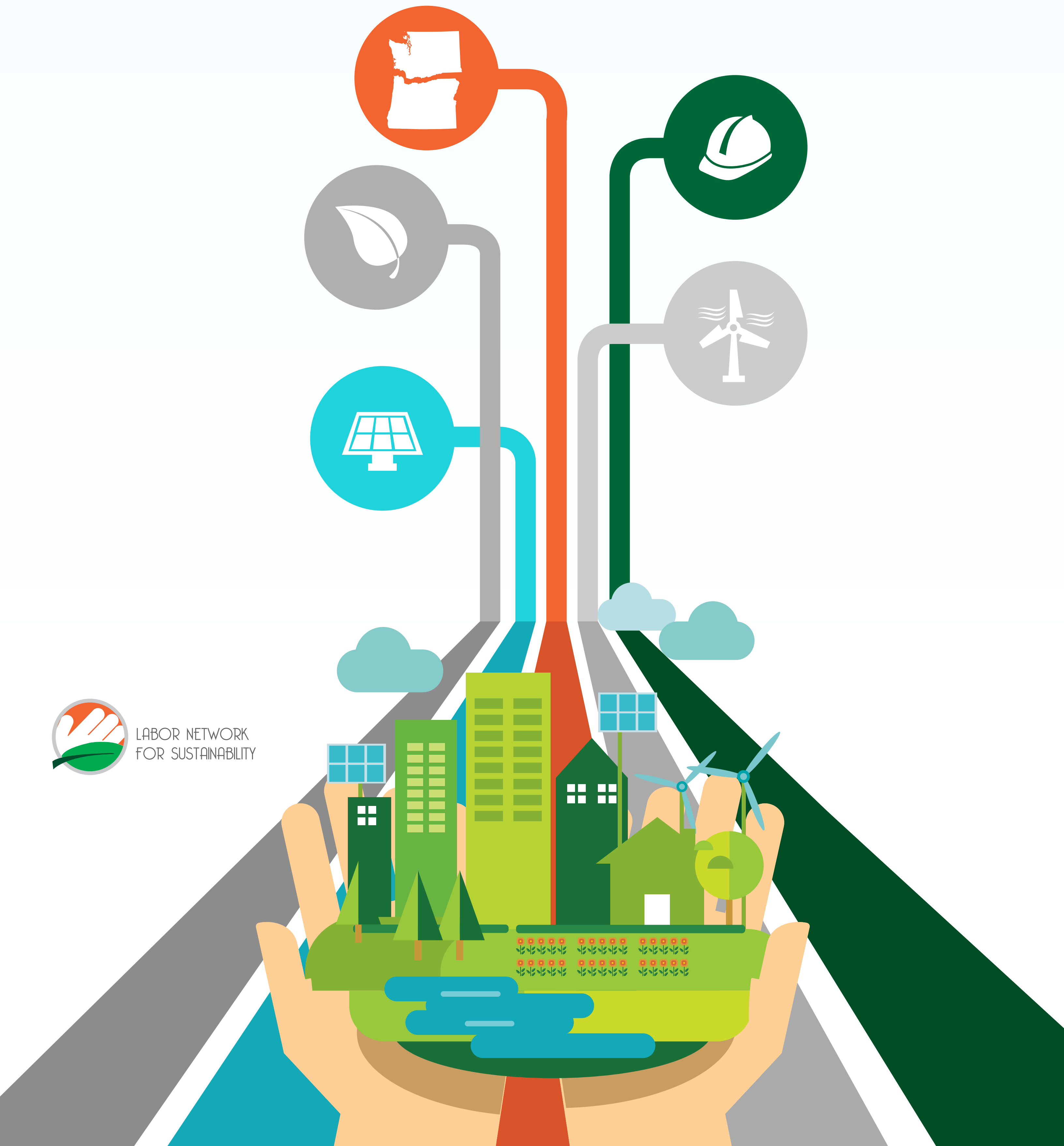
THE ECONOMIC IMPACT OF CLEAN ENERGY INVESTMENTS IN THE PACIFIC NORTHWEST: ALTERNATIVES TO FOSSIL FUEL EXPORTS



LABOR NETWORK FOR SUSTAINABILITY

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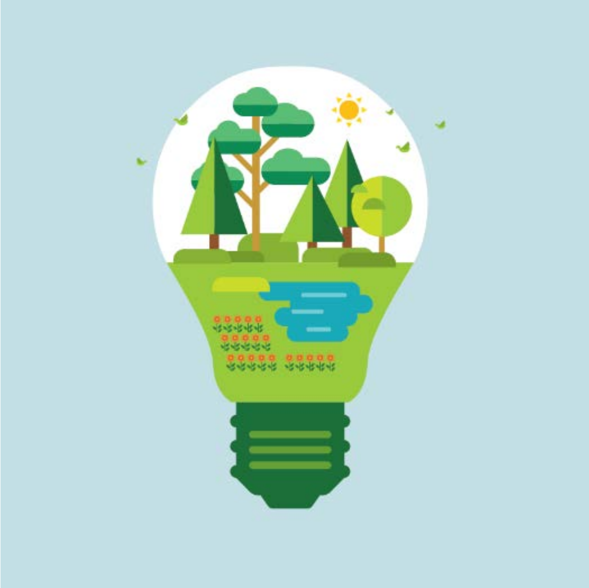
Introduction: Jobs for Hard-Hit Communities



