if we made a serious, strategic effort to align our latent strengths in manufacturing and engineering with the evolving opportunities in clean energy technology sectors.

Addressing this problem presents a clear opportunity for the state of Michigan to take a leadership role in clean energy manufacturing and investment. Developing this lead role requires business and industry leaders to focus their power and influence to promote clean energy policy. They must also articulate and communicate to policymakers and legislators the market shift to a low-carbon economy. Investment, financial services, and insurance industries must lead this transition by providing more private incentives for clean energy and energy-efficient investment, while government should focus on crafting innovative financial tools that support investment in clean energy development. Competition and innovation in engineering, design, materials, and processes can make this the Sputnik moment[1] of our time—an idea that we must embrace. While we make the case for clean energy development and innovation it is equally important to shed light on the existing energy subsidies that support carbon intensive energy sources. We must insist that, at minimum, the playing field be level when it comes to

1. The launch of Sputnik 1 by the Soviet Union on October 4, 1957, called into question American technological leadership and galvanized public and governmental support for what ultimately became known as the "space race."

energy subsidies. As business leaders advance the innovations that advantage Michigan in global clean energy technology markets, they must involve government officials and policymakers in the day-to-day activities of building a low-carbon economy. Ramping up energy efficiency efforts in the industrial and commercial sectors is an intelligent business decision that public officials and business leaders can easily support. Utilizing these strategies will help concentrate the influence and creative capacities of business and industry leaders, building collaborations between industry, finance, and government and utilizing our research capabilities to transition to a low-carbon economy.

I. Clean Energy Technology—An Opportunity Like No Other

An intelligent energy policy is critical to the success of our twenty-first century economy. Energy policy choices will determine the extent and magnitude of future economic and investment opportunities in the burgeoning clean energy technology sectors. Growing preferences for clean energy solutions, increasing carbon sensitivity on behalf of businesses and corporations, and the geopolitical implications of energy security are thrusting energy policy to the forefront of public and political discourse.

Energy is a trillion dollar industry.[2] Global investment in clean energy systems rose to $243 billion in 2010, up from $186.5 billion in 2009.[3] The International Energy Agency estimates $46 trillion in new capital investment in clean energy infrastructure will occur over the next forty years resulting in $112 trillion in avoided fuel costs over the same period.[4] Renewable energy technology is becoming a mainstream energy solution across the world, validating the forecasted potential of the new energy economy.[5] This creates significant, sustained new market opportunities as developed nations transition from fossil fuel-based infrastructure to clean energy technologies, and undeveloped nations begin to meet energy needs from highly distributed, renewable clean energy sources.

For the developed world, international investment banks and insurers share an evolving consensus that the transition to the new energy economy

2. *A Primer on Energy and the Economy: Energy's Large Share of the Economy*, Inst. for Energy Res. (Feb. 16, 2010), http://www.instituteforenergyresearch.org/2010/02/16/a-primer-on-energy-and-the-economy-energys-large-share-of-the-economy-requires-caution-in-determining-policies-that-affect-it.

3. Alex Morales, *Low-Carbon Energy Investment Hit a Record $243 Billion in 2010*, Bloomberg (Jan. 11, 2011, 7:23 AM), http://www.bloomberg.com/news/2011-01-11/low-carbon-energy-investment-hit-a-record-243-billion-in-2010-bnef-says.html.

4. World Coal Ass'n, *IEA Clean Energy Options*, Ecoal, Oct. 2010, *available at* http://www.worldcoal.org/resources/ecoal/ecoal---archive/iea-clean-energy-options.

5. Worldwatch Inst., Renewables 2010 Global Status Report 9 (2010), *available at* http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20 Sept2010.pdf.

is a certainty. In a recently issued report, *Sustainable Energy Security*, Lloyd's of London argues that the path to clean, low-carbon energy production is inevitable and businesses that prepare for and take advantage of the new energy economy increase both their long-term resiliency and competitiveness.[6] Clean energy systems[7] will become the preferred option for replacing the existing aging infrastructure as fossil fuel costs rise and the levelized cost of energy[8] options increasingly accounts for environmental externalities and greenhouse gas emission profiles.

In developing economies, 1.4 billion people await the delivery of the distributed energy systems that will provide basic energy needs—the key to addressing endemic poverty and advancing nation building efforts.[9] These developing countries will largely forego baseload generating plants and the costly attendant transmission and distribution infrastructure. For poor countries, the electrification revolution will likely follow the same path as telecommunications. As cell phones obviated the need for telephone poles and wires, so will energy systems utilizing local clean energy resources—solar, wind, hydroelectric, and wave energy—avert the need for large-scale baseload infrastructure.[10] In this way, electrifying the developing world presents enormous market opportunities for technology manufacturers producing compact energy delivery systems.

