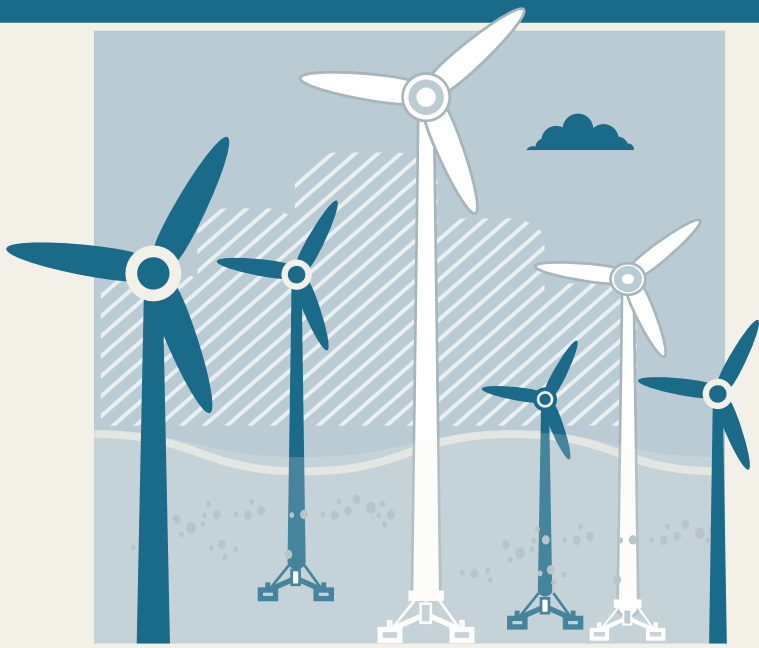
# CREATING THE CLEAN ENERGY ECONOMY

## Analysis of Three Clean Energy Industries

Electric Vehicles
Off-shore Wind
Net-zero Homes



INTERNATIONAL ECONOMIC DEVELOPMENT COUNCIL
*The Power of Knowledge and Leadership*

# Creating the Clean Energy Economy

## Analysis of Three Clean Energy Industries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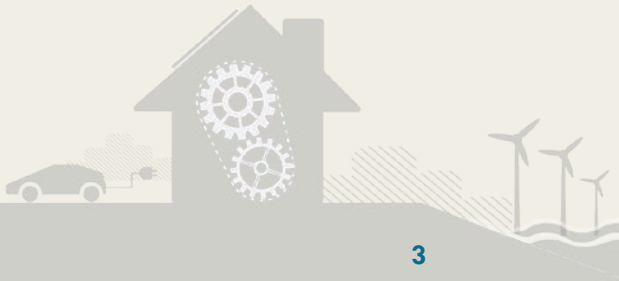

# EXECUTIVE SUMMARY

## INTRODUCTION

In the past five years, the U.S. has undergone shifting economic sands the likes of which haven't been experienced since the Great Depression. Job losses in manufacturing and across the broader economy have prompted businesses, policymakers and concerned citizens to look forward with a pensive eye.

One industry that holds promise is clean tech energy. In spite of the recession, there has been increased interest and investment in this sector. The 2007-2010 period, which is the height of the recession, averaged nearly 400 percent more clean energy deals than the 2003-2006 period.[1] Although clean energy represents a relatively small base of industry, this fact highlights its growth potential.

Further, clean energy technologies can produce new jobs to mitigate the impacts of economic downturns and losses of manufacturing jobs. Looking to the long-term, more nascent clean energy industries also hold promise. Between 2010 and 2011, clean energy jobs grew four times faster than all other types of jobs combined.[2] Clean energy jobs even grew faster than jobs in the healthcare industry, according to the Bureau of Labor Statistics.

To explore the potential of emerging clean tech industries, the International Economic Development Council, with support from the Rockefeller Brothers Fund, investigates three avant-garde clean tech markets: electric vehicles, offshore wind energy and net-zero energy homes. IEDC focuses on economic development's role in creating and stimulating the clean energy economy, as well as how these three clean energy sectors contribute to manufacturing sector, the creation of quality jobs, and the lowering of the national carbon footprint.

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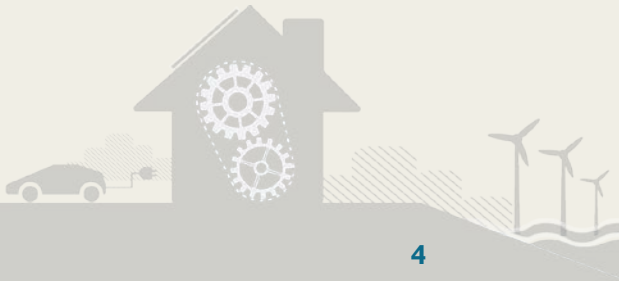
[1] Jobs in the Making: Economic Development Strategies to Support Manufacturing. (Forthcoming 2011). *International Economic Development Council*. Data from fDi Intelligence. http://www.fdiintelligence.com/ on May 11, 2011. fDi Intelligence defines the Alternative/Renewable Energy sector according to SIC codes 2819 and 2869.
[2] Lee, D. (2013, March 19). Green jobs grow four times faster than others. Los Angeles Times. Retrieved from http://articles.latimes.com/2013/mar/19/business/la-fi-mo-green-jobs-20130319.