In 2015, The Labor Network for Sustainability[1] released its "Clean Energy Future" report showing that the US could reduce its greenhouse gas emissions 80% by 2050 – and increase jobs and save money in the process.[2] It showed this will benefit the US economy, US workers, and US consumers. But throughout American there are communities, often devastated by deindustrialization and runaway employers, that face high levels of unemployment and poverty. Likewise there are skilled workers who would like to find work in their trades but instead face chronic unemployment. For such communities and workers, the possibility of jobs building and running coal, oil, and gas infrastructure often seems like a ray of hope. Those who seek to halt new fossil fuel infrastructure can easily appear as a threat to their future.

Grays Harbor County in western Washington is a case in point. Once a lumber processor and exporter, the largely rural county now suffers from high rates of poverty; a 9% unemployment rate; jobless lumber workers; and increasing numbers of workers who have simply given up even looking for work.[3] A consortium of three companies has proposed to greatly expand the Grays Harbor Westway and Imperium crude oil storage and export terminal to ship oil brought by train from Utah to Asia. The project is estimated to create 231 construction jobs over the year or so it will take to build, and thereafter provide 148 operations jobs as long as it is open.

Yet despite the county's great need for jobs, in 2014 the city council of its principal city, Aberdeen, voted unanimously to oppose the transport of crude oil by rail through the city. They found that just in the first quarter of 2015 there had been "several explosions and fires of rail-borne tank cars carrying crude oil" and that the city has "very serious concerns about the safety of the public, public services, and public infrastructure," all of which would be "placed in serious jeopardy" by the addition of new petroleum storage and sales facilities. The city council decided that "the development of additional and expanded crude petroleum facilities is contrary to the health, safety, and welfare of its citizens and business community, the economy of the entire Grays Harbor estuary, and is inconsistent with the City's newly adopted planning goals of reconnecting its commercial, retail, and residential communities with the waterfront."[4]

[1] The Labor Network for Sustainability (http://www.labor4sustainabilty.org) was founded in 2009 based on an understanding that long-term sustainability cannot be achieved without environmental protection, economic fairness, and social justice. LNS believes we all need to be able to make a living on a living planet.
[2] Labor Network for Sustainability, "The Clean Energy Future: Protecting the Climate, Creating Jobs, and Saving Money" http://www.labor4sustainability.org/wp-content/uploads/2015/10/cleanenergy_10212015_main.pdf
[3] https://fortress.wa.gov/esd/employmentdata/reports-publications/regional-reports/county-profiles/grays-Harbor-county-profile
[4] "A resolution adopting findings of fact in support of the six month moratorium imposed on crude oil facilities in the city of Aberdeen, Washington." Passed and approved on September 9, 2015. http://www.aberdeenwa.gov/wp-content/uploads/minutes-agendas-newsletters/Agenda_2015-09-09.pdf

Whenever there is opposition to a pipeline, power plant, oil well, or other fossil fuel project, it raises a legitimate question: Where are the people who would have built and operated them going to find jobs? The answer is often given that clean energy creates more jobs than the fossil fuel projects it replaces. This is true, but can it help the people of America's Grays Harbors?

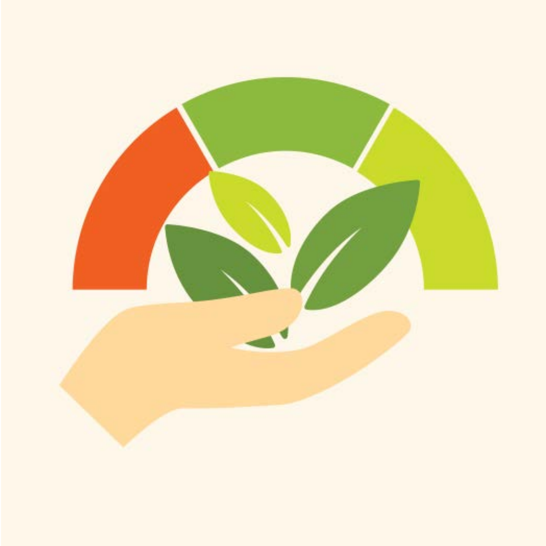
This report, "The Economic Impact of Clean Energy Investments in the Pacific Northwest: Alternatives to Fossil Fuel Exports," was prepared by Noah Enelow of Ecotrust Knowledge Systems,[5] with introduction and conclusion prepared by the Labor Network for Sustainability.

It shows how more jobs can be created through clean energy than through the proposed oil terminal and storage facility. It compares the proposed oil facility with two clean energy projects. The first is a 40 MW utility-scale solar photovoltaic array. The second is an energy efficiency program designed to reduce residential energy wastage and thereby reduce energy demand and consumer utility costs. These two projects would cost about as much as the proposed oil facility, *but would create far more jobs*.

We hope this report will be helpful for people in the affected communities of western Washington who want to ensure jobs and prosperity without the threat of a dangerous, polluting, climate-destroying coal export facility. We also hope it offers a model for constructing economic alternatives to fossil fuel infrastructure that can be drawn on by people in similar situations all around the region and the country to devise plans for their own communities. For both we hope it will show that there are alternatives to depending on fossil fuel expansion for jobs.