II. Finding Common Ground

Despite these apparent opportunities, Congress and state legislatures appear unlikely to embrace strategies that advance the transition to a clean energy economy. With so many members of Congress promoting fossil fuel interests, indifferent to evolving climate science, and unmoved by our na-

6. Anthony Froggatt & Glada Lahn, Lloyd's, Sustainable Energy Security: Strategic Risks and Opportunities for Business 4 (2010), *available at* http://www.lloyds.com/~/media/Lloyds/Reports/360%20Energy%20Security/7238_Lloyds_360_Energy_Pages.pdf.

7. The progression to more distributed generation—integrating wind, solar, and other renewable energy sources, energy efficiency and smaller baseload plants served by dynamic energy dispatching and storage systems that are interconnected, modulated, and optimized by an intelligent smart-grid—is properly viewed as an "energy systems" paradigm. The National Renewable Energy Laboratory (NREL) is currently constructing the "Energy Systems Integration Facility" to design and model the optimal systems approach for integrating large-scale, distributed renewable energy penetrations. *Energy Systems Integration Facility*, Nat'l Renewable Energy Laboratory, http://www.nrel.gov/eis/pdfs/nrel_esif_2010.pdf (last visited Nov. 19, 2011).

8. The "levelized cost of energy" (LCOE) is a means of calculating and comparing the aggregate cost of energy-generating sources over their assumed lifetime of operation, including capital costs, operation and maintenance, discount rates, fuel costs, and in some cases externalities.

9. Org. for Econ. Cooperation & Dev. & Int'l Energy Agency, *Energy Poverty: How to Make Modern Energy Access Universal?*, World Energy Outlook 7 (Sept. 2010), http://www.worldenergyoutlook.org/docs/weo2010/weo2010_poverty.pdf.

10. *Id.* at 19.

tion's billion-dollar-a-day addiction to imported energy, there seems little likelihood that comprehensive energy legislation or coherent energy policy will emerge any time soon.[11] This retrenchment threatens to decelerate U.S. efforts to participate fully in the opportunities that billions of dollars of new investment in clean energy technologies could bring to the national economy.[12] The United States risks surrendering substantial new markets to global competitors and further undermining our claim to leadership in innovation, engineering prowess, and science.

The apparent resistance of many newly elected politicians to accept the economic promise the new energy economy holds is unfortunate, but can be overcome. There are areas that should be ripe for building political consensus and will help the United States regain momentum in the globally competitive clean energy technology markets.

Reducing our dependence on imported fossil fuels by producing more domestic energy should be a national priority and a matter of patriotic duty. It is fundamentally in our national interest to create and propagate clean energy resources to displace imported foreign fossil fuels. Energy accounts for 8.8% of the United States' $13 trillion economy.[13] At $100 per barrel, the United States will expend more than $430 billion[14] on imported oil per year.[15] The United States imports over 4.5 million barrels a day from Organization of Petroleum Exporting Countries (OPEC) alone, providing substantial revenues to some countries whose domestic and foreign policies are incongruent with United States geopolitical interests.[16]

Michigan imports 100% of its coal and uranium fuels, 96% of its transportation fuels, and 82% of its natural gas at a total cost of approximately $31 billion annually.[17] While fossil fuels other than transportation fuels are imported from other states and not from foreign nations, producing a larger

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11. Well over twenty-five legislative proposals on climate and energy have been brought to Congress, but none have had adequate support to pass both the House of Representatives and the Senate. The most recent of these proposals, the Clean Energy Jobs and American Power Act, S. 1733 111th Cong. (2010), stagnated in the Senate and left little political capital for future climate proposals.

12. Deutsche Bank has stated that because the United States is "asleep at the wheel," it will make its clean energy investments elsewhere. *See US States Support Green Energy Through Local Policies even as Federal Government Is "Asleep at the Wheel"*, GREEN WORLD INVESTOR (Aug. 20, 2010), http://greenworldinvestor.com/2010/08/20/us-states-support-green-energy-through-local-policies-even-as-federal-government-is-asleep-at-the-wheel.

13. U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY REVIEW 2010 12 (2011), *available at* http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_13.pdf.

14. *U.S. Total Crude Oil and Products Imports by Country of Origin*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mbbl_a.htm (last visited Nov. 19, 2011).

15. As of 2009 the United States imported 4,267,110 thousand barrels of crude oil. With a reasonable, if not low, hypothetical price of $90 per barrel, the United States would spend more than $384 billion on oil in one year.

16. *U.S. Total Crude Oil and Products Imports by Country of Origin*, *supra* note 14.

17. *Michigan Energy Overview*, MICH. PUB. SERV. COMM'N, http://www.dleg.state.mi.us/mpsc/reports/energy/energyoverview (last visited Nov. 19, 2011).

share of energy within the state and reducing expenditures for energy imports directly benefits Michigan's economy and creates jobs.

Domestic production of clean energy necessarily employs American workers, creating more jobs throughout the clean energy value chain. Wind turbines and solar panels together require thousands of components that can be designed, manufactured, distributed, sold, deployed, installed, and serviced by a workforce trained and educated through the existing robust training capacity of our community colleges and technical training centers.[18] Clean energy technology manufacturing, utilizing advanced materials and machining capabilities, requires a higher level of education and technical skills. Thus, this type of manufacturing provides an opportunity to retrain, repurpose, and redeploy a new "knowledge-based" workforce essential to success in the new global clean energy economy. Clean technology knowledge-based jobs are a critical pathway to preserve and rebuild American middle-class prosperity.