**Electric vehicles (EVs) represent a vital part of the emerging economy.** In a world where oil is a limited resource, an alternate source of transportation fuel – electricity – is not only a smart investment, but as some would say, it is an inevitable one. Global demand for passenger vehicles, and the oil that fuels them, is growing as the world gets richer and more populous. Experts say that by 2050, there may be as many as 1.5 billion cars on the road, compared to 750 million in 2010.[3] This type of demand represents both a challenge and an opportunity to capitalize on new vehicle technologies, and in the process, reap substantial economic development benefits. The economic development benefits can be substantial. Electric vehicles create jobs, help attract talented workers to communities with EV infrastructure, reduce reliance on foreign oil, and can help reduce utility prices. The growing adoption of EV infrastructure in communities across the U.S. is evidence that EVs are a growing industry and are here to stay.

**Offshore wind power offers an inexhaustible energy source.** In the U.S., offshore wind power opportunities are located close to major population centers where demand for energy is highest. To date, this market has been insufficiently tapped. The U.S. has yet to produce a single megawatt (MW) of energy from an offshore wind source. There are projects in various stages of development, but none are yet operational.

However, the success of the domestic onshore wind industry foreshadows some of the potential of offshore wind. Onshore wind capacity has grown each year. New capacity has grown steadily since the late 1990's, peaking in 2009 at 10 GW. 2010 and 2011 also saw substantial new investment in onshore wind. The success of onshore wind is partly due to helpful policies like the production tax credit; the success of offshore wind, at least in early stages, is also likely to depend on targeted, consistent policies.

**Net-zero energy homes (NZEH) target a key energy market – the home.** NZEH produce at least as much energy as they consume over the course of a year. Net-zero energy is achieved through a combination of energy efficiency and energy generation systems that are tailored to the location and structure of a home. Building net-zero energy homes spans a wide range of industries, including architecture, construction and solar industries. Thus, growth of NZEH would

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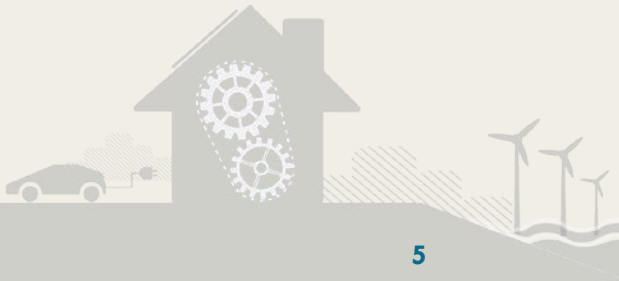
[3] Harvard Kennedy School, Belfer Center for Science and International Affairs. (2011, July). *Will Electric Cars Transform the U.S. Car Market?* Cambridge: Lee, H. & Lovellette, G. Retrieved from http://belfercenter.ksg.harvard.edu/files/Lee%20Lovellette%20Electric%20Vehicles%20DP%202011%20web.pdf



translate into growth in a variety of sectors. NZEH can create economic development opportunities not only in terms of jobs, but also from increased revenue through the sales of homes and NZEH components and lower energy costs for homeowners.

The NZEH industry is relatively nascent. There are only a few pilot demonstrations in place, mostly being undertaken by the private sector and by the U.S. Department of Energy. However, the green building industry as a whole is growing. Booz Allen Hamilton predicts that green construction, which includes NZEH as well as other green standards, is expected to generate 7.9 million jobs (direct, indirect, and induced) from 2009-2013.[4] While this figure is ambitious, other estimates also project NZEH jobs to grow. The Bureau of Labor Statistics estimates that jobs servicing the NZEH sector, such as electricians, operating engineers, and heating, air conditioning, and refrigeration mechanics and installers, are expected to grow at a rate of over 20 percent from 2010-2020.[5]

This report hopes to spur action that will unlock the potential of these three clean energy industries in the United States by discussing their economic development benefits in detail, hurdles to market development and strategies to help overcome these hurdles. The job creation potential of each industry is great, and these clean energy sectors provide additional economic benefits such as energy savings and increased sector sales revenue. EVs, offshore wind, and NZEH can play a part in bringing about economic, environmental and social transformation from traditional fossil fuels to a cleaner, more sustainable society.