[5] The mission of Ecotrust (http://www.ecotrust.org) is to inspire fresh thinking that creates economic opportunity, social equity, and environmental wellbeing.

1. Background



With increasing global demand for fossil fuels from countries spanning the Pacific Rim, the Pacific Northwest is experiencing a dramatic rise in the demand for expansion of existing infrastructure, as well as new construction of terminals, storage tanks, pipelines, and rail and barge traffic.

The proposed fossil fuel transport and export projects in the Pacific Northwest have been supported in part in the expectation that they will create jobs and revitalize struggling economies up and down the Northwest coast. Are there alternative ways to do so?

In this study, we start by analyzing a sample fossil fuel infrastructure project. The particular project was chosen from the large array of proposed or planned projects in the Northwest because information about its costs and impacts is available from other studies. We will compare its projected job creation impact, using the results of studies developed by regional economic analysis firm ECONorthwest (Kitchen, Krebs and Whelan 2013), with the projected impact of a hypothetical renewable energy investment of comparable size in the same region, using the Jobs and Economic Development Impact (JEDI) model developed by the National Renewable Energy Laboratory (NREL). This thought experiment will allow us to answer the question of whether the proposed investments in fossil fuel export terminals are the best economic development option for the Pacific Northwest region.

This study demonstrates that investments in renewable energy and energy efficiency create more jobs per dollar of investment than fossil fuel infrastructure investments. Specifically, a portfolio of targeted investments in renewable energy such as solar and wind, complemented by energy efficiency upgrades for businesses and homes in the Pacific Northwest, can generate a greater number of jobs in construction, transportation, supply chains, and operations and maintenance (O&M) than a similar dollar investment in oil, coal, and natural gas infrastructure in this region.

2. Sample Fossil Fuel Project: Westway/Imperium

The Westway and Imperium crude oil storage and export terminal expansion projects in Grays Harbor County, Washington, is the fossil fuel project we have chosen to use as a benchmark comparison to a potential renewable energy investment of similar size. The project is a composite of two storage and export terminal expansions, Westway and Imperium. The original proposal also entailed the conversion of Imperium's storage facility, which formerly contained only biodiesel, to be able to contain crude oil.[6]

[6] In a recent development, the company that owns a majority stake in Imperium Renewables, Renewable Energy Group, Inc. (Business Wire 2015), canceled its plans to ship crude oil through its terminal, though its plans for expanding its existing biodiesel storage capacity are still in effect (Gonzalez 2016).

We chose this project for three main reasons. First, it is a proposed project that is currently nearing the end of a lengthy and controversial permitting process. The project has been opposed legally by the Quinault Indian Nation, whose livelihoods would be negatively affected by the facilities' expansion (Resource Dimensions 2015, Powell and De Place 2015). In 2014, the city council of Aberdeen, WA, voted unanimously to oppose the transport of crude oil by rail through the city (Hart 2014). Second, the project involves multiple forms of fossil fuel infrastructure including storage tanks, rail spurs, pipelines, and marine port services, making it an apt representative project for the region. Third, an economic analysis of the projected impacts of the Westway-Imperium project exists (Kitchen, Krebs and Whelan 2013), whereas for most of the other proposed fossil fuel projects, no such study exists.

The construction of the Westway and Imperium oil export terminals is expected to cost $106.9 million, of which $62.2 million is expected to be spent within the state of Washington. Table 1 below presents projected estimates of the number of jobs that Westway and Imperium are projected to create, based on the ECONorthwest economic impact analysis from 2013 (Kitchen, Krebs and Whelan 2013). The estimates are presented for each of the two phases of the project: construction and operations. The construction period is expected to last 9-16 months, while the operations phase continues indefinitely. The operations costs include all direct spending associated with the terminals and related marine and rail services. Likewise, the operations jobs reflect those created at the terminals, as well as those created for the provision of marine and rail services. All job estimates are counted in full-time person-years. While the construction jobs only last one year each, the operations jobs last as long as the terminals are in operation. The data in Table 1 are updated from 2013 USD to 2015 USD, using the Producer Price Index (PPI) for NAICS sector 4861, Pipeline Transportation of Crude Oil (BLS 2016).

For in-state spending, we assume that the only spending occurring in-state consists of the payroll, utilities, services, and leasing data provided in the economic analysis (Kitchen, Krebs and Whelan 2013). Since some raw materials, parts, and components used in everyday operations and maintenance are also likely to be sourced in-state, this spending figure is a lower-bound estimate. The total construction jobs per $1 million invested, displayed in the third row, rightmost column of the table, is thus an upper-bound estimate.