To be sure, every politician and government official shares the common objective of creating new jobs and securing new investment. For Michigan and other industrialized states, well-established strengths in fields like advanced manufacturing, robotics, engineering and materials science position us to exploit the opportunities developing in the new energy economy.[19] Michigan-based clean energy manufacturing and technology companies have unique opportunities to design, engineer, and deliver next-generation energy technologies at home and abroad. The problem is that many of Michigan's political and business leaders are uninformed about the job-creating potential and economic benefits that could be realized if the state made a serious, strategic effort at aligning its latent strengths in manufacturing and engineering with the evolving opportunities in clean energy technology sectors.

III. Delivering the Message—Business & Industry Must Take the Lead

Creating new jobs and new industries while reducing dependence on imported fossil fuels, abating pollution, and revitalizing America's workforce should be regarded as a compelling confluence of opportunities that

18. Michigan is home to thirty-three community colleges and eighteen Michigan Technical Education Centers. *See Michigan Community Colleges*, Mich. Cmty. C. Network, http://www.michigancc.net/contact/mcc.aspx (last visited Nov. 20, 2011); *Michigan Technical Education Centers Training and Workforce Development Solutions*, Mich. Econ. Dev. Corp., http://www.michiganadvantage.org/cm/files/Fact-Sheets/Michigan TechnicalEducation CentersMTEC.pdf (last visited Nov. 20, 2011).

19. Michigan has 330 automotive-related research and development companies—more than all other U.S. states combined. *See* Mich. Econ. Dev. Corp., Michigan Automotive Research and Development Facilities Directory 7 (3rd ed. 2007), *available at* http://ref.themedc.org/cm/attach/ebc193df-7af9-4908-861a-0946e02ddffe/MEDC_AutoRD_Directory_2007.pdf.

politicians and business leaders should be rushing to embrace. But that is not occurring. While much of the world is moving strategically to capture the economic benefits accruing from clean energy technology manufacturing, the United States seems to be moving backwards.

What once was within reach in terms of energy policy—carbon pricing, cap and trade, a national renewable energy standard—seems unattainable today. In Congress as well as in state legislatures, partisanship prevents accommodation and compromise. Data and science no longer effectively inform policy discussions and policy goals. Universities and academics are regarded by some as special interests whose motivations are fueled by the quest for research grants. Environmentalists are marginalized and regarded as neither persuasive nor credible. Much of the media are at times without the capability to dig deep enough to discern fact from fiction, or worse, are unwitting accomplices to disinformation disseminated by old economy front organizations.

In this milieu, business and industry is the constituency that must influence policy debates and move members of Congress and local state legislators. Michigan's clean energy manufacturing and technology companies are the fastest growing segment of the state's economy.[20] Over $10 billion in capital investment in production infrastructure for new wind ($270 million),[21] solar ($4.1 billion),[22] and advanced energy storage systems ($6 billion)[23] has created whole new sectors in Michigan's economy and established Michigan as a leader in clean energy technology manufacturing. Clean Edge, an authoritative source of research on clean technology industry trends, reports that in 2010, Michigan was first among states in clean energy patents, foretelling robust future opportunities as companies commercialize clean energy intellectual property.[24]

The entrepreneurial hopes and ambitions of scores of Michigan clean energy CEOs are hinging on enabling and accelerating the clean energy economy. Their ambition should be Michigan's ambition: to become leaders in producing the highest quality, most cost-effective clean energy technologies serving regional, national, and international markets. Through

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20. MICH. DEP'T OF ENERGY, LABOR AND ECON. GROWTH, MICHIGAN GREEN JOBS REPORT 2009 6 (2009), *available at* http://www.michigan.gov/documents/nwlb/GJC_GreenReport_Print_277833_7.pdf.

21. Press Release, Governor Jennifer M. Granholm, State of Mich., Wind Manufacturing Creating Jobs, Diversifying Economy (Dec. 10, 2010), *available at* http://www.michigan.gov/granholm/0,1607,7-168-23442_21974-248244--,00.html.

22. Keith Schneider, *Midwest Emerges as Center for Clean Energy*, N.Y. TIMES, Dec. 1, 2010, at B8.

23. Press Release, Governor Jennifer M. Granholm, State of Mich., Next Week Marks One-Year Anniversary of Milestone in Vehicle Electrification (July 30, 2010), *available at* http://www.michigan.gov/granholm/0,4587,7-168-23442_21974-241500--,00.html.

24. *California, Oregon, and Massachusetts Lead List of Top 10 Clean-Energy States*, CLEAN EDGE, INC. (Dec. 7, 2010, 8:03 AM), http://www.businesswire.com/news/home/20101207005888/en/California-Oregon-Massachusetts-Lead-List-Top-10.

strengths in advanced manufacturing, robotics, engineering, and material science; through engagement of the capacity of research universities and the workforce development capabilities of community colleges; and through building synergetic cross-collaborations between innovative Michigan businesses, Michigan can become an international clean technology presence. At the same time, clean energy development and manufacturing can be a primary means of attracting and retaining knowledge workers.

