DUKE UNIVERSITY NICHOLAS SCHOOL OF THE ENVIRONMENT

The Energy Investment Index

A business case for Duke University Energy Initiative's Energy Investment Index

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Abstract

The Duke University Energy Initiative, with the goal of establishing Duke University as a leader in energy industry data analytics, is exploring the creation of an index that tracks investment in the energy sector over time. The Index would assist industry leaders, policymakers, and investors in decision-making and consulting by providing a comprehensive summary of trends in energy investment through aggregating data from various sources. This business plan comprises a market scoping analysis, customer and competitor analyses, a discussion of barriers to entry, a detailed description of the product and its underlying models, marketing materials, a financial analysis, and an implementation strategy. It concludes that the creation of the Energy Investment Index is both feasible and advisable.

Beginning Note: According to the MP requirements all non-traditional project papers should follow "a framework that is considered good practice in the relevant field." As this project is essentially starting a new line of business for the Energy Initiative, we have followed the US Small Business Administration's Guidelines for creation of a business plan[1].

[1] http://www.sba.gov/category/navigation-structure/starting-managing-business/starting-business/how-write-business-plan

Table of Contents

0. Executive Summary

The Energy Initiative engaged three graduate researchers from the Nicholas School of the Environment to further explore the feasibility of developing an integrated solution, specifically an energy investment index, to drive "effective and efficient markets and financing mechanisms for energy and energy technologies"[2]. Duke University's Energy Investment Index (Eii) aims to be a complete source of information on domestic energy. Currently under development by the Initiative, the Duke University Eii will aggregate and analyze disparate investment data from across all value chains in the energy industry. Duke University's Eii seeks to provide a comprehensive, holistic view of energy investment and deployment.

This business case determines that there's an attractive market for an energy investment index by analyzing market trends, customer segments, competition, and barriers to entry. The business case also offers a high-level product description, financial analysis, and implementation plan.

Not made publically available: Pilot of energy investment index

[2] The Initiative, *Education: Preparing Tomorrow's Leaders to Meet Global Energy Challenges,* http://energy.duke.edu/initiative (November 2013).

1. Introduction

Duke University is recognized as a leading national university for interdisciplinary energy education and research.

> Duke University is committed to training future leaders from multiple disciplines in problem-solving techniques to help pioneer the transformation of our energy system and ensure a sustainable future. Energy solutions take the form of scientific and technological discovery, innovative market designs and business models, and creative architectures for policy and law. By leveraging the expertise of faculty from six schools—Fuqua School of Business, Pratt School of Engineering, Nicholas School of the Environment, School of Law, Sanford School of Public Policy, and Trinity College of Arts & Sciences—Duke engages students in multidisciplinary education and research. Duke has created degree programs, courses, team-based projects, and co-curricular activities to increase student and professional development opportunities.[3]

The Energy Initiative was created in 2011 to coordinate and promote energy education and research activity on campus.

> The Duke University Energy Initiative is focused on educating future leaders, researching to find solutions, and engaging with business and policy decision makers to address three major energy challenges:
>
> - Meeting growing energy demand to support a competitive and prosperous economy

[3] The Initiative, *Education: Preparing Tomorrow's Leaders to Meet Global Energy Challenges,* http://energy.duke.edu/initiative (November 2013).

- Reducing the environmental footprint of energy
- Addressing energy security concerns

Creating energy solutions with the potential for real impact entails navigating a complex, global energy system, and then bringing ideas into practice. It requires seeing the whole energy picture, not just the parts, and performing innovative research to increase understanding and open up new possibilities. To that effect, the Energy Initiative is seeking to increase understanding and develop integrated solutions along three major pathways:

- Innovative energy technologies, systems, and science
- Effective and efficient markets and financing mechanisms for energy and energy technologies
- Creative and pragmatic energy and environmental policies and practices

The University's vision for the Energy Initiative includes new research collaborations that span academic disciplines and institutional boundaries in fresh ways to create novel solutions; students who are skilled in addressing multiple realms of the energy challenge in an integrated way; alumni who apply these skills in leadership positions throughout the private, public, and non-governmental sectors; and a constructive problem-solving dialogue with business and policy decision makers that spans our campus, our country, and our world.

The Initiative's approach to education, research, and engagement therefore cuts across disciplines and schools, bringing together Duke's assets in business, engineering, environment, law, policy, arts and sciences, and its interdisciplinary institutes.

> Collaboration and connection of knowledge to real-world problems is a hallmark of Duke's special strength in applying "knowledge in service of society." Duke's many campus energy activities further enrich the university, community, and provide hands-on opportunities for confronting these distinct yet interrelated energy problems.[4]

The Energy Initiative has engaged three graduate researchers from the Nicholas School of the Environment to further explore the feasibility of developing an integrated solution, specifically an energy investment index, to drive "effective and efficient markets and financing mechanisms for energy and energy technologies"[5]. The Duke University Energy Investment Index (Eii) creates a well-researched, easy to understand, and actionable metric that will allow industry professionals to better understand the current state of the energy system.

[4] The Initiative, *The Initiative: Energy Education, Research, and Engagement,* http://energy.duke.edu/education (November 2013).
[5] The Initiative, *Education: Preparing Tomorrow's Leaders to Meet Global Energy Challenges,* http://energy.duke.edu/initiative (November 2013).

2. Industry Trends

Every day, investment professionals, consultants, policy makers and other industry professionals access information about energy investment to advise their clients and guide policy decisions. Yet the energy system is rapidly changing: growing and contracting across different sectors in fundamental ways. Below are a number of trends in energy usage that necessitate the development an overarching energy investment index.

Power

Changes within the power sector show large shifts in investment away from the traditional American power system based on the abundance of cheap coal, and those shifts will have long term implications that investors and market professionals need to be aware of. Several of these changes are discussed below.

Natural Gas Generation

Between 1970 and 2008, natural gas prices increased at an average annual rate (CAGR) of 11%[6], which is 6.04% above the rate of inflation over the same time period[7]. However, due to the combination of drilling technologies that have made more gas reserves economically feasible, the wellhead price has dropped 66% over the last 5 years, or an annual loss of nearly 20% every year[8].The most recent dip in the price of domestic natural gas resulted in the lowest price since the 1990s[9], which is spurring record investments in natural gas power infrastructure[10].

Coal Generation:

[6] "U.S. Natural Gas Wellhead Price (Dollars per Thousand Cubic Feet)." EIA, n.d. Web. <http://www.eia.gov/dnav/ng/hist/n9190us3a.htm>.
[7] "Inflation Calculator: Bureau of Labor Statistics." U.S. Bureau of Labor Statistics, n.d. Web. <http://www.bls.gov/data/inflation_calculator.htm>.
[8] "U.S. Natural Gas Wellhead Price (Dollars per Thousand Cubic Feet)." EIA, n.d. Web. <http://www.eia.gov/dnav/ng/hist/n9190us3a.htm>.
[9] "Henry Hub Gulf Coast Natural Gas Spot Price (Dollars/Mil. BTUs)." EIA, n.d. Web. <http://www.eia.gov/dnav/ng/hist/rngwhhdM.htm>. (adjusted from nominal to real prices)
[10] Tubb, Rita. "Billions Needed To Meet Long-Term Natural Gas Infrastructure Supply, Demands." Frontpage. N.p., n.d. Web. <http://pipelineandgasjournal.com/billions-needed-meet-long-term-natural-gas-infrastructure-supply-demands?page=show>.

Due to recent regulations surrounding mercury and air pollution, over 34 gigawatts of coal are anticipated to be retired over the next 7 years[11]. The subsequent pressure that this will put on the reserve margins of major utilities[12] is leading to large investments in new power infrastructure, much of which will be natural gas and renewable energy[13]. Despite large retirements of coal power within the US, coal extraction continues at the same pace[14], due to a larger global demand for coal, particularly from Asia[15].

Nuclear Generation

There were no nuclear capacity additions in the United States between 1991 and 2011, and 8 nuclear plants were decommissioned during the same time frame[16]. However, despite having the same number of reactors as in 1987, the percent of the US generation that is attributable to nuclear energy remained unchanged over the same time period due to an increase of 23% in the capacity factor[17]. While investment in new nuclear has stagnated over the last 22 years, there are now plans for 5 new nuclear reactors to be constructed and brought online by 2020[18].

Alternative Generation & Demand Management

Wind turbines in the Midwest are causing power prices in the region to be lower than that of conventional fuels[19], spurring the large-scale development, 13.2GW in 2012[20], of sites in the US

[11] "Powerplants to Be Closed as a Result of EPA's Regulations." Institute for Energy Research. N.p., n.d. Web. <http://www.instituteforenergyresearch.org/epa-powerplant-closures/>.
[12] "ICForecast Energy Outlook Projects Increasing Number of New Gas Builds to Meet Reserve Margin Needs." N.p., n.d. Web. <http://www.icfi.com/news/2013/10/icforecast-energy-outlook-projects-increasing-number-of-new-gas-builds-to-meet-reserve-margin-needs>.
[13] "Strong Growth for Renewables Expected through to 2030." Bloomberg. N.p., n.d. Web. <http://about.bnef.com/press-releases/strong-growth-for-renewables-expected-through-to-2030>.
[14] "Independent Statistics and Analysis." *Quarterly Coal Report*. EIA. N.p., n.d. Web. <http://www.eia.gov/coal/production/quarterly/?src=Coal-b2>.
[15] "Rising Asian Demand Drives Global Coal Consumption Growth." EIA, n.d. Web. <http://www.eia.gov/todayinenergy/detail.cfm?id=4390>.
[16] "Annual Energy Review." EIA, n.d. Web. <http://www.eia.gov/totalenergy/data/annual/index.cfm>.
[17] Ibid
[18] "Nuclear Power in the USA." N.p., n.d. Web. <http://world-nuclear.org/info/Country-Profiles/Countries-T-Z/USA--Nuclear-Power/>.
[19] "North American Windpower: Texas Utility Adds 570 MW To Wind Portfolio." N.p., n.d. Web. <http://www.nawindpower.com/e107_plugins/content/content.php?content.11709>.
[20] Woody, Todd. "U.S. Installed Record 13.2 Gigawatts Of Wind Energy In 2012." Forbes Magazine, 18 Jan. 2013. Web. <http://www.forbes.com/sites/toddwoody/2013/01/18/u-s-installed-record-13-2-gigawatts-of-wind-energy-in-2012/>.

wind corridor. Solar install prices have dropped by over 50% since 1998[21], new installations have grown over 300% in the last 3 years[22], and investment in solar technology research and development by the top 10 manufacturers was over $350B in 2011, up almost 700% from 2007[23]. Additionally, the grid system is steadily becoming more responsive, with demand management accounting for 5% of total capacity in NYISO[24] and 7.3% of total capacity in PJM[25]. This technology will continue to grow as the $4.5B in smart grid demonstration and deployment through the American Recovery and Reinvestment Act boost market demand[26].