Project Phrase	Total Cost	In-State Cost	Direct Jobs/Year	Total Jobs/Year	Total Construction Jobs/ $1 Million Invested Locally
Construction	$118,041,921	$68,629,373	231	758	11
Operations	$107,920,865	$27,583,228	148	303	11

Table 1. Projected Job Creation Impacts: Westway and Imperium Crude Oil Bulk Storage and Export Terminals

Three points are worth noting related to the results presented in Table 1. First, the table shows that the one-year construction phase of the project creates many more total jobs than the multi-year operations phase (758 vs. 303). Second, the study that generated these figures assumes that the project will operate at full capacity for its entire lifetime. The possibilities of increases in oil extraction costs, fluctuations in global demand for U.S. crude oil exports, and public policies that discourage oil consumption (such as a carbon tax or cap-and-trade), all entail that the terminals may operate at below full capacity in some years, reducing the number of operations jobs created or maintained at the terminals. In other words, it's likely that the predicted number of operations jobs will only be accurate in "good" years where global oil export demand is high; in "bad" years where demand is low, some of the workers at the terminal or related service industries will be laid off. The job creation figures for the operations phase of the project must thus be viewed as upper-bound, *best-case* scenario estimates.

Third, the results presented below also omit any jobs that may be *destroyed* by the expanded oil transport related to the building of the terminals. These jobs would exist in sectors negatively affected by oil train transport and the related dangers to natural resources and infrastructure due to explosions, derailments, and spills, as well as everyday increases in train traffic. The sectors that stand to lose out from the oil terminals include commercial and recreational fishing, tourism and hospitality, and local commerce and retail. The job creation figures for the project as a whole must thus be viewed as *gross* (as opposed to *net*) estimates, that fail to take into account the *opportunity cost* of the oil terminal expansion – the value of what must be given up in order to have the terminals.

What kinds of jobs will be created by the proposed Westway and Imperium terminals? Will they be predominantly administrative, managerial, and scientific; or will they also include significant numbers of construction, installation, transportation, and maintenance jobs? Table 2 below provides an estimate of the breakdown of *direct* jobs created, sorted by job category, during the construction phase of the Westway and Imperium terminals and pipeline.[7] We estimate job categories for the construction phase of the project from the Industry-Occupation matrix dataset (Bureau of Labor Statistics 2012), published every ten years by the Bureau of Labor Statistics (BLS). The best proxy for the construction phase of the Westway-Imperium project is the industry category labeled "Other Heavy and Civil Engineering Construction", which is given the six-digit code 237900 under the North American Industrial Classification System (NAICS).

From Table 2 below we can see, not surprisingly, that construction and extraction occupations are predicted to comprise a majority (59.4%) of the jobs generated by the construction phase of the Westway-Imperium project. We can also see that transportation and material moving occupations comprise 7.0% of total jobs; installation, maintenance and repair occupations comprise 5.0% of jobs; and production occupations comprise 2.6% of jobs.

Category	**Percentage of Industry**	**Number of Direct Jobs**
Construction and extraction occupations	59.4%	137
Installation, maintenance, and repair occupations	5.0%	12
Production occupations	2.6%	6
Transportation and material moving occupations	7.0%	16
All other job categories	26.0%	60
TOTAL	**100.0%**	**231**

Table 2. Direct Job Breakdown by Top Level Occupational Category, Construction Phase, Westway and Imperium
Source: Bureau of Labor Statistics (2012); Kitchen, Krebs, and Whelan (2013)

[7] We do not have data on the industrial sectors in which the additional (indirect and induced) jobs will be created during the construction phase of the project; hence, we cannot identify the occupational categories for these jobs without replicating the original study.

What kinds of jobs are expected to be created in the operations phase of the Westway-Imperium project? Table 3 below presents the corresponding direct job breakdown using three Industry-Occupation matrices. For the employment at the terminals, we use NAICS category 424710, Petroleum Bulk Stations and Terminals. For related employment in marine services at the port, we use NAICS 488300, Support Activities for Water Transport. For rail-related services, we use NAICS 488200, Support Activities for Rail Transport. (Bureau of Labor Statistics 2012).

From Table 3 below we can see that the largest single occupational category is Transportation and Material Moving Occupations, comprising 85 of the 148 direct jobs. The other major industrial job categories create smaller numbers of jobs. The total number of direct permanent jobs created in the categories of installation, maintenance and repair, production, construction and extraction total only 24. The remainder of the jobs created directly by the operations phase of this project (41 direct jobs) include office-based administrative work, sales and related support, managerial, financial, and technical job categories.

	Terminals		**Marine Services**		**Rail Transport**		**Total**
Job Type	% Jobs	# Jobs	% Jobs	# Jobs	% Jobs	# Jobs	# Jobs
Transportation and material moving occupations	38.3%	17	70.9%	52	48.1%	14	83
Installation, maintenance, & repair occupations	5.8%	3	9.0%	7	26.0%	8	18
Production occupations	3.1%	1	2.6%	2	7.9%	2	5
Construction and extraction occupations	0.2%	0	0.6%	0	2.8%	1	1
All other occupations	52.6%	24	16.9%	12	15.2%	5	41
TOTAL	**100.0%**	**45**	**100.0%**	**73**	**100.0%**	**30**	**148**

Table 3. Direct Job Breakdown by Top Level Occupational Category, Operations Phase, Westway and Imperium

Table 4 presents a comparison of the job creation between the construction and operations phases of Westway and Imperium. If we sum the jobs created in the four top categories of occupations above, we see that whereas the construction phase creates 171 of these jobs for one year, the operations phase creates 107 long-term jobs, assuming the terminals are operating at full capacity. We can conclude that the Westway-Imperium project promises to create a relatively larger number of direct jobs in the construction phase than in the operations and maintenance phase. We will now compare these job figures to those of a hypothetical renewable energy project undertaken at similar scale.