IV. Mobilizing Clean Energy Manufacturing Leadership—A Unique Opportunity for Michigan

If this message is to be understood by policymakers and our legislative leadership, it must be effectively delivered by those who are regarded as the most credible, authoritative, and trusted sources—business and industry leaders. Politicians know that business leaders have the most to gain and the most to give. Today, when job creation is foremost on the minds of politicians and policymakers, the job creators—business and industry leaders—are the most compelling and persuasive voices.

Clean economy business leaders must take the initiative, educate the skeptics, and press their entrepreneurial ambitions.

1. Business and Industry Leaders Must Strengthen and Focus Their Power and Influence

Clean energy manufacturing and technology companies must organize their constituencies, aggregate and align their collective interests, and focus their power and influence on policymakers, legislatures, and Congress. Clean energy CEOs must convincingly press for policies and legislative support for their businesses and industries that will enable and accelerate their own opportunities for sector growth and capturing projected future markets. They should stand as a powerful, unified block of business interests who understand the trajectory of clean energy investment and future market opportunities and demand greater support for twenty-first century policies that support research, development, and accelerated commercialization efforts.

Similar efforts have already started moving forward at the national level. The American Council on Renewable Energy has over 600 members dedicated to "moving renewable energy into the mainstream of America's economy," including companies like Duke Energy, DuPont, and Google.[25] Bill Gates, Jeff Immelt, and the American Energy Innovation Council have called for tripling the budget for clean energy innovation, the creation of a National Energy Strategy Board, and the establishment of Centers of Excellence that

25. *Member Directory*, Am. Council On Renewable Energy, http://www.acore.org/membership/member-directory (last visited Nov. 20, 2011).

concentrate resources and intelligence to accelerate innovation and breakthrough technologies.[26] These organizations understand both the necessity of transitioning to a clean energy economy, and the strength and potential of future markets. Their understanding of the need and the potential of the clean energy economy must spill over to other business leaders, legislators, and policymakers in Michigan.

2. Business Leaders Must Insist on Forward-Looking, Coherent Energy Policy

Business and industry leaders must work to compel government officials and policymakers to concentrate on developing twenty-first century energy policy. Michigan's politicians and policymakers must demonstrate leadership by embracing the potential for the rapidly expanding clean energy technology markets. Sound energy policy is the rational response and organizing framework to address the powerful economic and environmental drivers that are propelling the clean energy economy forward. Investment, job creation, and the opportunity to diversify Michigan's economy in the evolving trillion-dollar energy economy are transformational goals and should constitute priority policy objectives. Acknowledgement that energy economics are shifting rapidly in favor of cost-effective clean energy technologies that offer long-term price stability and away from escalating, unpredictable, and unstable fossil fuel energy sources should be the foundation for forward-looking energy policies. Producing energy within Michigan and the United States reduces fossil fuel imports and enhances energy security while boosting local prosperity. Addressing greenhouse gas emissions and other externalized pollutants will correct the market distortions and their highly negative market and environmental implications while providing the regulatory certainty that business and industry require.

These "drivers" are such strong policy imperatives that they will actively shape the economy regardless of whether we adopt strong energy policies or not. But failing to craft energy policy ensures a suboptimal future, allowing the best opportunities to slip through our fingers, surrendered to our global competitors.[27] Strategically capturing these opportunities by deploying well-designed policy allows the exploitation of manufacturing advantages and assets, mobilizes the capacity to innovate, and ameliorates energy and environmental risks.[28]

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26. *See* AM. ENERGY INNOVATION COUNCIL, A BUSINESS PLAN FOR AMERICA'S ENERGY FUTURE 5 (2010), *available at* http://www.americanenergyinnovation.org/full-report.

27. The United States has dropped to second among G-20 nations in clean energy technology investment for the first time in five years. PEW CHARITABLE TRUSTS, WHO'S WINNING THE CLEAN ENERGY RACE? 7 (2010), *available at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Global_warming/G-20%20Report.pdf.

28. For instance, "feed-in tariffs" (FITs) are the most widely used and effective policy mechanism to deploy clean energy technologies economically. "FITs are responsible for approximately 75% of global [photovoltaic power] and 45% of global wind deployment."