Transmission Infrastructure

While annual investment in transmission infrastructure by shareholder owned utilities declined on an annual basis by 3.19% between 1982 and 1998[27], since that time, investment in transmission has grown at a combined average growth rate of over 10%[28]. The key drivers behind this resurgence in transmission infrastructure investment are two-fold: aging infrastructure and changes in the generation mix toward renewable resources. Additionally, the resurgence of electric transportation is projected to increase the stress on local distribution networks[29], which will spur significant investment needs in the "last mile" of operation. Given the policy and economic climate, these trends are anticipated to continue.

Transportation

OIl & Gas Exploration & Production

[21] "Tracking the Sun VI". Lawrence Berkeley National Laboratory. July 2013. <http://emp.lbl.gov/sites/all/files/lbnl-6350e.pdf>.
[22] "Solar Energy Facts: Q2 2013" SEIA. <http://www.seia.org/sites/default/files/Q2%202013%20SMI%20Fact%20Sheetv2.pdf>.
[23] "Friday Focus: R&D Spending Analysis of Top 10 PV Module Manufacturers." PV-Tech. N.p., n.d. Web. <http://www.pv-tech.org/friday_focus/friday_focus_rd_spending_analysis_of_top_10_pv_module_manufacturers>.
[24] "Power Trends 2012". ISO New York. <http://www.nyiso.com/public/webdocs/media_room/publications_presentations/Power_Trends/Power_Trends/power_trends_2012_final.pdf>.
[25] "2016/2017 RPM Base Residual Auction Results". PJM. <http://www.pjm.com/~/media/markets-ops/rpm/rpm-auction-info/2016-2017-base-residual-auction-report.ashx>.
[26] Joskow, Paul. "Creating a Smarter US Electricity Grid". MIT CEEPR. <http://web.mit.edu/ceepr/www/publications/reprints/Reprint_237_WC.pdf>.
[27] "Transmission Investment". Edison Electric Institute. June 2013. <http://www.eei.org/issuesandpolicy/transmission/Documents/transmission_investment.pdf>.
[28] IBID
[29] Shao, Shengnan. "Grid Integration of Electric Vehicles and Demand Response with Customer Choice". <http://www.ceage.vt.edu/sites/www.ceage.vt.edu/files/ieee_trans_sg_dr_with_customer_choice.pdf>.

Increasingly we are looking to unconventional sources of oil and gas to meet rising global demand[30]. Within the US, development of unconventional sites for the production is on the rise[31], while public regulation for the harvesting of these resources has increased in kind[32]. To meet these unconventional demands as well as growth in conventional sources, there have been over 20,000 miles of pipeline (representing 97Bcf of capacity) added between 1998 and 2008[33]. Despite vocal and visible criticism[34], Americans are in favor of development[35]. At the same time, more money is being invested in oil and gas exploration than ever before[36]. OECD use of oil actually declined between 2000 and 2010[37], but oil production has increased by 12% in the same time frame[38], driven by a 40% increase in non-OECD demand[39]. Accordingly, the number of oil and gas rigs is at its highest level since 1986[40], US oil exports have risen by 22% annually over the past decade, and imports have fallen by 0.65% over the same time period[41].

Automotive Efficiency

[30] "BP Energy Outlook 2030". January 2013. <http://www.bp.com/content/dam/bp/pdf/statistical-review/BP_World_Energy_Outlook_booklet_2013.pdf>.
[31] Ratner, Michael, et al. "An Overview of Unconventional Oil and Natural Gas: Resources and Federal Actions". 15 July 2013. <http://www.fas.org/sgp/crs/misc/R43148.pdf>.
[32] Richardson, Nathan, et al. "The State of State Shale Gas Regulation". June 2013. <http://www.rff.org/rff/documents/RFF-Rpt-StateofStateRegs_Report.pdf>.
[33] "Natural Gas Pipeline Development & Expansion." EIA, n.d. Web. <http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/develop.html>.
[34] Mohamed, Farah. "Keystone XL Pipeline Protesters To Obama: 'No Planet Drama'" The Huffington Post, 22 Sept. 2013. Web. <http://www.huffingtonpost.com/2013/09/22/keystone-xl-protest_n_3969407.html>.
[35] "Continued Support for Keystone XL Pipeline." Pew Research Center for the People and the Press RSS. N.p., n.d. Web. <http://www.people-press.org/2013/09/26/continued-support-for-keystone-xl-pipeline/>.
[36] "International Energy Statistics." N.p., n.d. Web. <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=5>.
[37] "What Drives Oil Prices?" Energy & Financial Markets. N.p., n.d. Web. <http://www.eia.gov/finance/markets/demand-oecd.cfm>.
[38] "International Energy Statistics." EIA, n.d. Web. <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5>.
[39] "What Drives Crude Oil Prices?" Energy & Financial Markets. EIA, n.d. Web. <http://www.eia.gov/finance/markets/demand-nonoecd.cfm>.
[40] "Crude Oil and Natural Gas Drilling Activity." EIA, n.d. Web. <http://www.eia.gov/dnav/pet/pet_crd_drill_s1_a.htm>.
[41] "U.S. Crude Oil Supply & Disposition." EIA, n.d. Web. <http://www.eia.gov/dnav/pet/pet_sum_crdsnd_k_m.htm>.

With the corporate average fuel economy standards stagnating between 1990 and 2010, the energy efficiency of cars has progressed little over the last 20 years[42], but new CAFE standards for light duty vehicles and trucks will almost double average efficiency by 2025[43]. These CAFE standard when combined with new regulation around greenhouse gas emission will require an average fleet efficiency of approximately 54.5 miles per gallon for light-duty vehicles[44].

Electric Vehicles

While electric and electric vehicles are only 0.02% of all passenger vehicles[45] globally, plug-in electric car sales represented 0.4% of all new car sales in the United States in 2012, up from 0.1% in 2011. And this growth is expected to continue globally, with sales of electric or hybrid electric cars anticipated to grow 100-fold over the next 8 years[46]. Additionally, prices of batteries are predicted to fall from $500-600/kWh to $200-300/kWh by 2020[47], further fueling the electrification of vehicles.

Compressed Natural Gas

Additionally, while still a small percentage of the automotive market, natural gas used for vehicles has increased 125% between 2000 and 2010. Conversely, compressed natural gas filling stations saw a steady decline from 1996 to 2007, but have grown almost 50% between 2007 and 2012[48]. Combining these two trends we see an increase in fuel used per station, which is explained by an increase in the use of natural gas for fleet vehicles, specifically transit agencies, refuse companies, and delivery fleets[49].

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[42] Davis, Stacy, et al. “Transportation Energy Data Book.” Edition 32, <http://cta.ornl.gov/data/tedb32/Edition32_Full_Doc.pdf>.
[43] “2017-2025 Model Year Light-Duty Vehicle GHG Emissions and CAFE Standards: Supplemental” EPA. <http://www.nhtsa.gov/staticfiles/rulemaking/pdf/cafe/2017-2025_CAFE-GHG_Supplemental_NOI07292011.pdf>.
[44] “EPA and NHTSA Set Standards to Reduce Greenhouse Gases and Improve Fuel Economy for Model Years 2017-2025 Cars and Light Trucks “. EPA. <http://www.epa.gov/oms/climate/documents/420f12051.pdf>.
[45] “Global EV Outlook”. IEA. April 2013. <http://www.iea.org/topics/transport/electricvehiclesinitiative/EVI_GEO_2013_FullReport.pdf>.
[46] Ibid
[47] Hensley, Russel. "Battery Technology Charges Ahead." McKinsey and Co., July 2012. Web. <http://www.mckinsey.com/insights/energy_resources_materials/battery_technology_charges_ahead>.
[48] “U.S. and Canadian Natural Gas Vehicle Market Analysis”. <http://www.cngnow.com/Tagged%20PDFs/TIAX_CNGInfrastructure.pdf>.
[49] Ibid

Air Travel and Freight

Passenger air travel in the United States has increased at an average rate of 4.2% every year from 1970 to 2012 (in revenue passenger air miles), and freight travel has grown even more quickly (5.5% annually)[50]. Yet, due to increases in passenger efficiency (30% increase in passenger load factor[51]), and airplane efficiency (approx. 50% decrease in energy per passenger mile[52]), the effect of this increase in demand on energy usage is much hard to determine. While each of these trends has increased over the last three decades, they seem to be approaching an asymptote (lower marginal gains).