Job Type	Construction Phase	Operations Phase
Transportation and material moving occupations	16	83
Installation, maintenance, and repair occupations	12	18
Production occupations	6	5
Construction and extraction occupations	137	1
All other occupations	60	41
TOTAL	**231**	**148**

Table 4. Comparison of Direct Job Breakdown by Occupational Category, Construction and Operations Phases, Westway and Imperium

3. Renewable Energy Scenario: Utility-Scale Solar PV

For our sample renewable energy project, we have chosen to model a utility-scale solar photovoltaic (PV) facility, located in the state of Washington. Solar energy is one of the fastest-growing energy sectors in the United States, in terms of both installed capacity and job creation. In 2015, solar and wind power accounted for 60 percent of new U.S. power capacity, and are expected to account for 70 percent in 2016 (Koch 2016). Prices for solar power have fallen by 60 percent since 2008. In a rare show of bipartisan cooperation, the United States Congress recently voted to extend the renewable energy production tax credits for another five years, which Bloomberg New Energy Finance (BNEF) expects will boost solar power capacity by an additional 20 gigawatts (GW) over the next five years (Randall 2015). Solar and wind power have surged even as fossil fuel prices have fallen, due to a combination of government incentives, strong consumer demand, and increasing cost competitiveness with fossil fuels. A recent Bloomberg article predicts, "By the time the new tax credits expire, solar and wind will be the cheapest forms of new electricity in many states across the U.S." (Randall 2015).

We predict the job creation and economic development impact of a utility-scale solar PV array using the Jobs and Economic Development Impacts (JEDI) model developed by the National Renewable Energy Laboratory (NREL), a public research institute and think tank based in Golden, CO. The JEDI models are Excel-based economic impact models that use fixed production coefficients to predict the impacts of renewable and non-renewable energy projects in each of the 50 states (National Renewable Energy Laboratory 2015). Renewable energy projects include onshore and off-shore wind, solar photovoltaics (PV), and cellulosic biomass-based ethanol.

We assume a utility scale, photovoltaic (PV) solar array of 40 MW nameplate capacity, which is approximately the average size of a utility-scale solar project in the United States as of 2014 (Bolinger and Seel 2015). We assume that the solar panels are made of crystalline silicon and arranged in a fixed mount pattern (National Renewable Energy Laboratory 2015). We assume that the mounting, the modules, and the electrical components are manufactured in-state, and the solar inverter is manufactured out of state. We assume that 50% of all materials and equipment by value are sourced through in-state suppliers; 100% of labor for installation, operations and maintenance is sourced in-state; and 50% of business overhead is spent in-state.

Table 5 below provides projections of the total cost, in-state spending, and direct and total annual jobs created by the solar array described above. Three results are worth noting. First, the total cost and in-state investment spending in the construction phase are both much larger than in the operations phase. Second, as in the case of the oil export terminal above, the direct and total jobs created by the construction phase are much larger than in the operations phase. Third, the operations phase creates a very small number of total jobs per $1 million of in-state spending. This result stems from the fact that the vast majority of spending during the operations phase of the project consists of debt service payments; the actual operational costs of the facility total $797,200, of which $733,424 is spent in-state. The number of direct and total jobs created per $1 million of in-state operational costs alone is quite large (9.5 direct jobs and *53.2 total jobs* per $1 million).

Project Phrase	Total Cost	In-State Spending	Direct Jobs/Year	Direct Jobs/ $1 Million In-State Spending	Total Jobs/Year	Total Construction Jobs/ $1 Million Invested Locally
Construction	$194,753,791	$109,920,707	478	4.3	1,114	10.1
Operations	$23,388,640	$23,324,864	7	0.3	39	1.67

Table 5. Projected Job Creation Impacts: Utility-Scale Solar Photovoltaic Array, 40 MW Nameplate Capacity, Washington State

Table 6 below provides the breakdown of construction jobs from the solar array. We find that 478 of these jobs are in construction or construction related services. These jobs comprise 43% of those created during the construction phase of the solar array. Indirect jobs created through sourcing and manufacturing of solar energy parts and components comprises an additional 409 jobs, or 37% of total jobs created. A large number of these indirect jobs will be created in manufacturing industries.

Impact Type	Jobs	Earnings ($ Million)	Output ($ Million)
Direct: Construction Labor	274	$17.75	-
Direct: Construction Related Services	204	$12.12	-
Subtotal: Direct	478	$29.86	$40.78
Indirect: Equipment and Supply Chain	409	$29.95	$122.17
Induced Impacts	226	$13.6	$54.89
Direct: Construction Labor	274	$17.75	-
Direct: Construction Related Services	204	$12.12	-

Table 6. Projected Job Breakdown, 40 MW Solar PV Array, Construction Phase

Table 7 below provides a comparison of the jobs breakdown of the construction phases of the proposed Westway/Imperium project and the hypothetical solar array. The results are clear: the solar array would create many more jobs, including many more construction jobs, than the oil terminals. The solar array would create 247 more construction or construction-related jobs, 147 more indirect, supply chain-related jobs, and 356 more total jobs, than the oil terminals.