3. Business Leaders Must Articulate and Communicate the Market Shift to a Low-Carbon Economy

While many businesses and corporations forecast significant opportunities in clean energy manufacturing, technology development, and deployment, more and more businesses and corporations are going green for other reasons. They are becoming aware that customers are increasingly seeking products and services that are environmentally friendly. They are quickly grasping that implementing energy efficiency measures and clean energy solutions cuts operating costs and enhances their bottom lines. Many businesses now seek to measure their own carbon footprint as a metric of performance. Corporations are beginning to make siting decisions based, in part, on the amount of renewable energy resources available from the utility providing energy services.[29]

These changes are not fads; rather, they express clear market shifts.[30] Businesses and corporations are seeking low-carbon solutions to energy needs and product and service offerings. The carbon profile of businesses has now become a relevant factor in investment decisions. Organizations like the Investor Network on Climate Risk[31] and the Carbon Disclosure Project[32] advise some of the world's largest investment firms and pension funds managing trillions of dollars in assets by collecting and evaluating emissions data for the purpose of determining investment risks and guiding investment decisions.[33]

The business community is the most effective vehicle for the delivery of information on the market shift to a low-carbon economy to political leaders. They must increase their efforts to articulate and effectively communicate the accelerating market acceptance and evolving demand for low-carbon technology, products, and service offerings.

NAT'L RENEWABLE ENERGY LAB., A POLICYMAKER'S GUIDE TO FEED-IN TARIFF POLICY DESIGN v (2010), *available at* http://www.nrel.gov/docs/fy10osti/44849.pdf.

29. Letter from John T. Lenio, Econ. Incentives Grp., to Dusty Duistermars, Mich. Econ. Dev. Corp., Project Doublewide Evaluation Update (Mar. 3, 2010) (on file with author).

30. *See* ANDREW J. HOFFMAN & JOHN G. WOODY, CLIMATE CHANGE: WHAT'S YOUR BUSINESS STRATEGY? 5 (2008).

31. *Investor Network on Climate Risk*, CERES, http://www.ceres.org/incr (last visited Nov. 20, 2011).

32. *What We Do*, CARBON DISCLOSURE PROJECT, https://www.cdproject.net/en-US/WhatWeDo/Pages/overview.aspx (last visited Nov. 22, 2011).

33. A 2011 report released by Ceres highlighted the increased pressure on the Securities and Exchange Commission (SEC) to disclose climate related risks and opportunities to investors, emphasized the importance of disclosure projects, and discussed the growing role of carbon in business decisions. CERES, DISCLOSING CLIMATE RISKS AND OPPORTUNITIES IN SEC FILINGS (2011), *available at* http://www.ceres.org/resources/reports/disclosing-climate-risks-2011.

4. The Investment, Financial Services, and Insurance Industries Should Lead the Transition to the Clean Energy Economy

Business and industry have thus far called upon government to craft policies and provide better financial tools, tax benefits, and policy incentives to support clean energy technology development and manufacturing. These efforts are focused on marshaling public resources and government support for clean energy technology investment. But the private sector's role and persuasive influence is greater than that of government. The financial and investment community understands how future carbon constraints, water scarcity, and environmental and human health externalities threaten long-term investment in traditional energy technologies. The insurance industry understands the actuarial implications of more frequent and severe weather events over time. Yet institutional inertia and the enormous historical stake in old economy infrastructure prevent or retard needed changes in lending and insurance practices. The financial and insurance sectors must be urged to wield more influence on the utility sector directly by accelerating efforts to transition financial products and services to favor clean energy technology markets.

The investment and insurance industries are already preferentially targeting and redirecting energy lending and investment programs to support clean energy technologies and projects over fossil fuel investments. In 2008, Citigroup, J.P. Morgan Chase, and Morgan Stanley established "Carbon Principles" setting forth new, more stringent investment criteria for financing future coal plants.[34] More recently, the World Bank retained Dan Kammen, Director of the Renewable and Appropriate Energy Laboratory at the University of California, Berkeley to become the Chief Technical Specialist for Renewable Energy and Energy Efficiency, charged with enhancing "the operational impact of the Bank's renewable energy and energy efficiency activities."[35] In March 2011 the World Bank went further, indicating it would no longer finance coal energy projects in poor countries.[36]

Like the World Bank, the investment and insurance industries should be encouraged to adopt aggressive plans to increase the percentage of clean energy resources in their investment portfolios. In addition, they must make clear that they are acting on economic-based imperatives in transitioning

34. *See The Carbon Principles Statement of Intent*, MORGAN STANLEY, *available at* http://www.morganstanley.com/globalcitizen/environment/CarbonPrinciplesFinal.pdf (last visited Nov. 22, 2011).

35. Daniel Kammen, *Development in a Changing Climate*, BLOGS.WORLDBANK.ORG (Mar. 22, 2011), https://blogs.worldbank.org/climatechange/team/daniel-kammen.

36. WORLD BANK GRP., COMM. ON DEV. EFFECTIVENESS, ENERGIZING SUSTAINABLE DEVELOPMENT: ENERGY SECTOR STRATEGY OF THE WORLD BANK GROUP x (2011), *available at* http://media.bloomberg.com/bb/avfile/r4RV2ukyDBiU.

from higher risk, carbon-intensive energy generation to lower risk, "fuel-less" clean energy technologies.[37]

5. Talk Up the "Sputnik Moment"

The public needs to better realize that technological innovation drives economic growth and prosperity. Ingenuity, invention, and innovation are the foundations of American leadership in technological development, manufacturing, and market development. The United States established leadership in technology development and deployment by setting ambitious goals and targets that catalyzed cross-collaborations among industry, universities, and government as well as dynamic public-private partnerships that spurred creativity and innovation. President Kennedy's challenge to go to the moon enabled and accelerated the development of countless new technologies—GPS navigation systems, fuel cells, advanced electronics, robotics, biometric devices—as well as the collateral effects of focusing and concentrating our creative capacities, talents, and latent strengths on ambitious fixed targets and goals.[38]

Political and opinion leaders must understand that robust support for clean energy technology development and commercialization is critically important to our national aspirations and expectations. Clean energy manufacturing and technology leaders must demand new clean energy stretch goals and ambitious targets that will ignite competition and innovation in engineering, design, materials, and processes.