Industry

As the United States has become a more service-driven economy, we've seen the GDP contribution of energy intensive manufacturing drop from 22.7% in 1970 to 11.7% in 2010[53], with many of the previous industrial jobs having moved to developing markets[54] and service sector jobs continuing to rise. However, despite this stagnation of heavy industry, levels of industrial output per facility have been rising and energy usage per unit of output has shrunk by 16% over the last 10 years[55].

[50] "Transportation Energy Data Book." N.p., 31 July 2013. Web. <http://cta.ornl.gov/data/index.shtml>.
[51] Ibid
[52] McCollum, David, et al. "Greenhouse Gas Emissions from Aviation and Marine Transportation". <http://www.c2es.org/docUploads/aviation-and-marine-report-2009.pdf>.
[53] Atkinson, Robert, et al. March 2012. "Worse Than the Great Depression: What Experts Are Missing About American Manufacturing Decline". <http://www2.itif.org/2012-american-manufacturing-decline.pdf>.
[54] "The Future of Manufacturing Opportunities to drive economic growth". April 2012. <http://www3.weforum.org/docs/WEF_MOB_FutureManufacturing_Report_2012.pdf>.
[55] "GDP per Unit of Energy Use (constant 2005 PPP $ per Kg of Oil Equivalent)." N.p., n.d. Web. <http://data.worldbank.org/indicator/EG.GDP.PUSE.KO.PP.KD?page=1>.

3. Customer Decision Criteria

The index will have to compete for the attention of consumers in a market that is crowded with many different types of energy indices. To do this, the index will have to stand out and market itself on the criteria that are most important to the consumer**.** There are several different areas upon which the index can compete: through its academic rigor and credibility, through its accessibility, and through its long-term brand strength. By targeting the index along customer decision criteria, we will be able to increase the adoption of the index within a crowded market.

Academic Rigor and Predictive Value

While the strength of the Duke brand will signal credibility and academic integrity, the index must externally prove that its methodology and conclusions are sound. As this academic rigor and third party objectiveness will be a major market differentiator, this criteria will be very important to all market professionals, but especially those who will rely of this index for financial decisions. To ensure the academic integrity of the index, there are two steps that the index should perform before launching to the external market.

- Open publishing and comment on the methodology behind the index
- Review of the weighting methodology by subject matter experts

By going through these steps, the index will provide external verification of the academic integrity of the index and further enhance Duke's brand strength within energy data analytics.

Accessibility

Duke must be sure that the index is accessible and promoted through the channels that each customer segment values. For example, while bankers and investors may prefer to be able to access the index and all its reports through a Bloomberg terminal, consultancies may prefer to have a quarterly email with updates to the index and an insight report that synthesizes changes since the last report. The channels preferred by each of the target customer segments are explored more below, but the following steps should be taken to ensure that the index is accessible to key customers:

- Determination of channel importance by customer segment
- Identification of potential channel partners
- Work with channel partners to promote index

Marketing and Promotion

The long-term the brand strength of the index will lead new users to use the Energy Investment Index over other indices that may try to copy the methodology or the weighting used. In order to compete in the long-term the index will have to maintain a strong brand built off the academic integrity and dependability of the index. While the index will build its brand through use and word of mouth among industry professionals, Duke can expedite this brand recognition through targeted initiatives designed to increase brand awareness and promote brand loyalty. Through the below measures, Duke can continue to promote the brand of the index and maintain leadership/use of the index.

- Follow-on research projects to determine the effectiveness of the index in the marketplace; consumer outreach and interaction
- Promotion of the index within the channels that it's distributed
- Promotion of the high level index within popular media

Understanding and capitalizing on the existing market drivers for each of the customer segments the index is targeting will be critical to penetrating the market more broadly and more quickly than would otherwise be possible. Further, by understanding the market differentiators and decision criteria, the index will be well positioned for success well into the future.

4. Customer Segments

Duke University's Eii aims to be the complete source of information on domestic energy investment for the following industry professionals: utility and energy companies, large energy consumers, financial institutions and investors, consulting firms, government agencies and nonprofit corporations and universities.

Understanding the past and current composition of the energy landscape is one of the best ways to drive "effective and efficient markets as well as provide financing mechanisms for energy and energy technologies"[56]. The Eii will reliably identify past and current energy sector investment in like terms and time frames.

Exemplified below are a few ways industry professionals may choose to leverage the Eii:

Utility and Energy Companies

Utility and energy companies represent a broad cross-section of the energy industry, from multi-utility conglomerates to energy service companies to diversified global energy holding companies.

Major challenges: Utility and energy companies must grow to their complete potential, make wise investment decisions, and increase company value. Arguably the greatest challenge, energy companies must determine if/when to invest in expensive, long-term capital projects to fortify, produce and deliver future energy supply. These investment decisions are tough choices due to several new realities, including:

- Increased competition
- New and rapidly evolving technologies
- Limited subsidies due to government budget constraints
- Dynamic regulatory environment, including CO_2 abatement
- Environmental concerns, and customers' willingness/ability to switch to a new supplier
- Pressure on balance sheets and cash flow

[56] The Initiative, *Education: Preparing Tomorrow's Leaders to Meet Global Energy Challenges,* http://energy.duke.edu/initiative (November 2013).

Application of Eii: At the corporate level, energy companies can leverage Eii data to:

- Influence investment strategies
- Evaluate macro and industry trends and their impact on utilities
- Identify the right level of vertical integration
- Influence portfolio and international expansion strategies

Large Energy Consumers

Large energy consumers include companies involved in, but not limited to, the following industries: consumer product goods, inorganic chemicals, cement, data storage/services, travel, automobile, heavy industrial manufacturers, steel, and aluminum.

Major Challenges: Energy security concerns, rising and volatile commodity prices, natural catastrophes and technology advances are creating new business risks and opportunities. Managing resources and energy is complicated – acute changes in the energy industry expose large energy consumers to increasingly severe risks, such as:

- Weaker financial performance: Increased financial costs, lost sales due to rising input prices, secondary impact on logistics, supply chain costs, and capital equipment
- Business disruption: Raw material/energy supply disruption or lack of energy security
- Brand equity erosion: Failure to meet stakeholder or customer expectations related to energy and resource use, sustainability, and/or investment
- Regulatory compliance costs and potential penalties: Regulatory exposure from greenhouse gas emissions, waste streams, water use

Application of Eii: The abundance of energy sector data makes it increasingly difficult and time consuming for large energy consumers to track the health of the energy industry. Energy sector data is often disparate, static, expensive, and difficult to interpret. Large energy consumers can use Duke University's Eii to track capital stock investment levels for the energy industry as a whole, as well as across value chains for specific energy sectors or technologies.

Financial Institutions

Financial institutions help meet the world's power and fuel needs by offering the capital-intensive energy industry a wide range of debt and equity products. Additionally, financial institutions provide clients with comprehensive strategic advice and risk management expertise.

Major Challenges: Financial institutions must be energy industry experts capable of leveraging data to capture value and helping customers gain a full understanding of risks and rewards. Energy projects are often long-term capital-intensive projects with high-risk for delays or default, and often need to be restructured or reworked later in a project's life.

Application of Eii: Financial institutions can use Duke University's Eii to assess whether current energy investment trends align with their corporate view and strategy. The Duke University Eii may also be indicative of broader economic health.

Consulting Firms

Consulting firms support energy clients meet near-term performance goals and develop strategies to navigate today's increasingly uncertain and complex industry.

Major Challenges: Consulting firms have a broad client base, and therefore face many of the same challenges that other industry professionals face:

- Infrastructure Businesses: Consultants help clients manage and leverage capital stock.
- Market Analysis: Consultants provide clients with advice and analysis on energy markets.
- Global Gas Market: Consultants help clients evaluate how LNG will change national gas pricing dynamics and impact regional markets and the value chain.
- New technologies: Consultants assess emerging technologies, and determine how clients can get the most out of on new opportunities.

Application of Eii: Consulting firms can use Duke University's Eii to help clients better understand the past and current energy landscape, and emerging sector trends. Consulting firms can also leverage Duke University's Eii investment data to generate new industry research or insight, which can either be published externally or shared internally with clients.

5. Competitor Trends

Private Investment Tracking and Prediction

Introduction to Private Investment and Capacity Tracking

Due to the large amounts of investment being made on a daily basis in the energy industry, there are many companies that offer services and research that help advise these clients. Services of these companies range from the consolidation of available market information on specific sectors to the prediction of the spot prices of fuels over the next 25 years. Each of these services is highly valued by the clients, as shown by their willingness to pay for the research.

Example Private Investment Tracking Offerings

Navigant Consulting Assessments and Reports[57]

ICForecast (ICF International)[58]

IHS CERA[59]

Velocity Suite (Ventyx)[60]

Energy Intelligence[61]

Differences in Value Proposition

The principle differentiator between the Index and these offerings is that the Index will be available without cost to any market participant. Additionally, the Index will have full disclosure about the methodology used to create the Index and transparency in its calculation and the reporting. However, as a sacrifice for the public availability of the Index, the information that the Index will be drawing from will all be publicly available information collected primarily by government agencies.