Impact Type	Westway/Imperium	Solar PV Utility (JEDI)	Difference
Construction	137	274	137
Construction-related services	94	204	110
Subtotal: Direct	231	478	247
Indirect (Equipment / Supply Chain)	262	409	147
Induced Impacts	265	226	-39
Total: Direct, Indirect, and Induced	758	1,114	356

Table 7. Job Creation Comparisons, Construction Phase, Westway/Imperium vs. Solar Array

Table 8 below provides the results of the JEDI model for the operations phase of the solar array. These figures reveal a relatively small number of direct and total operations jobs. Every year the plant is in operation, assuming it is running at full capacity, it would create 39 total jobs, of which 7 would be direct jobs created on-site. The project would also create 17 indirect supply-chain related jobs.
Table 8. Projected Job Breakdown, Operations Phase, Solar Array

Impact Type	Westway/Imperium	Solar PV Utility (JEDI)	Difference
Direct: Onsite Operation Labor	7	$0.44	$0.44
Indirect: Local Revenue / Supply Chain	17	$1.13	$3.31
Induced Impacts	15	$0.89	$2.59
Total Impacts: Direct, Indirect, and Induced	39	$2.47	$6.36

Table 8. Projected Job Breakdown, Operations Phase, Solar Array

Table 9 below compares the operations jobs created by the solar array with those created by Westway/Imperium. Clearly the solar plant operations are insufficient to generate the number of jobs, year after year, that Westway/Imperium would create. This result suggests that investments in additional clean energy capacity must be ongoing, rather than one-time-only, to compete with investments in fossil fuel infrastructure. The following section of this study demonstrates that a complementary investment in energy efficiency upgrades can provide a larger number of jobs than those that would be created by a fossil fuel project such as Westway/Imperium.

Impact Type	Westway/Imperium	Solar PV Utility (JEDI)	Difference
Direct	148	7	-91
Indirect	87	17	-70
Induced	69	15	-54
Total Impacts (Direct, Indirect, Induced)	304	39	-265

Table 9. Job Creation Comparisons, Operations Phase, Westway/Imperium vs. Solar Array

4. ENERGY EFFICIENCY: A COMPLEMENTARY INVESTMENT

As the previous section makes clear, the solar PV scenario presented in this study creates fewer operations jobs than the Westway/Imperium terminals. However, evidence from the Pacific Northwest and around the country suggests that a complementary annual investment in *energy efficiency*, at the scale of the operations cost of the Westway and Imperium terminals, would provide a greater number of total operations jobs than those created by the terminals. Energy efficiency measures and practices refer to actions taken to improve the energy performance of commercial and residential buildings, such as retrofitting less efficient equipment, installing better insulation, and improving maintenance practices, among many other options (Anderson, et al. 2014).

Energy efficiency measures create jobs in three different ways. First, investment spending on energy efficiency construction, retrofitting, installation, and maintenance creates jobs directly, which have a ripple effect throughout the economy. Second, energy efficiency measures lead to household utility cost savings, freeing up funds that can be spent on other sectors that tend to create more jobs, per unit of spending, than energy sectors. In other words, when households save money on lower utility bills, they spend that money on other goods and services (such as food, entertainment, and transportation). These goods and services tend to be more labor-intensive than energy or utilities sectors, which are relatively capital-intensive; consumer spending out of energy savings thus creates more jobs than spending on utility bills. Third, increasing the efficiency of energy resource use increases productivity growth, which leads to increases in overall economic prosperity over time, as measured by GDP as well as other indicators (Whelan, Krebs and Morgan 2013).

The economic impact of energy efficiency investments has been measured in a variety of geographical and policy contexts. These include (proposed) municipal financing programs such as Property Assessed Clean Energy (PACE) (Pozdena and Josephson 2011, Multnomah County 2015), statewide incentive programs including Energy Trust of Oregon (ETO) (Josephson 2014), total statewide investments in residential and commercial energy efficiency (Whelan, Krebs and Morgan 2013) and national-level estimates of aggregate investments in energy efficiency measures (Anderson, et al. 2014). Examining the economic impact of energy efficiency investments using PACE financing, Pozdena and Josephson (2011) find that for each $1 million of investment, these programs create 5 to 8 jobs *within the municipality (town or city)* in which the programs are located, and a whopping *60 total jobs* within the United States as a whole. Importantly, these job creation impact estimates do not count the positive impacts of households' reallocation of spending due to savings on utility bills. A recent analysis from ECONorthwest (Whelan, Krebs and Morgan 2013) estimated that for each $1 million in cost savings from reduced utility bills in the State of Oregon due to energy efficiency, a total of *7.5 net jobs* were created in the state.

Table 10 below provides estimates of the job creation impact of recent investments in commercial and residential energy efficiency in the State of Oregon, adapted from a recent study (Whelan, Krebs and Morgan 2013). The study does not separate the impacts of commercial and residential energy efficiency investments. However, the 2014 annual report of Energy Trust of Oregon, the state's largest energy efficiency service provider, found that roughly 70% of the electricity savings and 62% of the natural gas savings went to industrial and commercial buildings (Energy Trust of Oregon 2014).