6. Develop New Financial Tools that Support Continuous Investment

Michigan, like other states, is experiencing declining revenues with little prospect of new discretionary spending to support entrepreneurial activity and investments in new sectors like clean energy technology. Direct federal support, which has been instrumental in leveraging new investment, building new industry sectors, and creating more "knowledge-based" jobs, will decline as funding from the American Recovery and Reinvestment

37. According to a February 2011 report by Mercer, climate change and carbon emissions could increase portfolio risk by ten percent by 2020, and low carbon investment opportunities in clean technology could be as high as five trillion dollars by 2030. Emphasizing these economic incentives for low-carbon investment will help separate banks, finance institutions, and companies from their inertial association with carbon intensive energy. MERCER, CLIMATE CHANGE SCENARIOS—IMPLICATIONS FOR STRATEGIC ASSET ALLOCATION (2011), *available at* http://www.mercer.com/articles/1406410.

38. In President Obama's 2011 State of the Union Address, he urged the U.S. economy to move toward a clear target of eighty percent clean energy by 2035. This goal is combined with support for a "Sputnik-like" innovation push from national figures such as Energy Secretary Steven Chu, Al Gore, and President Obama himself. Barack Obama, President, U.S., State of the Union Address (Jan. 25, 2011), *available at* http://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address.

Act winds down. Securing access to capital to support industry expansion and nourish diversification efforts is a critical national imperative. Michigan needs a suite of new financial tools that can provide stable, long-term, low-cost financing and loan guarantees for clean energy technologies and projects to lower the cost of development and deployment. Many sound ideas have come from recent papers calling for the establishment of "green banks," clean energy development corporations, and other proposals that would offer specialized, commercially feasible financial products to serve clean energy industries and businesses.[39]

In chartering these new specialized lenders, it is essential to have the technology assessment capabilities and expertise to evaluate applications to ensure Michigan provides financial resources and tax incentives to only the most promising, competitive, highly innovative, and cost-effective business opportunities.

7. Shine the Spotlight on Energy Subsidies

The relative cost of generating the energy we need now and in the future is an important issue, and one that deserves vigorous public scrutiny. In particular, a robust public discourse led by business and industry leaders on the issue of energy subsidies is long overdue. It is important to recognize that all new forms of energy generation cost more than the energy generated by Michigan's existing fleet of coal and nuclear plants. These facilities, now averaging more than fifty-two years old, are largely paid for and fully depreciated but will need to be replaced soon.

The relevant question is: What are the most cost-effective replacement energy technologies?

In Michigan and across the country, commercial-scale wind energy already is the least expensive technology available. Wind energy today, at about $0.08 per kilowatt-hour, costs less than energy generated from either new coal plants ($0.13 per kilowatt-hour) or nuclear plants (more than $0.20 per kilowatt-hour).[40] Innovation has led to a dramatic drop in the price of solar energy modules—about 50% in the last two years alone. Importantly, the cost gap between renewable energy and conventional energy generation

39. Recently Senators John Kerry, Kay Bailey Hutchinson, and Mark Warner have proposed a ten billion dollar rotating loan fund for infrastructure improvements that is projected to leverage $640 billion. While not exclusively or explicitly providing funding for energy and climate projects, this is the type of feasible and creative financial tool necessary for clean energy investment. *See* Abby Phillip, *Infrastructure Bank Gains Steam*, POLITICO (Mar. 16, 2011, 9:36 AM), http://www.politico.com/politico44/perm/0311/banking_on_bank_b47de358-f285-4cf2-ad8b-25ed5da4493b.html.

40. *See* MICH. PUB. SERV. COMM'N, DEP'T OF ENERGY, LABOR & ECON. GROWTH, REPORT ON THE IMPLEMENTATION OF P.A. 295 RENEWABLE ENERGY STANDARD AND THE COST-EFFECTIVENESS OF THE ENERGY STANDARDS 12–14 (2011), *available at* http://www.michigan.gov/documents/mpsc/Report_on_Implementation_of_PA_295_RE_Standards_and_Cost_Effectiveness_of_Standards_345871_7.pdf.

will only get wider in the future as fossil fuel prices escalate and the cost of clean energy technologies decline. "Grid parity" between traditional generation and clean energy technologies is already occurring. As innovation and improved performance continues to reduce clean energy technology costs, fuel-less generation sources will gain an increasing share within utility energy portfolios.