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[57] "Energy." Navigant. N.p., n.d. Web. <http://www.navigant.com/industries/energy/natural-gas-and-energy-generation/fuels---natural-gas/>.
[58] "ICForecast: Energy Information Products Suite." N.p., n.d. Web. <http://www.icfi.com/markets/energy/campaigns/icforecast>.
[59] "IHS CERA North American Natural Gas Advisory Service." N.p., n.d. Web. <http://www.ihs.com/products/cera/energy-research/north-america-natural-gas.aspx>.
[60] "Enterprise Software Solutions for Energy, Mining and Other Asset Intensive Industries." Ventyx, n.d. Web. <http://www.ventyx.com/en/enterprise/business-operations/business-products/velocity-suite>.
[61] "Natural Gas." Energy Intelligence Group. N.p., n.d. Web. <http://www.energyintel.com/Pages/About_NGW.aspx>.

Public Energy Indices

Introduction to public Indices

Public indices are created and freely published and available for public consumption. While the majority of these indices are published by non-profits working with energy or environmental missions, others are sponsored or published by for-profit companies who hope to increase public awareness of specific issues or increase brand awareness for their company within a specific field.

Example macroeconomic indicator-based Indices

Energy Sustainability Index (World Economic Council)[62]

US Cleantech Leadership Index (Clean Edge)[63]

Global Energy Architecture Performance Index (World Economic Forum)[64]

Renewable Energy Country Attractiveness Index (Ernst & Young)[65]

Energy Sector Carbon Intensity Index (International Energy Agency)[66]

REN21 Global Status Report (Renewable Energy Policy Network)[67]

Differences in value proposition

The Energy Investment Index is different than the indices above because of the depth of information it will use to calculate the index and the direct applicability to investment decision making. Many of the current public macroeconomic Indices are to broad in scope to be directly relevant to investors, but the Energy Investment Index aims to provide information that will directly allow investors to adjust their strategies. Also, while the Index it will not use proprietary information (like many of the private Indices), it will combine granular public information to

[62] "World Energy Trilemma 2012." World Energy Council. N.p., n.d. Web. <http://www.worldenergy.org/publications/3962.asp>.
[63] "Clean Edge - The Clean-Tech Market Authority." N.p., n.d. Web. <http://www.cleanedge.com/research/leadership-index>.
[64] "The Global Energy Architecture Performance Index Report 2013 | World Economic Forum - The Global Energy Architecture Performance Index Report 2013." N.p., n.d. Web. <http://www.weforum.org/reports/global-energy-architecture-performance-index-report-2013>.
[65] "RECAI: Updated Methodology." Renewable Energy Country Attractiveness Index. N.p., n.d. Web. <http://www.ey.com/UK/en/Industries/Cleantech/Renewable-Energy-Country-Attractiveness-Index---Methodology>.
[66] "Energy Sector Carbon Intensity." IEA. N.p., n.d. Web. <http://www.iea.org/etp/tracking/esci/>.
[67] "Renewables Global Status Report." REN 21, n.d. Web. <http://www.ren21.net/REN21Activities/GlobalStatusReport.aspx>.

give a more substantive and actionable metric for current and historic investment in the energy sector than the other public energy-related Indices.

Competitive Case Studies

To give a better understanding of the other energy information and analytic offerings on the market, we've chosen two of the above offerings to explain and note how the energy investment index will differentiate itself from them.

Ventyx

Similar offering: Ventyx Velocity Suite

Description: Ventyx Velocity Suite provides vast amounts of raw information to industry professionals doing analytical work within the energy system. Information is well organized and can be searched via a database query tool or through an interactive mapping tool. This interface quickly allows researchers to find the energy information that they need. Velocity Suite provides information across all industries -- Electricity, Coal, Natural Gas, Solar, Wind, etc. -- and across all aspects of the value chain -- extraction, transportation, refining, distribution, and many more.

Energy Investment Index Differentiation: While Ventyx Velocity Suite is a powerful and informative offering for those within the industry doing analysis, the information is too detailed to be of use for informal traders or market professionals with limited financial and human resources. The points where the Energy Investment Index will differentiate itself is on the availability of the index and the simplicity of the index. By using public information and making the output available to the public for no cost, the investment index can be used by non-profits and others unable to afford the cost of Velocity Suite. Additionally, by using the Eii staff as a filter for information, the Index will provide an easy to understand result without the analyst having to compile the information themselves. This simplicity will be of use to informal industry professionals who may not have the in depth industry knowledge to compile the useful information in Ventyx to draw out the necessary conclusions.

ICF International

Similar Offering: ICForecast: Energy Information Products Suite; Renewable Energy Consulting

Description: ICF International tracks and analyzes changes within the different sectors of the conventional energy economy (power, coal, and natural gas) and produces quarterly presentations and monthly updates about the state of each sector (including information across the value chain of each sector). Additionally they predict demand for each of the conventional energy sectors and do forecasts for anticipated changes in the electricity prices, regional supply, and regional demand. Through their renewable energy consulting engagements they have experience in renewable energy supply and demand tracking, but they do not have an offering comparable to their ICForecast product for renewable energy or for transportation energy.

Energy Investment Index Differentiation: There are two primary areas in which the Energy Investment index will differentiate itself from the ICForecast and ICF International's renewable energy consulting: comprehensiveness and availability. Firstly, unlike the ICForecast and ICF international's quarterly sector updates, the Energy Investment Index will provide information and analysis about minor power fuel sectors (wind, solar, biomass) as well as transportation fuel (oil). The comprehensive nature of the index will allow users to understand how each of these sectors is performing in relation to other relevant sectors. Secondly, as mentioned above, the Index will use publicly available information and will provide the Index information free of charge. This availability will allow this important information to be available to thought leaders and industry professionals who do not have the resources to purchase a report such as the ICForecast.

6. Barriers to Entry and Major Challenges

There are three major categorical barriers to entry faced by a new energy index: output generation, branding and distribution, and management.[68] Despite these challenges, effective planning and organizational dedication will allow Duke University to enter the market successfully.

Output Generation

The most challenging market barrier is data sourcing. Unlike a stock market index, which records and reports a pre-existing, reliable stream of data, a capital stock-based energy index will need access to a broad range of primary data from public and private energy companies investing in infrastructure. Some basic data are available through subscription-based vendors such as Bloomberg and regulatory bodies such as the Federal Energy Regulatory Commission (FERC), however, some categories of data are not aggregated and must be collected independently. Obtaining a satisfactory statistical sample of all energy investment data is challenging. To address this issue, it will be necessary to rely on data from the industry's largest representatives, which represent a significant share of the directional movement in each sector and are more readily available through major data vendors. Since the Energy Initiative does not have experience generating an index, the resources necessary will be more costly in terms of time and effort than they would be for an academic institution that already publishes a number of indices. In that sense, Duke University lacks a competitive advantage in this area that will make it more challenging, though not impossible, to generate the energy index.

Branding and Distribution

Another barrier to entry for a new energy index is gaining recognition and attracting users. Because a large number of existing indices focus on specific components of the energy system already exist, branding a new index and communicating its added value is challenging. Fortunately, the Energy Initiative benefits from access to Duke University's strong brand, which will help to establish legitimacy of the index early on.

[68] "Competition and Barriers to Entry". OECD. January 2007. http://www.oecd.org/competition/37921908.pdf

A further barrier will be gaining access to effective distribution channels. While it is possible and straightforward to publish index results on the Energy Initiative's website, it could be more effective to publish the index through an industry periodical or a data vendor. If the Energy Initiative chooses to partner with a data vendor, it may need to consider waiving full rights over the data.

Management

Managing and maintaining an index throughout the year requires a small, dedicated staff, which must have data collection and analysis skills and marketing knowledge. This requires financial resources, which can be difficult to obtain in an academic setting. The Energy Initiative will need to prove the value of the index to Duke University to secure funding internally as well as seeking grant funding externally.

Finally, there is the barrier of replicability. It would be possible for a company or academic institution that has a competitive advantage in index publication, such as MSCI or the University of Michigan, to create a similar product, leveraging their brand to gain market share. The Energy Initiative will have gain distinct advantages by being first to market with this product and by having the Duke brand associated with the product.

7. Eii Product Description

The Duke University Energy Investment Index are intended to give a variety of interested parties a way to easily understand current trends in energy industry investment. Understanding where the future energy system is headed depends fundamentally on understanding energy investment and how energy investment is unfolding. The state of the future installed energy system will be a function of the current system, its rate of depreciation and retirement, reinvestment in the existing system, and investment in new technologies, systems, production capacity, and equipment. Despite the importance of investment to the determination of the future energy system, statistics, projections, and analyses often focus on the state of the current system or a snapshot of the future system at some distant point in time, rather than focusing on the *increment of investment or disinvestment* that is driving change.