## SUMMARY OF ELECTRIC VEHICLES

### State of the Electric Vehicle Market

This section outlines the extent of market development, growth opportunities, and major players within the EV market. The market for EVs is fairly new. Sales of plug-in EVs and extended-range EVs have been steadily growing since the early 2000's. On the other hand, the market for pure electric vehicles (without a gas option) is only a couple of years old. However, even in its

[4] Booz Allen Hamilton. (2009). U.S. Green Building Council Green Jobs Study. Retrieved from http://www.usgbc.org/ShowFile.aspx?DocumentID=6435
[5] United States Department of Labor, Bureau of Labor Statistics, 2011

relatively short debut, pure EVs have hit a number of high notes; the Tesla Model S, a luxury pure EV, received Motor Trend's prestigious "Car of the Year" award in 2013. This award recognizes the best performing car on a wide basis of criteria including engineering excellence, advancement in design, efficiency, safety and value. The larger domestic EV industry holds an integral role in the nation's economy. Although an exact count of EV employment is unavailable, auto OEMs employ over 197,000 workers in the U.S. and the auto supply chain employs over 17 million workers.[6]

On this note, the economic development benefits of EVs are multifaceted:

1. **EVs create jobs.** Estimates for job creation from EV adoption vary, but most agree that the net effect on jobs is undoubtedly positive. The Electrification Coalition projects the most optimistic job growth – 1.9 million net jobs by 2030 if 75% of all U.S. passenger vehicle miles are powered by electricity by 2040. Project Get Ready estimates local job growth tied to EV deployment – 10,000 EVs on the road can produce an average of 250 net jobs, even in cities without significant auto manufacturing. A detailed discussion of jobs benefits is presented in the section on Job Creation Potential.

2. **EV infrastructure improves the local quality of life and attracts talented workers.** In addition to job benefits, EV infrastructure within a community also attracts high-talent workers, who have been the most enthusiastic drivers of EVs. Surveys by the University of Michigan and Pike Research found that the more education a person has, the more likely he or she is to be interested in purchasing a plug-in hybrid vehicle. Thus, EV infrastructure would be a valuable quality of life consideration for these workers. Attracting high-talent workers help stabilize a community's employment base by boosting industries that are innovative and creative, even in the face of shifting economic sands.

3. **EVs can help reduce reliance on foreign oil.** EVs can decrease demand for gasoline and increase demand for locally-produced goods. According to the U.S. Energy Information Administration, over 80 percent of the cost of a gallon of gas immediately leaves the local

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[6] Electrification Coalition. (2010). *Economic Impact of the Electrification Roadmap*. Washington, D.C. Retrieved from http://www.electrificationcoalition.org/sites/default/files/SAF_1249_EC_ImpactReport_v06_proof.pdf

economy. If even a fraction of fuel savings from EVs is spent locally, this has the potential to bolster job growth and build wealth within local economies. For example, New Yorkers drive much less than the average U.S. metro resident, and this keeps $19 billion each year flowing within the local economy (CEOs for Cities).

4. **EVs can help reduce utility prices.** Electric vehicles typically charge at night, when electricity is cheapest to generate. By balancing the demand for electricity between day and night, electric vehicles decrease the average cost of electricity. Further, vehicle-to-grid (V2G) technologies in the pipeline allow EVs to feed electricity back into the grid. The possibility for EVs to function as essentially backup generators can decrease the need for utilities to invest in expensive new power plants. Initial studies estimate that electric vehicle owners can make $300 to $500 per year through V2G.[7]

### Key Factors and Stakeholders

Moving forward, several factors have the ability to sway the EV market. The relatively higher cost of EVs has held the market back from fully competing with conventional vehicles. However, the prices of EVs have fallen dramatically over the past few years. The Chevy Volt, after current government subsidies, is comparable in price with the average cost of new cars today. The prices of EVs are driven by battery costs and are also indirectly related to the price of gasoline. Past and future reductions in battery costs are driven by the interplay of technological advances and economies of scale. Gas prices are difficult to predict with certainty, although most studies agree that they will rise in the long-term.

Stage 1 wraps up by identifying the key stakeholders and partnerships needed to drive the EV industry forward:

- **Local and state governments,** especially transportation and energy offices, have a critical role in building a policy and regulatory environment conducive to EV adoption.