The numbers presented below indicate the gross, rather than net, job creation impacts, similarly to the numbers presented above for both the proposed Westway/Imperium project and the hypothetical solar array. The Oregon study indicates that for each $1 million invested in energy efficiency, 10 direct jobs and 18 total jobs were created.

	Output/Initial Spending ($ Million)	Job Creation	Jobs/$1 Million Initial Spending
Direct	$272.30	2,702	10
Indirect	$71.70	890	3
Induced	$160.70	1,339	5
Total	$ 504.70	4,931	18

Table 10. Estimated Impacts of Energy Efficiency Investments, State of Oregon (2013)

These job figures suggest that a steady flow of investments in energy efficiency can provide consistent jobs in numbers that exceed those provided by fossil fuel export terminals. Consider a scenario that invests annually the difference between the direct operational (non-debt-related) expenditures on the solar PV array described in Section III above ($733k) and the (lower bound) amount spent in-state on the fossil fuel terminal project in Section II above ($27.5 million). This scenario entails annual investment of $26.85 million into energy efficiency improvements in the state of Oregon.

Table 11 below provides the estimated job creation impacts of an annual investment of $26.85 million into energy efficiency improvements. The initial investment of $26.85 million creates 266 direct jobs and 486 total jobs, and gives rise to a total of $49.76 million in output.

	Output/Initial Spending ($ Million)	Gross Job Creation
Direct	$ 26.85	266
Indirect	$ 7.07	88
Induced	$ 15.84	132
Total	$ 49.76	486

Table 11. Job Creation Impact, Energy Efficiency Scenario

Table 12 below provides a comparison of the total jobs created through the operations phase of the Westway/Imperium fossil fuel terminal with those created by a comparably scaled investment in solar PV operations, plus energy efficiency. While the solar PV operations alone are insufficient to create as many jobs as the terminal, the energy efficiency investment creates many more. The combination of solar PV operations and energy efficiency creates 273 direct and 525 total jobs. These figures exceed the job creation impact of Westway/Imperium by 125 direct jobs, and 221 total jobs. The majority of the direct jobs created by the energy efficiency investments will be in residential and commercial building maintenance and construction sectors.

Impact Type	(A) Westway/ Imperium	(B) Solar PV Only	(C) Solar PV + *Energy Efficiency*	(D) Difference (C-A)
Direct	148	7	273	125
Indirect	87	17	105	18
Induced	69	15	147	78
Total	304	39	525	221

Table 12. Comparison of Total Jobs Created, Operations Phase, Westway/Imperium vs. Solar PV with Energy Efficiency Investment

What kinds of jobs will be created by the energy efficiency investment? The best proxy industrial category for which we have data is NAICS 230000, the construction industry as a whole. Table 13 below presents a breakdown by top-level occupational category of the direct jobs created by the hypothetical energy efficiency investment. We see that 76% of the direct jobs (202 jobs) are expected to be created in occupations such as construction, maintenance and repair, production, and transportation.

Occupational Category	Percentage of Industry	# Direct Jobs
Construction and extraction occupations	62%	166
Installation, maintenance, and repair occupations	9%	23
Production occupations	2%	5
Transportation and material moving occupations	3%	9
All Other Occupations	24%	64
TOTAL	**100.0%**	**266**

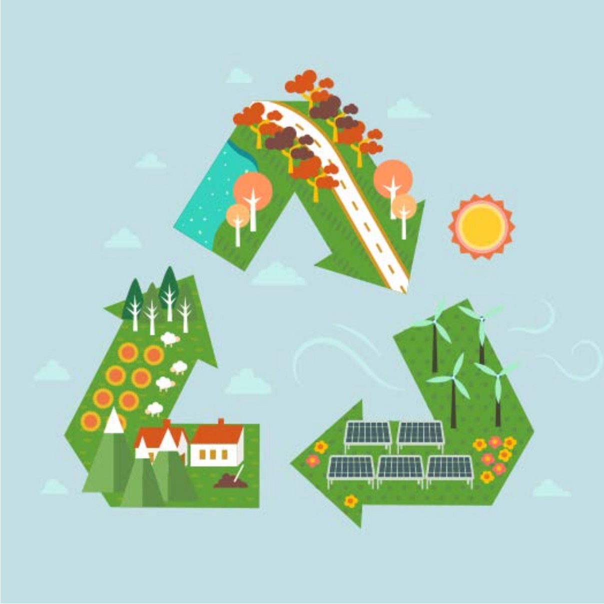
Table 13. Direct Job Breakdown by Top Level Occupational Category, Energy Efficiency Investment

Table 14 compares the expected job breakdown of the operations phase of Westway/Imperium with an energy efficiency investment of comparable size. We see that the number of direct jobs expected to be created directly by the energy efficiency investment is over half again the number expected to be created by the operations of the oil terminals and related marine and rail transport services (266 vs. 148). For construction related jobs, there is no contest: while the energy efficiency investments will create 166 direct jobs in the construction sector, the terminal operations create only one job.