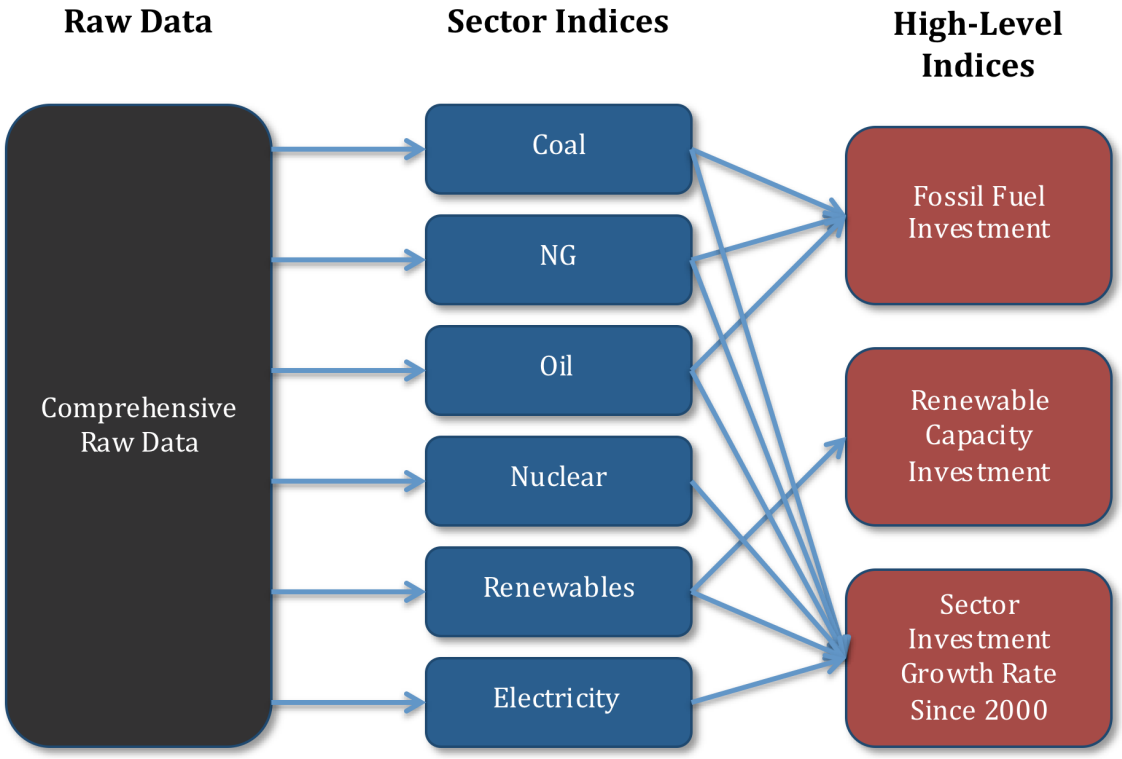
This section will discuss the objectives of the constituent sub-indices, how they are organized, their output format and structure, the methodology for their generation, the data sources, and recommendations for associated quarterly and annual reports.

Objectives

The purpose of the Eii is to provide a comprehensive set of indicators that track a set of relevant investment metrics, which would appeal to a variety of interested parties. On the highest level, the Energy Initiative hopes to provide transparent insight into the overall levels of investment within each sector of the energy industry and also across all sectors from a holistic perspective. This high-level, aggregated information could appeal to policymakers, journalists, investors, and other parties concerned with the current and future relative composition of electricity generation and primary energy sources within the United States. Additionally, sub-indices that track a variety of metrics along each sector's value chain would provide transparency into investment trends within each sector, which could appeal to industry professionals, NGOs, policymakers, and investors who might benefit from more granular insight into secular investment trends. Finally, providing a comprehensive dataset of investment data across all sectors could be useful for consultants or any party interested in using raw data to feed into decision-making models for their own purposes.

Format, Structure, and Methodology

Although this project is called the Duke University Energy Investment Index, in reality, it is a hierarchical series of indices that track components of the energy value chain in ways that are relevant to a variety of potential users. The following figure gives a general idea of the structure of the indices:

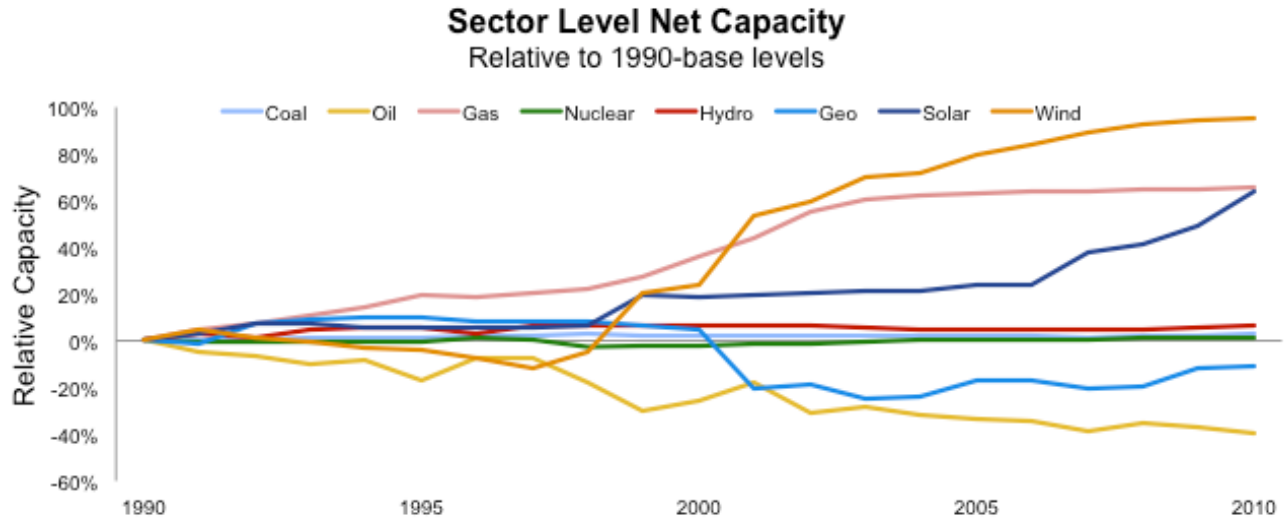


The foundation of the Eii is raw data aggregation. Data are organized within a Microsoft Excel spreadsheet, comprising the following sectors: coal, natural gas, nuclear, oil, hydro, wind, biomass, geothermal, solar, electricity, and other (battery storage and waste heat). Data for each of these sectors are maintained in sector-level worksheets, which track various metrics of investment over time, either on a monthly or an annual basis. Each category is divided into upstream, midstream, and downstream metrics. The individual value chain investment components tracked vary by the nature of each sector. If a sector has a primary energy source component (coal, natural gas, and oil), then metrics such as number of new wells drilled are tracked. While, for each sector that feeds into electricity generation, metrics such as new MW of generating capacity and MW of retired capacity are tracked. Finally, the indices distinguish between sectors and electricity transmission components of a value chain. Source sector measurements end with units of generation, and electricity sector measurements begin once

electricity has been generated. As the indices develop further, categories that track environmental and security metrics should be incorporated, such as the carbon intensity of electricity generation from each fuel source in tons/MWh.

This raw dataset will be used to generate two tiers of indices: individual sector level and trans-sector indices. Individual sector indices showcase important investment metrics across the sector's value chain. For example, for the natural gas sector, indices will track new wells drilled, newly built pipeline capacity in MMcf/d, and net installed generating capacity in GW, among others.

Higher-level indices will compare sectors against each other to show, on an industry-wide basis, the magnitude of important trends. As seen in the figure below (for illustrative purposes), the growth of generating capacity is compared across all sectors, normalized to 1990 levels. The value of an index like this is that it shows very clearly the rapidity with which investment in certain sectors is growing, relative to others.



While sector level indices will track individual value chain components, the high level indices will aggregate metrics across sectors. However, it is important to clarify that these indices will remain completely determined by comparable metrics, as to avoid the subjectivity associated with weighting. For example, pipeline capacity, generating capacity, or carbon intensity that are in the same unit across sectors can be aggregated, while metrics using irreconcilable units such as miles of pipeline and wells drilled cannot be combined.

The high level indices will be showcased for marketing purposes, as it will be more accessible to market a small number of impactful metrics than it would be to emphasize the vast array of sub-indices that are tracked. Although subject to modification over time, there are three high level indices that will be emphasized. The first is a total capacity index, which shows the generating capacity investment in each sector in absolute terms. This might appeal to policymakers who are interested in determining whether their policies are having the intended impact. The second is a carbon intensity index, which will show the impact that current investment is having on the CO2 produced throughout the industry. This could be useful for environmental NGOs and policymakers. The third index, as seen in the figure above, is the sector growth rate index, which could appeal to investors, as it would help to identify opportunities and trends in energy investment.

Data Aggregation

Data will be collected on a monthly, quarterly, or annual basis, depending on the release timeline from each relevant source. Public data from sources such as the Federal Energy Regulatory Commission or the Energy Information Administration is less reliable in terms of timeline and delay before publication than data from a paid service such as Ventyx. The process for inputting data from public sources will involve downloading reports and inputting periodic results into the Eii database. According to trials conducted during the development of the index, this process can take between one and three hours to complete per month. Using paid data, this process would be much faster and more reliable, and it would minimize the risk of human error in data entry.

Quarterly and Annual Reports

In addition to the regularly scheduled publication of Eii metrics, this business analysis also recommends that quarterly and annual reports be released to supplement the data and provide economic and market context from Duke University's researchers and experts. Quarterly reports would summarize trends through Q1, Q2, and Q3, and a comprehensive annual report would be released at year-end. These reports are intended to give the Eii more visibility, credibility, and context. The timeline for releasing reports will have to follow the availability of data. Using a paid source like Ventyx would ensure that quarterly data are available for publishing quarterly reports. If monthly or quarterly data are not available, only the annual report will be feasible.

8. Financial Analysis

A financial analysis of the costs of maintaining the Energy Investment Index and the benefits it will generate indicates that the Index is a worthwhile investment of time, money, and resources for both Duke University and the Energy Initiative.

Financial Costs

The financial cost of the Index will comprise operational staff salaries, research and analysis personnel wages, and promotional expenditures. Fortunately, all of these costs are fixed, and therefore simple incorporate into a budget.

With respect to data sourcing, the Energy Initiative has already licensed two Bloomberg terminals, at an annual cost of $12,000. It is estimated that 60% of the use of these terminals will be dedicated to Eii research, bringing the annual cost to $7,200. Most capacity and demand data can be collected from free resources such as the U.S. Energy Information Administration and FERC.