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[7] Ferber, D. (2011, October 31). Vehicle-to-Grid: A New Spin on Car Payments. *Miller-McCune*. Retrieved from http://www.miller-mccune.com/environment/vehicle-to-grid-a-new-spin-on-car-payments-36697/

- **Utilities** must manage charge times and locations to avoid overburdening the grid if there is widespread use of EVs. Their role will be especially critical as smart grid implementation moves forward.
- **Consumers**, in addition to actually buying EVs, can also provide valuable feedback to entities engaged in studying consumer behavior, such as research institutions, utilities, and local/state governments.
- **Local businesses** can purchase EVs for their corporate fleets or provide incentive programs to encourage EV use among employees. Widespread EV adoption will open up new service opportunities that local businesses can capitalize on.
- **Universities and research institutions** operate on-campus technology transfer offices that can assist with commercializing EV innovations. Some universities have established research centers dedicated to EV technology and demonstration, such as the University of California, Davis' Plug-In Hybrid Electric Vehicle Research Center and the Ohio State University's Center for Automotive Research.
- **Economic developers** negotiate financial and non-financial incentives for EV adoption, can catalyze and support EV infrastructure investment, and can help educate consumer perception of EVs. Further, economic developers interface with the above stakeholders to rally local, state and regional development of EV infrastructure and adoption.

## The Hurdles to Growth in the EV Industry

This section summarizes the key hurdles to market development and identifies concrete strategies economic developers can pursue to overcome these hurdles. Wide deployment of EVs will require action on several fronts, including:

1) Reducing the cost of EVs
2) Developing a wider network of charging infrastructure
3) Aligning consumer perception of EVs with reality

EVs are on a path toward cost competitiveness and ultimately, cost advantages over traditional vehicles. They are already much more cost effective to *operate* than comparable internal combustion vehicles. With that said, EVs currently carry a premium sticker price which can keep

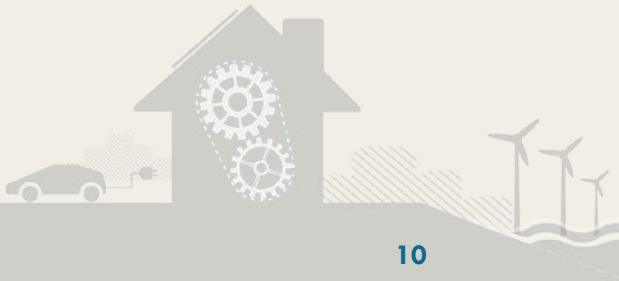
potential owners from making the switch from conventional vehicles. This section discusses in detail the economic development strategies to reduce the cost of EVs, which include:

- Provide Tax Incentives for Purchase
- Alleviate Battery Ownership Risk
- Provide Non-Financial Incentives
- Encourage Utility Rate Discounts
- Transition Government Fleets to EVs
- Encourage EV Cabs
- Make Public Investments in R&D
- Create Tailored Workforce Training Programs
- Provide Business Financing
- Support Supply Chain Development

While cheaper and better batteries are crucial to making EVs more price competitive, many industry experts see charging infrastructure as the key hurdle to the growth of this market. EV infrastructure requires expensive upfront investment, cooperation among a host of stakeholders, and time to before it can rival the universality of gas stations. Economic development strategies on this front include:

- Invest in Charging Infrastructure in Public Spaces
- Provide Incentives for Investment in Charging Infrastructure
- Collaborate with Private Charging Station Providers
- Streamline Local Zoning and Permitting
- Disseminate Information on Charging Locations

The upfront cost of EVs and a lack of infrastructure are some real hurdles holding back the EV market. Consumer perception of problems, however, also comes into play. Vehicle electrification requires consumers to operate within a new transportation framework. Consumers attuned to the status quo may overstate the drawbacks of EVs, such as the higher cost or the limited range



relative to gas cars. Several economic development strategies can help alleviate consumer perception distortions:

- Develop a Consumer Education Plan
- Establish Public Demonstration of EVs
- Market Private Sector Solutions

This section concludes with important "Lessons from the Past" – lessons learned from established industries that can be applied to nascent ones. Electric vehicles can take cues from the conventional gas industry. Process innovations and supply chain savings helped make the gas car affordable for the middle class. Regarding infrastructure, federal and state taxes helped pay for road expansions in the first half of the 1900's. Oil companies began to invest in fueling stations as demand for gas cars rose. Finally, there was collaboration across industries and institutions to address consumer concerns, and carmakers introduced innovative marketing techniques to increase the widespread appeal of gas cars. Likewise, the prices of EVs are likely to decrease with process and supply chain innovations. This will lead to greater adoption of EVs, which increase the private incentive to invest in charging stations. Consumer concerns about EVs will also ease as EV prices drop and as marketers find innovative ways to emphasize EVs' environmental benefits and fuel savings.

## Job Creation Potential of EVs

This section focuses on the job creation potential of EVs and supplementing quantitative information with qualitative feedback from industry. Analyses of job creation potential depend on different assumptions about the future trajectory of EV, gas and electricity prices, availability of subsidies and macroeconomic conditions. To capture the range of estimates of EVs' job creation potential, IEDC conducted a literature review of job creation studies tied to greater deployment of EVs:

- The BlueGreen Alliance and the American Council for an Energy Efficient Economy published a June 2012 study that estimated the new federal vehicle emissions standards passed in 2012 would create 570,000 net jobs by 2030, including 50,000 in auto manufacturing.