Oil, gas, and coal industries are heavily subsidized today—a fact poorly understood by the public. These subsidies include both direct subsidies in the form of tax abatements and investment incentives, but also indirect subsidies that include environmental impairments, health effects, and climate consequences. Fossil fuel subsidies have the pernicious additional effect of limiting innovation, efficiency gains, and social benefits created by clean energy technologies.[41] Economists generally agree that the failure to account for the cost of these subsidies or externalities results in underpriced energy, market distortions, and reduced competitiveness.[42]

8. Insist that Government Provide a Level Playing Field Between the Old Energy Economy and the New Energy Economy

The subsidies that exist for clean energy technologies are inferior to subsidies that exist for the fossil fuel industry in another key aspect: subsidies for the latter are largely established and embedded in the federal tax code where they continue in the absence of further congressional or administrative action.[43] Clean energy technology subsidies, on the other hand, are authorized by law for a limited time period and will expire absent periodic reauthorization. This represents a huge advantage for the fossil fuel industries that can depend on continuous subsidy support. By comparison, investors in clean energy cannot count on the continuity of incentives. This creates a distinct chilling effect on investor willingness to make future financial commitments. Tax incentives and financial tools that expire and require periodic reauthorization are, at best, "blinking" market signals that limit and disable

41. *See* UNITED NATIONS ENV'T PROGRAMME, ENERGY SUBSIDIES: LESSONS LEARNED IN ASSESSING THEIR IMPACT AND DESIGNING POLICY REFORMS (2004), *available at* http://www.unep.ch/etb/publications/energySubsidies/Energysubreport.pdf (discussing the complexity of determining place-dependent benefits and burdens associated with energy subsidies).

42. *See generally* CANADIAN ENERGY POLICY AND THE STRUGGLE FOR SUSTAINABLE DEVELOPMENT 123 (G. Bruce Doarn ed., 2005) (presenting an overview of Canadian energy policy).

43. *See* ENVTL. LAW INST., ESTIMATING U.S. GOVERNMENT SUBSIDIES TO ENERGY SOURCES: 2002–2008 (2009), *available at* http://www.elistore.org/reports_detail.asp?ID=11358 (attributing the largest U.S. fossil fuel subsidies to tax breaks in aid of foreign oil production). The analysis indicates that over the 2002–2008 period, subsidies to fossil fuel industries were seventy-five billion dollars compared to twenty-nine billion dollars for clean energy technologies (with almost half dedicated to supporting corn-based ethanol production). *Id.*

long-term investment opportunities, slow the pace of sector development,[44] and provide distinct advantages to foreign competitors that have well-established long-term government support.

Business and industry must insist that they be supported by predictable and reliable financial policies. They must demand a level playing field and stable long-term market signals that build investor confidence and help ensure continuity in investor support.

9. Promote Clean Energy Success and Connecting Community Interests

As businesses and corporations take measures to lighten their carbon footprint and seek low-carbon energy sources for production and operations, they must create learning experiences for their legislative representatives, local officials, and congressional delegation. A communications plan and press conference should accompany every new groundbreaking, demonstration project, or clean energy investment. Engaging governmental leaders to celebrate clean energy implementations will educate leaders on the merits and successes of business and corporate clean energy investment.

Clean energy companies need to adopt and utilize social media platforms for communication and promotion and take social media technology to the next level. Best-in-class social media technology not only facilitates communication but can also support efforts to build catalytic cross-collaborations and identify market opportunities among clean energy manufacturing and technology companies. Similar to the innovative MichEEN[45] network recently launched to speed the deployment of energy efficiency opportunities, the optimal design would connect business and industry, government, universities, and national laboratories with customers, market resources, and opportunities. The platform would include social architecture and infrastructure for requirements, selection, implementation, and integration of the right social technologies for clean energy business applications, including listening platforms, marketing and campaign management, business intelligence, learning, social CRM, online community, and enterprise collaboration applications.

Non-governmental organizations and foundations must also strategically combine resources to develop educational campaigns and grassroots efforts that can further understanding and acceptance of clean energy

44. For instance, the production tax credit for wind energy has been reauthorized for one or two year periods since 1992 and has been allowed to expire, creating a "boom or bust" cycle in wind investment. *Production Tax Credit*, AM. WIND ENERGY ASS'N, http://awea.org/issues/federal_policy/upload/PTC_April-2011.pdf (last visited Oct. 26, 2011).

45. The Michigan Energy Efficiency Network (MichEEN) is a sophisticated social media platform connecting communities, vendors, experts, academics, and service suppliers to advance cost-efficient energy efficiency implementations. It also provides the capability to analyze user data. *Welcome*, MICH. ENERGY EFFICIENCY NETWORK, http://www.micheen.org (last visited Oct. 25, 2011).

technologies. NGOs and foundations can play pivotal roles supporting local governments and school districts that adopt clean energy demonstrations, projects, and programs. Local clean energy initiatives can prove to be transformational experiences for students, teachers, and parents as communities become involved in the projects.