The Energy Initiative would see more value in hiring a Program Coordinator than a director or higher-paid employee. Additionally, the Index would depend on student researchers, which through the Work-Study and Assistantship programs, would cost the Energy Initiative between $112 and $840 per student per semester.[69] In total, assuming two student-researchers per semester, this would cost approximately $2,000 annually. Finally, the Energy Initiative should act as a Masters Project client to future groups of Nicholas School students, which will provide approximately 900 hours of cost-free labor per academic year. This would save the Energy Initiative $27,000 annually, compared to the cost of a full time employee paid at the Program Coordinator level. During the initial stages of the index, the financial calculations will assume that a Program Coordinator will not be hired unless the index becomes a major project. All associated decision-making and operations will be delegated to existing Initiative administrators and future graduate students.

[69] "Work Study and Assistantships." Nicholas School of the Environment at Duke University. N.p., n.d. Web. <http://www.nicholas.duke.edu/programs/professional/finances/work-study-and-assistantships>.

The budget for marketing and promotion will be determined annually, and will include website maintenance, outreach to prospective users of the Index via email, and advertising.

Direct Revenue

Outreach to industry experts and potential customers has shown that charging a subscription fee to access Index figured directly would not be lucrative. Most other comparable indices are published freely via the Internet or through data vendors. However, the Energy Initiative may release a quarterly publication that interprets changes in the Index using research conducted by Duke University researchers. Outreach has shown that potential customers would be willing to pay for a subscription to this publication, if the Energy Initiative can demonstrate value.

Intangible Revenue

Two key purposes of the Energy Initiative are to attract highly esteemed faculty to Duke University and to draw more attention to the University as a preeminent center for energy data analytics. By publishing the Energy Investment Index, and thereby demonstrating real value to the business, academic, and policy communities, both of the goals can be accomplished. Duke University does not currently earn revenue from the publication of academic articles. However, references to Duke research can be considered a form of intangible revenue. Based on benchmarking against other universities that have published indices that serve a similar marketing function, an increase in publication downloads has resulted.

Funding

The Energy Initiative earns funding through the Provost's Office and through outside gifts, which are the result of satisfactory or exemplary performance. The University would be likely to provide additional funding to support this type of research, and gifts would be more likely as a result of an exciting project such as the Energy Investment Index.

External funding is also available for this type of initiative. The federal government provides grants through the Department of Energy and the National Science Foundation.

Financial Risks

The four major financial risks relate to funding, markets, operations, and data gathering. Although action must be taken to mitigate these risks, the potential benefits from launching the Energy Investment Index outweigh the potential downside.

Funding

Developing and operating the Eii will require a reliable source of funding, whether from the University's budget or from external grants. While the University funding may vary from year to year, it can be reasonably estimated in advance. External grants, on the other hand, will be less certain from year to year. Therefore, It will be important to incorporate uncertainty into the budget when considering available grant funds.

Markets

There are a number of external factors that might present risks to the Eii. If another competing index is developed, market share and influence might be compromised. However, it is unlikely that another index would be developed once the Eii gains recognition because it would be difficult to gain market share without differentiation. Additionally, changes in the markets might reduce uncertainty in the direction of the energy industry, which would reduce demand for an index like this.

Operations

Executing the implementation of the Index presents risks in that customers may come to expect releases of updated Index figures at regular intervals, and if operations do not function smoothly, for example, if researchers are not able to produce the quarterly report on time, this process could be delayed. In order to maintain the trust of customers, it will be important to efficiently and reliably match Index result publication with expected deadlines.

Data

The Eii may encounter challenges with accessing relevant data that can be used to generate Index output, such as not having access to private investment information or a discontinuation of data that vendors have provided in the past. It will be important to verify that all data collected are publishable in the form of an aggregated index.

Recommendation on the Allocation of Funds

Although the Eii does not promise to cover annual expenses with direct revenue generation, the stated goals of the Energy Initiative are to increase visibility of Duke University as a center for

energy data analysis, attract talented industry leaders as faculty, and contribute meaningfully to broader knowledge in the energy space. The value that the Eii will generate for these areas meets the stated goals.

9. Implementation

9.1 Next Steps and Project Timeline

The extent of this Master's Project was limited to market research, index scoping, and initial sector piloting of the Index, and there will still need to be significant development work done after the completion of this project. Work beyond the scope of this project that will need to be completed by subsequent researchers or Master's Project teams includes the following: research and development of energy sectors outside of the pilot sector; development of channel relationships for distribution of the index; procurement of data sources for all other index sectors; and marketing and communications surrounding the launch of the Index. Below is a tentative timeline for the aforementioned activities necessary for launch of the Index, but not covered under the scope of this Master's Project.

Development Timeline

Completed by January 1, 2014 (Under the current MP team)

Market research and positioning of the index among competitors

- Research and analysis of the competition within the energy index space
- Determination of value to be created through the addition of the Energy Investment Index

Determination of sectors and information to be included in the Index

- Enumerating and justifying the energy sectors that would be relevant to the Energy Investment Index
- Determining the granularity of information needed across sectors to provide value for customers
- Determining the availability and sources of information regarding energy investment and divestment

Structure of Index score and all sub-Indices

- Determination of how to synthesize information across sectors into specific categories
- Initial plan for analyzing different sectors across the driver categories

Piloting of initial sector (Natural Gas)

- Finding and sourcing information to be included in the Natural Gas sub-index
- Establishment of preliminary relationships with data providers to regularly access information

Completed by January 1, 2015

Development of the Oil, Wind, and Coal sectors

- Definition of sector level boundaries for inclusion
- Investigation and acquisition of data sources
- Re-evaluation and revision of initial weighting structure proposed by Dec. 2013 MP team

Predictive Analytics Development (tentative based on client wishes)

- Determination of appropriate length (balancing accuracy and market need)
- Development of predictive analytics or recruitment of Ph.D. statisticians for development
- Pilot predictive analytics for the four sectors completed
- SME / academic journal outreach for validation of predictive analytics

Completed by June 1, 2015

Development of remaining Index sectors (Solar, Biomass, R&D)

- Definition of sector level boundaries for inclusion
- Investigation and acquisition of data sources
- Re-evaluation and revision of weighting structure

Finalization of distribution channels and frequency of distribution

Creation of a marketing plan for the launch of the Index

Execution of pre-launch marketing / distribution plan

Targeted Launch Date: June 1, 2015

<u>Implementation timeline</u>

The index should be updated at regular intervals on the Duke University Energy Initiative website and Bloomberg to give access to both personal and professional users of the index. Additionally, the index should be released to the news media on a quarterly basis to increase visibility to the index to the general public. In addition to publishing of the index on a quarterly basis, in order to provide valuable information to investors, changes in the index should be explained in industry report published on a annual basis.

Quarterly (every 3 months)

Week 1 - Consolidation of data from the previous quarter

Week 2 - Analysis of previous quarter's data and drafting of the quarterly report

Week 2 - Internal review and vetting of the quarterly report to ensure accuracy

Week 3 - Publishing of the quarterly report & public phone call to discuss questions and implications

Week 3 - Archiving of the report within the Energy Initiative system and publicly

Annual Timeline (every 52 weeks)

Weeks 1 to 4 - Solicitation of comments and feedback from key users of the index

Weeks 1 to 4 - Evaluation of performance of index against the performance metrics listed below

Weeks 5 to 8 - Integration of user comments and revisions into the methodology of the index

Week 9 - Release of revised index based on user feedback and performance metrics

Weeks 41 to 44 - Collection and analysis of data for the "year in review" analysis document

Weeks 45 to 48 - Drafting and review of the "year in review" analysis document

Weeks 49 to 52 - Release of the "year in review" synopsis document

Annual Index Deliverables

- Quarterly updated index published online
- Annual report looking back at the change in the index (and sub-indices) over the past year and the implications of this for the energy industry
- Three Quarterly update reports with a snapshot of the index and quarterly analysis

9.2 Governance and Management

This recommendation uses the Deloitte governance operating model as the underlying framework for the management plan.[70]

Structure

Design

[70] "Developing an effective governance operating model". <http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/FSI/US_FSI_Developinganeffectivegovernance_031913.pdf>.

Because the Eii will not require a large staff, its organizational structure can be fairly simple. The Index should be governed by a management team, comprising the Energy Initiative Director, Richard Newell, the Director of Engagement and Administration, David Doctor, and the Energy Investment Index Program Coordinator, who will oversee a staff of both primary and secondary researchers. The Program Coordinator role may be assigned to an existing Energy Initiative Employee or hired externally.

Reporting

The Eii management team will be responsible for all communication with the broader Duke University community. The Program Coordinator will report to the Eii management team on behalf of the operational staff of the Index. The primary research staff will report directly to the Program Coordinator, and all secondary staff will report to the primary researchers.

Oversight Responsibilities

The management team will meet periodically, as determined by need. It will be responsible for guiding the direction and philosophy of the Index, creating policy for external communication, making financial decisions, and hiring staff when necessary. The Program Coordinator will be responsible for implementing the management team's decisions, acting as the liaison between the management team and the research staff, managing operation of the Index, and leading external communication. The primary research staff will comprise postdoctoral employees of the Energy Initiative who will play a large role in Index research, as determined by the Energy Initiative and Eii management team. They will be responsible for organizing and conducting the research necessary to compile the data used in the Index and sub-indices. When available, secondary researchers will be graduate students either employed at the Energy Initiative as work-study participants, assistantship participants, or students conducting their Masters Project at the Nicholas School of the Environment or the Sanford School of Public Policy. They will assist the primary researchers in gathering data and developing strategy as necessary.

Talent, Culture, and Infrastructure

Primary and secondary researchers will be hired as needed and in line with annual budget expectations. The research positions can be offered with the incentive that students will gain

skills using Bloomberg terminals and gaining insight into the complexities of capital investment in the energy industry through research. With regard to infrastructure, the Eii should operate within the existing framework of the Energy Initiative and take advantages of the resources already in place.