- A 2009 University of California-Berkeley study predicted that EVs would create over 350,000 net jobs by 2030 if gas prices are high enough and if federal tax credits stay in place.
- The Electrification Coalition projects the most optimistic job growth – 1.9 million net jobs by 2030 if 75% of all U.S. passenger vehicle miles are powered by electricity by 2040.
- Project Get Ready estimates local job growth tied to EV deployment – 10,000 EVs on the road can produce an average of 250 net jobs, even in cities without significant auto manufacturing.

The disparities in job creation numbers stem from different assumptions about critical benchmarks and model inputs. These include EV costs, energy prices, policies and incentives, degree of foreign competition, and competition from non-EV vehicle efficient technologies.

IEDC's "Driving Growth in Electric Vehicles" workshop on December 4, 2012 featured a plenary discussion with EV industry stakeholders to solicit an insider's view on job creation potential. These industry representatives cited specific challenges to growth – such as the difficulties for small auto suppliers to ramp up to large-scale production and the likelihood of increased automation, which would dampen job prospects. However, they point to local, concrete "stories" that can help illuminate the benefits of EVs in the absence of assured job creation estimates in the aggregate. These community-level case studies can include how EVs have assisted with job creation, investment, business retention, lower emissions, supply chain benefits, entrepreneurship, higher disposable income and innovation.

# SUMMARY OF OFFSHORE WIND ENERGY

## State of the Offshore Wind Market

This section outlines the extent of market development, growth opportunities, and major stakeholders within the offshore market. The offshore wind industry in the United States is in developmental stages. Projects are not yet "in the water" (under construction) nor are they "on-line" (producing energy output). The good news is that there is a lot of energy-generating potential from offshore wind in the United States due to the length of the U.S. coastline and the

quality of the wind resource. Most of the offshore projects being proposed are in the Northeast and Mid-Atlantic regions, where winds are strongest, wind energy supply is plentiful, and the population demand is high.

There are a few dozen projects in the pipeline, with some that have advanced through several permitting milestones in the last year. Most of the proposed projects that are now looking for buyers will enter into a contract with a utility to purchase the power. Obtaining a power purchase agreement (PPA) is a crucial step in development since it connects the seller of electricity with the buyer for it. However, PPAs have presented some challenges to developers; the first PPA in North America for an offshore wind farm was canceled due to difficulties finding an investor.

Despite early difficulties, each region within the U.S. has distinct advantages for offshore wind development:

- The North Atlantic region (Massachusetts, Maine and Rhode Island) has strong wind supply, high demand from population centers, and a number of wind farm and demonstration project proposals.
- The Mid-Atlantic region (New Jersey, Delaware, Maryland and Virginia) receives the most federal investment and also has strong demand.
- The Great Lakes region (New York, Michigan and Ohio) has gentler water conditions, streamlined permitting, proximity to domestic supply chains, and port and infrastructure capacity.
- The Gulf Coast and Texas region has synergies with the oil and gas industries, existing land-based wind energy, an innovative utility structure, and streamlined permitting due to state jurisdiction of coastal waters.

This section of the report wraps up by identifying the key stakeholders and partnerships needed to drive the offshore industry forward:

- **Federal, local and state governments** play a role in offshore development, and they have the mandate and authority to review and/or approve aspects of offshore wind projects.

- **Developers** are a diverse set of market suppliers, who may be private companies or consortiums of companies, focused on one local project or developing offshore wind in multiple regions, and may represent various environmental, economic and/or group interests.
- **Utilities** are buying a product that has been untested in the U.S. market based on a technology that is relatively new. They are concerned about not just the cost but the dependability of the offshore wind.
- **Research and development partnerships** such as the DeepCWind Consortium are driving forward technology advancements in offshore wind turbines, and some research universities are starting to provide education in offshore wind.
- **Industry and industry partnerships** include OEMs, foreign wind companies, and businesses along the offshore wind supply chain. These organizations often work closely with local, state and federal government to gain support for research and development, regulatory and permitting assistance and economic development
- **Workforce stakeholders** represent, train and educate the workforce. They include labor unions, universities and community colleges.
- **Opposition and concerned stakeholders** who anticipate they may be adversely affected by offshore development also need to be engaged in the development process. These include marine life advocates, local residents and property holders, fishermen, recreational boaters, and preservationists.
- **Economic developers** are actively involved in regional planning, helping to synchronize local industries and supply chains, supporting research and development institutions and partnerships, and coordinating policy and communication on offshore wind.

In addition, there are some critical stakeholders who have been largely missing from the table. Financial stakeholders (i.e. investors and lenders) and purchasers (i.e. utilities) are two of the primary players that are missing in the marketplace. They hesitate to enter a market with an unproven track record and an unclear case for profitability. Thus, these stakeholders are inhibiting the development of offshore wind projects.