10. Ramp Up Energy Efficiency Measures in the Industrial and Commercial Sectors

Numerous economic analyses confirm that energy efficiency implementations, often considered the cheap, easy, and quick first steps in the transition to a low-carbon economy,[46] have a high return on investment and create more jobs than any other energy investment. The American Council for an Energy-Efficient Economy ("ACEEE") has found that current energy efficiency standards—setting a minimum level of efficiency for certain products—have generated approximately 340,000 jobs.[47] It is projected that 625,000 sustained jobs will be generated if the United States implements energy efficiency upgrades in 40% of its residential and commercial buildings.[48] These jobs, like most in the clean energy sectors, cannot be outsourced. Investments in energy efficiency increase demand and production of efficient appliances, lighting, motors, pumps, and building materials while increasing the production, sales, and installations of equipment and an array of materials that can make businesses and households more energy efficient. Businesses stand to gain from taking advantage of this market by developing and selling more energy efficient products.

Energy efficiency will reduce the demand for energy, accelerating the transition to a national energy portfolio with high percentages of clean energy generation. It is also a smart business choice.[49] The commercial sector

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46. AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., THE 2010 STATE ENERGY EFFICIENCY SCORECARD (2010), *available at* http://www.aceee.org/research-report/e107.

47. According to the American Council for an Energy-Efficient Economy, reducing energy use through efficiency standards will create jobs by diverting money from the utility industry, an industry that has a typically low number of jobs per dollar of revenue, to industries that have higher job intensity. *Id.*

48. BRACKEN HENDRICKS ET AL., EFFICIENCY WORKS: CREATING GOOD JOBS AND NEW MARKETS THROUGH ENERGY EFFICIENCY 2 (2010) *available at* http://www.americanprogress.org/issues/2010/08/pdf/good_jobs_new_markets.pdf.

49. Some argue that increases in energy efficiency will have a rebound effect known as the Jevons paradox and may cause increased energy consumption because appliances and other products are more energy efficient. Therefore, consumers will be less mindful of energy conservation practices and will consume the same dollar value as they did before energy efficiency upgrades. Jonathan Koomey of Stanford University and many energy and economic experts assert that this effect is theoretical and does not hold in real life scenarios. Jonathan G. Koomey, *A Fascinating Encounter with Advocates of Large Rebound Effects*, JONATHAN KOOMEY BLOG (Feb. 13, 2011), http://www.koomey.com/post/3286897788; *see, e.g.*, James Barrett, *Rebounds and Jevons: Nobody Goes There Anymore. It's Too Crowded*, REAL CLIMATE ECON. (Jan. 18, 2011, 8:27 AM), http://realclimateeconomics.org/wp/archives/654; Peter Bosshard, *Energy Efficiency: Paid Lunch or False Shortcut?*, HUFFING-

accounts for nineteen percent[50] of energy consumption in the United States, while industry and agriculture account for approximately one third of energy consumption.[51] For business and industry, there are incentives to improve operations and supply chain performance in addition to making more energy-efficient and desirable products. Intelligent investments in energy efficiency will reduce operating costs, increase productivity by reducing unit costs, and free capital for further investment. Businesses can also improve their public image with consumers by utilizing energy efficiency as a cost-effective and quick first step to reducing their carbon footprint rather than investing immediately in the more capital-intensive start up costs of clean energy generation. By reducing energy expenditures and increasing productivity, energy efficiency improves economic performance and our overall competitiveness. Businesses should utilize energy efficiency to lower internal costs of production and operations and should also take advantage of expanding markets for energy efficient products and services.

Conclusion

Establishing clean energy research, development, commercialization, manufacturing, and deployment as priority areas of economic opportunity is essential if we are to fully realize the benefits of the clean energy economy. We can overcome the institutional and political resistance to establishing a clean energy economy by effectively educating political leaders and demonstrating convincingly the significant opportunities latent in clean energy manufacturing and technology. We must aggregate and focus the power, influence, and creative capacities of key stakeholders—those who have the most to gain and the most to give—by building strategic collaborations between industry, finance, government, and the research capabilities of our universities and national laboratories, and advance policies that support this still emerging trillion-dollar industry. The clean energy technology and manufacturing industry must take control of its own destiny. By redefining policy and political agendas, the clean energy industry can optimize its opportunities in the emerging twenty-first century clean energy economy.

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ton Post (Dec. 31, 2010, 4:59 PM), http://www.huffingtonpost.com/peter-bosshard/paid-lunch-or-false-short_b_802532.html; Karen Street, *Does Improving Efficiency Do Any Good?*, The Energy Collective (Jan. 3, 2011), http://theenergycollective.com/karenstreet/49288/new-yorker-article-jevons-paradox-does-improving-efficiency-do-any-good.

50. *Commercial Sector: Buildings and Equipment*, Am. Council for an Energy-Efficient Econ., http://www.aceee.org/sector/commercial (last visited Nov. 21, 2011).

51. *Industrial Sector: Manufacture and Agriculture*, Am. Council for an Energy-Efficient Econ., http://www.aceee.org/sector/industrial (last visited Nov. 21, 2011).