9.3 Research and Data Collection

Physical Investment vs. Financial Investment

There are two distinct ways that "investment" in the energy sector can be tracked: through financial or economic assets. Financial assets include the money invested in of energy companies (stocks, bonds, etc.), but that has little tangible impact on the ability of the company to produce energy. Economic assets, on the other hand, include new infrastructure and infrastructure expansions that allow the energy system to produce more. These economic assets can be measured in both financial terms ($2B invested in new natural gas pipeline capacity) or in physical capacity additions (13GW of new wind generation capacity in 2012). Although there are differences in the efficiency of financial capital invested in different sectors of the energy system, because of the comprehensive nature of the information available and the universality across different sectors, this index will focus specifically on *economic investment*. Focusing on the economic investment will allow the index to transcend sector boundaries to make comparisons and will give an implicit weighting of investment by current size within the market. In order to get this information, we recommend that the Index rely on public information in first year, and purchase a license for Ventyx Velocity Suite in the long-term.

9.4 Marketing Strategy

Three major goals of marketing are to acquire customers, maintain customers, and grow customer relationships. External marketing drives acquisition, and marketing through relationship-building with current customers drives maintenance and growth.[71] It will be necessary for the Eii management team to target external marketing channels deliberately, as well as maintain an open dialogue with key customers to ensure that all three goals are met.

News Media

[71] Lusch, Robert F, and Stephen L Vargo. "Service-dominant logic: reactions, reflections and refinements." *Marketing theory* 6.3 (2006): 360.

Upon launching the Index, the Energy Initiative should publicize itself through a major press release. In the age of the Internet, a press release is important because it provides digital content that will be searchable, thereby increasing traffic, improving visibility, and enabling virality, all at very low cost.[72] It will be important to include key words and phrases in the press release that will draw Internet searches to news articles that mention the Eii, such as: Energy Initiative, Duke University, predictive analytics, energy investment, and energy index. Finally, providing a link to the Eii website will increase Google rankings and increase Wikipedia page legitimacy.[73]

Digital Media

The Energy Initiative should create a website dedicated to the Eii that is searchable through Google, and it should prioritize increasing its PageRank in order to attract more traffic.[74] The website should include a summary of what the Index tracks, why the Index is valuable and legitimate, who might find it relevant, how it can be relevant, how often it is updated, and what the basic methodology for Index figure generation is. It should also provide contact information and links to any commentary on the Index through external publications. This format will provide interested parties an easily accessible resource for explaining the Eii.

Additionally, a Wikipedia page should be created to explain the Eii to a casual audience. Wikipedia articles are frequently the first results in a Google search, and they tend to provide legitimacy to the existence of an organization or product. However, in order to successfully create a Wikipedia page, the Index should be referenced in external publications, whether they are Duke University publications, academic papers, or newspaper articles.[75]

Direct Marketing

[72] "Why Press Release? The Importance of Press Release in Internet Marketing." Moweblecom. N.p., n.d. Web. <http://www.moweble.com/why-press-release-the-importance-of-press-release-in-internet-marketing.html>.
[73] "Statistics Highlighting the Importance of SEO Press Releases." PR Fuel Public Relations News PR Tips. N.p., n.d. Web. <http://www.ereleases.com/prfuel/statistics-seo-press-releases>.
[74] "Google PageRank: How To Improve PageRank - Google Guide." N.p., n.d. Web. <http://www.googleguide.com/improving_pagerank.html>.
[75] "Wikipedia for Marketing, Should Your Business Use It?" Social Fresh. N.p., n.d. Web. <http://socialfresh.com/wikipedia-marketing>.

The Energy Initiative should pursue dialogue with relevant industry leaders to promote the Index. Eii staff should contact representatives from each major customer group (e.g., finance, consulting, policy, and industry) to engage in a discussion about the Index and how it can be beneficial to the potential customer, in addition to providing promotional materials that give more details. This will increase visibility of the Index as well as establish direct communication with customers. Once communication channels are formed, the Energy Initiative should develop a process for seeking regular feedback from customers to improve the Index and make it as relevant as possible.

9.5 Distribution Channel

Partnership for Distribution Channels

According to Kash Rangan at the Harvard Business School, organizations that launch new products frequently discount the importance of establishing partnerships for distribution channels deliberately. Managers' primary concern is often getting a product to market, at the expense of ensuring that a partnership accomplishes the organization's broad goals in addition to its distribution needs[76]. For the Eii, the main goals are (1) making the Index available to as broad a number of industry professionals as possible, (2) ensuring that the source of data used to generate the Index does not prohibit publication, (3) retaining the right to publish the Index figures on the Energy Initiative website, and (4) partnering with a distributor that will enhance the visibility and legitimacy of the Index.

In addressing the first goal, the Eii should enter into any partnership negotiation with the intent to avoid providing exclusive distribution rights to any one partner. Similarly, to reach the largest audience, the Eii should be published by key influencers in non-overlapping sectors, such as finance, consulting, policy, and industry. Examples, respectively, of key partners in these sectors would be Bloomberg, McKinsey, the International Energy Agency, and the Oil & Gas Journal.

Distribution through Partners

[76] "The Promise of Channel Stewardship." HBS Working Knowledge. N.p., n.d. Web. <http://hbswk.hbs.edu/item/5375.html>.

Ideally, the Eii will be published through a major representative from each customer segment. By doing this, the Index will optimize its visibility, while still allowing key distribution partners to claim the semi-exclusive privilege to publish the data to their segment.

Finance

Publishing through a data vendor such as Bloomberg would allow the Index to reach the majority of financial industry consumers--over 315,000 people currently[77]--who would find information about energy investment useful. Searching the database for an identifying key word such as "EIIX" would allow investment professionals to track trends in the Eii quickly and easily.

Consulting

Partnering with a major consulting firm to release Index figures in a publication that it distributes to clients in the energy industry would allow the firm an advantage over its competitors as well as provide a targeted release of Eii numbers, thereby marketing the Energy Initiative to both consultants and industry professionals.

Industry Publication

Releasing Eii figures through industry publications such as the Oil & Gas Journal would target key energy professionals. However, it will be important to ensure that the publication chosen does not target a key sector within the industry at the expense of other sectors. The Oil & Gas Journal, for example, might alienate potential consumers within the solar or power sectors.

Policy Publication

Finally, it will be important to release the data directly to policy leaders. The International Energy Agency publishes a magazine biennially called Energy Technology Perspectives. However, it might be more useful to publish the figures directly through the Energy Information Administration's Twitter feed or other social media outlet.

Self-Publication

[77] Chozick, Amy, et al. "Privacy Breach on Bloomberg's Data Terminals". New York Times. 10 May 2013.<http://www.nytimes.com/2013/05/11/business/media/privacy-breach-on-bloombergs-data-terminals.html?pagewanted=all>.

In addition to publishing the Index through segment-specific partners, it will be important for the Energy Initiative to maintain the right to publish Eii results on its own website. In order to allow partners a degree of semi-exclusivity, the Energy Initiative might consider including a time delay between partner publications and its own website release.

9.6 Performance Measurement Strategy

In order to determine whether the index is having the intended effect, the Energy Initiative should track key metrics across all of the areas in which they hope the index will benefit the Initiative. Through discussions with Richard Newell and David Doctor of the Energy Initiative, we determined that there were five specific metrics that both directly and indirectly track the success of the index:

1. Agreement extensions of the distribution partners

   The extension agreements of the distribution partners are a clear indicator to the Initiative that the customers of those distribution partners find value in the publishing of the index. To this end, the Initiative should reach out to each of its distribution partner on a regular (suggested 6 month) basis, to ensure that they are satisfied that the Index is of value to its users.

2. The number of pageviews of the online publishing of the index

   Pageviews are a proxy indicator for both the penetration and the relevance of the indicator to the public, or people without access to private distribution channels. Because part of the mission of the index is to increase the flow of information to the public, and not just those with access to the private distribution channels, it is important that the Initiative realize if the public is consuming the Index. Increases in pageviews means that the people who are aware of the Index and find it useful to their personal investing decisions is growing.

3. Inquiries about the index, either through the online platform or the email notification

   The number of inquiries about the index is an indicator that people are interested in verifying the academic integrity of the Index or learning more about the publishing of the

Index. As such, the inquiry button can be an indicator of those who are more likely to use the Index on a regular basis, or as a tool to make important decisions about their investments.

4. Interest from index users in sponsorship of research dedicated to specific industry topics
   One of the goals of the Index is to foster increased interest in the existing and developing research around energy happening at Duke University. The extent to which users of the index are interested in donating money to fund ongoing or additional research at the University related to energy serves as a direct measure of the Index's effectiveness toward this goal.

5. Number of grants specifically for the further development of the Energy Investment Index
   Another direct measure of the effectiveness of the Index is the extent to which people seek to further the development of the index. Such interest is evidence that the Index is providing value to market participants and that the further development of the Index would add value to the market.

While these five metrics provide a simple baseline for the effectiveness of the Index and suit the scale of the current Index operation, there are many more indicators listed in Appendix 6 that are available to the Initiative if they feel that the current metrics are not adequately measuring the Index.

Timing of measurement

Each of these metrics should be evaluated on a quarterly basis so that, if needed, the index methodology, marketing, or distribution can be amended and the index republished as quickly as possible. As cited in the Implementation timeline above, these metrics should be collected at the beginning of the year, the index should be quickly amended as needed.