## Identify the Hurdles to Growth of the Offshore Market

This section summarizes the key hurdles to market development and identifies concrete strategies economic developers can pursue to overcome these hurdles. Advancing offshore wind energy projects will require action on several fronts, including:

1) Supply-side hurdles related to high capital, operating and financing costs that make it difficult to get wind farms up and operational.
2) Demand-side hurdles related to securing purchasers for the offshore wind energy, which is often priced higher than fossil fuels and other clean energy sources.
3) Regulations and policy hurdles which has delayed projects for years. The industry also faces an uncertain environment for new and existing policies that help promote the industry.
4) Political hurdles due to a lack of a unified national energy policy and challenges from opposition stakeholders representing property, economic, energy and other interests.

Capital costs and operating costs are high for offshore wind energy. Offshore wind farms incur high costs due to the lack of experience in the industry as well as high costs associated with building and operating installations that meet the demands of the marine environment. Economic development strategies to increase supply of offshore wind energy include:

- Invest in R&D and regional planning
- Undertake regional grid planning
- Generate greater turbine efficiency
- Synergies with existing industries, such as oil and marine-based industries
- Offer shipbuilding stimulus
- Support various financing streams that give investors some protection from risk
- Conduct supply chain identification
- Establish offshore wind incubators
- Develop products for export market
- Conduct workforce training
- Attract FDI and forge U.S.-foreign partnerships

Currently, offshore wind energy is higher than the price of fossil fuels as well as some clean energy sources. It must compete with land-based wind energy and solar energy, in addition to traditional fossil fuels. Thus, offshore wind energy has faced challenges in finding a purchaser. Economic development strategies to increase demand include:

- A set-aside or carve-out for offshore wind in clean energy standards
- Incentive-based PPAs
- Funding assistance for energy production
- Government procurement
- National standard for clean energy production

As with most early industries, government plays a crucial role in determining if and when the offshore wind industry gets off the ground. They are active as regulators and as well as stimulators for the industry. Policy strategies include:

- Streamline the approval process
- Improve coordinated review
- Support tax credit programs

Finally, there are political hurdles at the national and project levels. The lack of a national policy for offshore wind hinders the development of the industry and puts it at a comparative disadvantage to countries in Europe as well as China. The interests that preclude development of a national policy are expressed at the local level by opposition stakeholders in various projects as well as at the national level by interest groups. For example, the Koch brothers (head of the oil refining company Koch Industries) helped form the Alliance to Protect Nantucket Sound in opposition to the Cape Wind offshore wind project. To combat political hurdles, industry advocates must:

- Align communication messages
- Advocate for proactive growth strategies in a recession
- Engage opposition stakeholders from the beginning of a project

This section concludes with important "Lessons from the Past" – lessons learned from an established industry that can be applied to nascent ones. The hydroelectric industry faced many of the same hurdles as the offshore wind industry does today. To raise the lifespan of hydroelectricity plants, the industry invested heavily in R&D. The public and private sectors also split investment costs. The industry established a primary regulatory agency early in anticipation of complex and weighty regulation issues. To alleviate fears about safety and quality of the plants, industry associations launched marketing campaigns to emphasize cautionary measures. They also emphasized the relative benefits of hydropower with respect to other energy technologies to put any drawbacks into perspective.

## Job Creation Potential of Offshore Wind

There is a lot of optimism that offshore wind energy will create new jobs and economic investment. Offshore wind generates more jobs per megawatt than onshore wind and other fossil fuels due to the labor associated with manufacturing, operating and servicing the wind farms. Studies project substantial job benefits of offshore wind development:

- The U.S. Department of Energy projects 43,000 permanent jobs associated with meeting its goal of 54 GW of offshore wind production.
- The most widely referenced job study (and the one on which U.S. projections are based) is the 2009 EWEA job study. In that report, 151,000 jobs (both direct and indirect) are projected for the offshore wind industry in Europe by 2020 and 215,000 by 2030.
- The local development company, Lake Erie Energy Development Corporation (LEEDCo) is undertaking the development of a 5,000 MW wind farm in the waters north of Cleveland, Ohio. LEEDCo projects that by the time the wind farm is online, 8,000 jobs will have been created. In Maine, the Deepwater Offshore Wind Plan is projected to generate 7,000 to 15,000 jobs.

# SUMMARY OF NET-ZERO ENERGY HOMES

## State of the Market of NZEH

The state of the NZEH market includes an overview of the housing and net-zero market, an analysis of NZEH supply chain industries as well as key stakeholders and partnerships, and a discussion of job creation potential. NZEH have several benefits to economic development, including:

- Job creation in the architecture and construction industries as well as NZEH component industries
- Increase in revenue from sales of homes and NZEH components (ex: photovoltaic (PV) panels, solar thermal systems, home insulation, energy efficient doors and windows, heating and cooling systems, and energy efficient appliances and lighting)
- Increased efficiency of existing energy infrastructure
- Lower energy costs for homeowners, freeing income for other uses in local economies

### Overview of the Market

There are several NZEH homes and developments throughout the U.S., but the industry is relatively young. The development of NZEH has been advanced by demonstration projects, such as the KB Home Zerohouse 2.0, as well as by federal government initiatives such as the U.S. Army's commitment to covert five installations to net-zero by 2020 and the U.S. Department of Energy's (DOE) *Builder's Challenge and Building America Program*, which support research and development in net-zero energy.

According to the 2010 Census, there were over 130 million housing units in the U.S. Overall growth has slowed in the residential construction market since 2005 as a result of the housing crisis and recession, but recent data suggest the overall housing market is slowly recovering from its low point in 2009.[8] A recent forecast from the University of Central Florida's Institute for Economic Competitiveness is in agreement with the U.S. Census numbers, projecting that the housing market

[8] U.S. Census, 2011. New Privately Owned Housing Units Started, Annual Data 1959-2011. Retrieved from http://www.census.gov/construction/nrc/

will grow slowly (but steadily) through 2015 in terms of new housing starts and sales of existing homes.[9]

U.S. housing stock is projected to increase, as is the proportion of that stock considered to be green, energy-efficient homes. Green residential construction describes homes that are either built to a recognized green building standard or are energy and water efficient. By 2016, green residential construction is projected to account for 29-38 percent of the residential market.[10] The increasing number of houses overall, in addition to the increase in energy efficiency, present opportunities for growth in the NZEH market.

### Key Stakeholders and Partnerships

Achieving net-zero energy is not a straightforward process for builders and contractors, as homes require different combinations of energy efficiency and energy generation systems. The first section of this report includes information about NZEH supply chain industries, including major manufacturers, market size and sales, regional distribution, and challenges. The key players in NZEH development and market acceptance are also discussed:

- **Home buyers and home owners** are critical to driving demand for NZEH as well as sharing real-world results from NZEH systems
- **Builders and developers** can help raise awareness of NZEH by including this type of home in their portfolio, educating buyers on the benefits of NZEH, and by sharing best practices to drive greater efficiencies in NZEH systems
- **Appraisers** are responsible for determining the value of a home; proper valuation of energy efficiency and generation systems can have a significant impact on the ability of NZEH builders, developers, and homebuyers to find financing
- **Government** policies and programs, such as tax credits and DOE demonstration projects, help make NZEH more technically and financially feasible

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[9] Institute for Economic Competitiveness, 2012). *Forecast for the Nation 2012-2015: March 2012 Report*. Orlando: University of Central Florida. p. 22. Retrieved from: http://iec.ucf.edu/file.axd?file=2012%2F3%2Fusforecast_mar2012_sec.pdf.pdf

[10] New and Remodeled Green Homes: Transforming the Residential Marketplace. McGraw-Hill Construction, p.4. 2012

- **Lenders and banks** are better equipped to evaluate NZEH mortgages with proper valuation of the energy efficiency components as well as NZEH-friendly programs such as energy efficiency mortgages
- **Manufacturers of energy efficiency products** are necessary to achieving net-zero energy. Reliable products help to encourage builders and home owners to adopt net-zero energy measures
- **Utility companies** can develop policies facilitating energy buy-backs from homeowners
- **Economic developers** can help support policies that promote energy efficient building, help address financial gaps through the creation of incentives, and coordinate regional promotion of NZEHs.

## Identify the Hurdles to NZEH Development

"Identify the Hurdles," describes major hurdles to further NZEH development, identifies potential solutions for challenges facing the industry, and lists strategies economic developers can undertake to promote NZEH development. Four hurdles to NZEH development are:

1. **Lack of data on homebuyer preferences and NZEH cost savings**. There is a need to establish predictability in estimating costs and savings for energy use, to identify homebuyer preferences, and to address utility company concerns. Funding for research and development is crucial to solving the data and technology hurdle. In order to achieve net-zero energy use, technologies and systems must increase home energy efficiency by 40 percent relative to current levels,[11] which will require advances in the home energy systems available today. This is a bridgeable gap, but several obstacles stand in the way, including developing a method for correctly projecting the energy demands and potential savings in a home, building cooling systems that have reduced electricity demands, designing more efficient lighting and lighting controls, and finding a way to reduce plug loads, especially as electric vehicles gain popularity.[12]

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[11] Anderson, R., & Roberts, D. (2008). *Maximizing Residential Energy Savings: Net Zero Energy Home Technology Pathways*. p. 1 National Renewable Energy Laboratory.
[12] Hammon, R. W., & Neugebauer, F. S. (2010). Applications for Large Residential Communities: What is Net-zero Energy? *Strategic Planning for Energy and the Environment*, *29*(3), 48-49.