Glossary of Acronyms and Terms

ASCE – American Society of Civil Engineers

BNEF – Bloomberg New Energy Finance

CNG – Compressed Natural Gas

CO_2 – Carbon Dioxide

DUEI – Duke University Energy Initiative ("Energy Initiative" or "the Initiative")

EIA – Energy Information Administration

Eii – Duke University Energy Investment Index ("the Index")

EPA – The Environmental Protection Agency

FERC – Federal Energy Regulatory Commission

IEA – International Energy Agency

LNG – Liquified Natural Gas

MP – Masters Project

NG – Natural Gas

OECD – Organization for Economic Co-operation and Development

R&D – Research and Development

REN21 – Renewable Energy Policy Network for th 21st Century

USDOT - United States Department of Transportation

USDOE – United States Department of Energy

Appendices

Appendix 1: Pros and Cons of Financial and Physical Investment

Financial Investment Tracking

Pros	*Cons*
• Can easily compare investment in energy resources to investments outside of the energy sector. • Based on the type of investor, can determine the maturity of the market. • When combined with physical investment, can track the efficiency of capital • Can elucidate divestment from a sector and strategic shifts • Can show financial depreciation of goods (although not economic depreciation)	• Does not show the changes in the energy supply & demand relationship • When seen alone, is hard to measure the result of the investment for different technologies. • Can give undue weight to newer technologies that require more initial investment • Information could be shielded by private companies or within aggregate categories

Economic Investment Tracking

Pros	*Cons*
• Allows investors to track the change in ability to supply energy to the market • Can show bottlenecks within the energy generation, transmission, and distribution infrastructure • Can show the relative amount of energy able to be delivered to market and be compared with potential demand	• When seen alone, is hard to measure the return of the investment for different technologies. • Doesn't track the different types of investors who are demanding the construction/destruction. • Does not take into account research and development investment that could be used as an indicator • Does not take into account the opportunity cost of capital

Appendix 2: Alternative tracking metrics

Increase in Energy Initiative awareness

Awareness of the Duke University Energy Initiative can lead to further interest in the research and analysis that Duke is generating in the areas of energy and energy data analytics. The team has defined increased awareness of the Energy Initiative as increased interest in the activities and

research of the Energy Initiative. The below metrics are indicators that the Energy Initiative can track to determine track changes in the public awareness of the initiative.

- The trend in usage of the term "Duke University Energy Initiative," "Duke Energy Initiative," and "Energy Initiative" on Google Trends[78] (Sample report in appendix 8)
- The number of hits to the Energy Initiative website, which can be tracked through Google Analytics[79] and other tool (Sample report in appendix)
- Increase in the number of inquiries to the energy initiative mailbox
- Phone survey of stakeholders (sample questionnaire in appendix)

While, for the first three metrics, it will be hard to create a causal link between the creation of the Energy Investment Index, the Index is meant to be one piece in a campaign to increase the awareness of the Energy Initiative.

Increase in Duke awareness

Another potential outcome of the index is an increase in the awareness of Duke University's brand. While it would be redundant for the Energy Initiative to track these metrics, as they are already being tracked by the University, the Initiative should reference these metrics in relation to the other metrics being proposed to determine whether the Index, and the Energy Initiative, is helping to increase the brand Duke University. A few of Duke University's overall metrics of brand awareness are listed below.

- University ranking in US News & World Report[80]
- University ranking in Forbes Magazine[81]
- University ranking in The Princeton Review[82]

[78] "Google Trends - Hot Searches." N.p., n.d. Web. <http://www.google.com/trends>.
[79] "Analytics." Google. N.p., n.d. Web. <http://www.google.com/analytics/>.
[80] "National University Rankings." US News & World Report. N.p., n.d. Web. <http://colleges.usnews.rankingsandreviews.com/best-colleges/rankings/national-universities>.
[81] "Duke University." Forbes Magazine, n.d. Web. <http://www.forbes.com/colleges/duke-university/>.
[82] "The Princeton Review's College Ranking Lists Are Here!" College Rankings. N.p., n.d. Web. <http://www.princetonreview.com/college-rankings.aspx>.

- University ranking in the Center for Measuring University Performance's Top research institutions[83]
- Application acceptance rate across undergraduate and graduate schools
- Recognition of the Duke Brand among industry professionals

Increase rankings among these metrics will show an increase in the brand of Duke University. While changes in these metrics are a combination of many different factors, in that the Index will bring the Duke brand to a wider audience than may have been reached before, there will certainly be an indirect impact on University brand.

Increase in demand for ancillary energy research

Increased recognition of the Duke University Energy Initiative among professionals who need energy information has the potential to increase the amount of Duke research that is consumed and used in making market decisions. For example, for industry professionals who use the Investment Index for everyday investment decisions, Duke University will be top-of-mind when they need more information about specific issues facing the energy sector. Below are a few metrics that should be tracked to determine whether the Energy Investment Index is helping to drive Energy research demand.

- Number of downloads of energy-related research
- Geographic diversity of downloads of energy research
- Number of requests for additional research or insight through the energy initiative's email address.
- Interest from market professionals in sponsorship of research dedicated to specific industry topics

Increase in grants and donations to the Energy Initiative and energy research at Duke

By increasing awareness of the Energy Initiative and showing the value of the Initiative in providing information to the market, there are a larger number of people who may be interested

[83] "The Top American Research Universities." Research- The Center for Measuring University Performance. N.p., n.d. Web. <http://mup.asu.edu/research.html>.

in giving money. If the index is well received, then many market participants will be willing to donate to the Initiative directly, or may be willing to sponsor the initiative.

- Number of grants received by Duke University Energy Researchers
- Donations received by the Energy Initiative
- Number of grants specifically for the further development of the Energy Investment Index
- Interest in sponsorship of the Energy Initiative's events and speaker series

Increase in the awareness and use of the Energy Investment Index

Perhaps the most direct metric that the Energy Initiative should track to measure the Energy Investment Index is the awareness among market professionals of the Index itself. This metric will directly indicate how far into the market of targeted users the index has penetrated and how well the marketing and distribution channels chosen are functioning. Underperformance on any of the metrics below should cause the Energy Initiative to assess the strategy for marketing and distribution to ensure that the Index is getting to the market participants who would benefit the most from the creation of the index.

- Phone interview of relevant market participants (see appendix for list of potential market participants).
- Number of hits to the Energy Investment Index website
- Number of searches for the Energy Investment Index Bloomberg Ticker, EIIX (both on Bloomberg and on search engines)
- Number of citations of the Energy Investment Index in investment prospectus, industry reports, and academic work

Cost Efficiency of the Energy Investment Index

While it is important to measure the effect of the Energy Investment Index on the University and market professionals, it is also important to determine whether the benefits of the index are outweighing the cost that the Initiative is incurring to produce the Index. This measurement is complicated by the inherently indirect benefit that is being gained by Duke University and the Energy Initiative from the creation of the Index. However, through cost comparisons against

other research-based index initiatives, the University can better understand if they are producing the Index at a cost similar to other similar Indices. Below are a few metrics that will help the Initiative understand the index's relative cost performance.

- Phone interviews with other academic Indices (contact information listed in appendix; potential question list presented in appendix)
- Tracking of the percentage of budget being occupied by the index as compared to the change in benefit metrics listed above.

Appendix 3: Sample Phone Script

Thank you for taking the time to talk with me this morning/afternoon. As my previous email said, I'm a graduate researcher working with Duke University to develop an energy investment index, and I've reached out to you to understand how this index can be useful to your business.

But first, let me give you some background about the larger context of the project. For years, Duke has been a preeminent research institution, and has been working on energy research related to engineering, the environment, policy, and business. Two years ago, as a part of a university wide initiative, the Duke University Energy Initiative was created to bring all this research together and provide a center for energy education.

Specifically, **The Duke University Energy Initiative** is focused on educating future leaders, researching to find solutions, and engaging with business and policy decision makers to address three major energy challenges:

1. Meeting growing energy demand to support a competitive and prosperous economy
2. Reducing the environmental footprint of energy
3. Addressing energy security concerns

The Initiative aims to be the premier center for energy data analytics. To achieve this objective, the Initiative plans to develop and offer a set of proprietary tools to help industry professionals

better understand the whole energy picture and make progress on the our greatest energy challenges.

Do you have any questions about the Energy Initiative?

[STOP & VALIDATE, OR GIVE OPT-OUT OPTION]

Now that you have an idea of what the Energy Initiative does, let me introduce you to our work. One of the most exciting projects within the energy initiative is the **Duke University Energy Investment Index** (also known as the Eii). We're still in the research phase, but essentially the Eii will serve as an indicator of capital investment in the energy sector based on current and historic levels of investment. Just like the Case-Schiller Home Price Index collects large amounts of data about home sales to understand the current state of the housing market, so will the Energy Investment Index collect data from various sources across all sectors of the energy economy to understand the energy sector. As an example, the index will track investment and divestment in the natural gas value chain, from exploration and production to field services and distribution, which will give us an extensive and exhaustive understanding of the present state of the system.

Do you understand what additional investment information Duke hopes to provide the energy industry by developing this index? [Keep explaining until yes] Great. Will you spend fifteen more minutes with us answering a few questions about the industry and sharing your thoughts on how this index could be useful to a company like yours?

[STOP & VALIDATE, OR GIVE OPT-OUT OPTION]

Great; thank you. We believe the Eii has the potential to add value to businesses, such as {company name}, by tracking the path of the energy industry through the growth and contraction of specific sectors. We've reached out to you for this discussion because we want to develop this index with the future users in mind. We'd like to get an idea of how {company name} currently tracks capital investment across the energy industry and what energy investment information is valuable for {company name}.

Are you ready to get started?