2. **Need for financing mechanisms for NZEH investment.** Financing needs span three parts:
    a. *Make energy generation systems more financially feasible*: according to Solarbuzz, a solar market research and analysis company, the cost for a 1 kilowatt peak system is between $8,000 and $12,000 before tax, assuming no governmental financial assistance (tax rebates, credits, etc). Programs that subsidize the cost of PV systems can reduce the total cost by 10-60 percent, however.[13]
    b. *Establish buy-back rates for energy contributed to the grid*: feed-in-tariff programs guarantee a clean energy generator an above-market price for energy contributed to the grid. Communities in Florida, California, and Vermont have already successfully implemented feed-in-tariff programs.
    c. *Value net-zero measures in home appraisals and mortgages*: in a 2012 McGraw Hill Construction survey, 81 percent of large home builders and remodelers agreed with the statement that "lenders/appraisers don't understand long-term value" as a major obstacle to increased green building activity.[14] Home appraisals and mortgages can be structured to include the added value of net-zero energy, but increased awareness of existing programs, as well as how to implement those programs, is needed.

3. **Lack of home builder, developer, and owner awareness of how to achieve net-zero energy and of NZEH benefits.** In a 2012 McGraw Hill Construction survey of homebuilders and remodelers, over half of respondents identified lack of consumer education as a top obstacle to green building and remodeling.[15]

4. **Uncertain regulatory environment for NZEH.** Before building or buying a NZEH, home builders and buyers need assurance that upfront costs associated with achieving net-zero energy will pay off. Market uncertainty in the form of temporary financial incentives (tax rebates and credits, for example), and utility companies that are not required to accept

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[13] Solarbuzz (2012, May 10). *Economic Payback*. Retrieved from http://www.solarbuzz.com/going-solar/using/economic-payback
[14] New and Remodeled Green Homes: Transforming the Residential Marketplace. McGraw-Hill Construction, p.29. 2012
[15] Ibid, p.28

and credit a homeowner for excess solar energy may be slowing greater market adoption of NZEH.

Specific actions that economic developers can take to support the growth of the industry include:

- Support policies that promote energy efficient building and clean energy systems. Tax credits and rebates are especially effective tools for encouraging the installation of clean energy systems in homes.
- Address financial gaps to implementing net-zero energy technologies and purchasing NZEH. State development authorities could supplement private lending by providing guarantees or loans to in-state companies with promising new technologies. They can also provide initial funding for revolving loan funds that target NZEH industries.
- Maintain a regional focus. Businesses in the NZEH market tend to develop best and more quickly when located in an industry cluster, especially in metropolitan regions. Economic developers can facilitate the development of industry clusters by improving the quality of available information about the existing industry base, identifying obstacles to local industry development, and supporting existing regional cluster initiatives.

## Job Creation Potential of NZEH

IEDC conducted a literature review of studies and reports about job creation related to NZEH, which includes projections for the green construction market, occupations related to NZEH construction, and jobs in component industries.

- **Job and industry development benefits from clustering**, especially in metropolitan areas: A recent clean economy report by the Brookings Institution found that 64 percent of all current clean economy jobs and 75 percent of jobs created from 2003-2010 were in the nation's largest metropolitan areas. [16] In addition, the study found that industry clusters helped individual clean technology companies grow much faster than those in more isolated areas. The difference between industries located near their peers and those that

[16] Muro et al., 2011, p. 10

were not near clusters was equivalent to 5.5 percent in annual job growth over the seven year study period.[17]

- According to a 2009 analysis by Booz Allen Hamilton, green construction, which includes LEED buildings, NZEH, and other green standards is **expected to generate 7.9 million jobs** (direct, indirect, and induced) from 2009-2013; approximately 2.4 million jobs were added from 2000-2008.[18]
- The Bureau of Labor Statistics estimates that jobs in the overall economy will increase 14.3 percent from 2010-2020. Several occupations in the NZEH home industry such as electricians, operating engineers, and heating, air conditioning, and refrigeration mechanics and installers are **expected to grow at a rate of over 20 percent.**[19]
- **Many NZEH supply chain industries also predict growth.** From 2011-2012 the Solar Foundation projected that solar industry installation firms would grow 25 percent, adding approximately 13,068 jobs and over 40 percent of manufacturing firms expected to add a total of 3,473 jobs for a growth rate of 35 percent.[20]

[17] Ibid, p. 30
[18] Booz Allen Hamilton. (2009). U.S. Green Building Council Green Jobs Study. Retrieved from http://www.usgbc.org/ShowFile.aspx?DocumentID=6435
[19] United States Department of Labor, Bureau of Labor Statistics, 2011
[20] Solar Foundation, 2011, p. 4-5