Occupational Category	Westway/Imperium (Operations)	Energy Efficiency
Transportation and material moving occupations	83	9
Installation, maintenance, and repair occupations	18	23
Production occupations	5	5
Construction and extraction occupations	1	166
All other occupations	41	64
TOTAL	**148**	**266**

Table 14. Comparison of Direct Job Breakdown by Occupational Category, Westway and Imperium (Operations) vs. Energy Efficiency

In summary, we can conclude that an annual investment in energy efficiency upgrades for homes, businesses, and institutions in the Pacific Northwest (Oregon or Washington) can create many more direct and total jobs, and many more jobs in construction and related sectors, than can a comparably scaled investment in fossil fuel transport, storage, and export infrastructure. An economic development strategy focusing on the creation of jobs in construction and related sectors should thus prioritize investments in energy efficiency over fossil fuel infrastructure. As numerous economic studies demonstrate (Whelan, Krebs and Morgan 2013), energy efficiency investments have the potential to create jobs, save ratepayers money on lowered utility bills, and increase the overall efficiency and productivity of the economy – all while protecting the environment by reducing fossil fuel consumption.



From Fossil Fuel to Community Economic Development

In 2011 environmental, labor, and other groups reached an agreement to phase out Washington's coal-fired Centralia Power Plant. While environmentalists had initially pushed for retraining for workers in the plant who would lose their jobs, they learned from discussions with union leaders that retraining was not what TransAlta workers—most of whom were fifty or older—wanted. Instead, union officials identified the crucial needs as job security, community reinvestment, and transition time—issues the environmental groups subsequently fought for in the negotiations. The ultimate TransAltra Energy Transition Bill included a community investment fund for local economic development paid for by TransAlta. Participants say that the fund was crucial to organized labor's support for the final agreement.[8]

TransAlta is has now moved ahead with plans to invest $55 million over 10 years to support energy efficiency, economic and community development, and education and retraining initiatives in Washington State as part of TransAlta Centralia's transition from coal-fired operations in Washington. According to the company, "The funding enables the community to transition to new sources of energy over a reasonable timeframe as well as manage the economic and employment implications of the scheduled plant closures." Washington Governor Jay Inslee said it is "a model for how we can make significant progress on climate change while creating jobs and strengthening communities."

The program has established three boards which have received funding over the past three years and will continue to receive annual payments through 2023.

The Weatherization Board funds energy efficiency and weatherization for the residents, employees, business, non-profit organizations and local governments within Lewis County and South Thurston County. Up to $1 million will fund residential energy efficiency and weatherization for low-income and moderate-income residents.

The Economic & Community Development Board funds education, retraining, economic development, and community enhancement. Up to $5M will fund education, retraining and economic development, specifically targeting the needs of workers displaced from the Centralia facility.

The Energy Technology Board funds energy technologies with the potential to create environmental benefits to the State of Washington.[9]

5. THE ECONOMIC IMPACT OF CLEAN ENERGY INVESTMENTS

This study has demonstrated that a program of renewable energy and energy efficiency investments in the Pacific Northwest can create more total jobs, and more jobs per unit of investment, than a comparably scaled investment in fossil fuel transport and export. However, a comprehensive renewable energy and energy efficiency strategy for the region remains to be developed. The specifics of this strategy must be tailored to the economic development priorities of the region. For instance, a clean-energy strategy

8 Additional information and references for this paragraph can be found in Jeremy Brecher, Jobs Beyond Coal (Labor Network for Sustainability, 2012) http://report.labor4sustainability.org

9 http://www.firmenpresse.de/pressrelease410420/55-million-community-development-energy-efficiency-investment-moving-ahead.html

encompassing the entire region would include a substantial role for land-based wind and solar energy, concentrated in the eastern half of Oregon and Washington. The ongoing development of wind and solar energy resources would create a large number of construction jobs, year after year, in different parts of the region. Construction laborers and related service providers would find themselves working in different sub-regions of the Pacific Northwest to build, install, and maintain new wind and solar power plants. While the number of permanent operations jobs for each of these plants would be relatively small, the ongoing regional transition away from fossil fuels and towards clean energy resources would entail that construction labor would be redeployed, year after year, to develop new projects.

By contrast, a clean-energy strategy targeting specific counties, such as Grays Harbor County, might focus instead on a combination of energy efficiency and residential and community solar. Use of locally abundant resources, such as making use of forest residue and thinning for commercial-scale cellulosic biomass production, may also be explored, though this option has proven difficult to commercialize, and controversial due to uncertain environmental impacts and related environmental risks.
This paper has not addressed the portfolio of policies and incentives required to make this clean-energy scenario a reality. Promising policy tools to promote the adoption of renewable energy and energy efficiency include:

- Clean Fuels Standard
- Renewable Portfolio Standard (RPS)
- Property Assessed Clean Energy (PACE)
- Feed-In Tariff
- Cap-and-Trade / Cap-and-Dividend
- Carbon Tax
- BETC/RETC
- Community Solar

Further research on clean energy in the Pacific Northwest can explore the potential job creation and economic development impact of these policy tools.

CONCLUSION: JOBS IN A CLEAN ENERGY FUTURE

The changing economics of fossil fuel, the rapid decline in the cost of clean energy, and the absolute necessity of radically reducing climate-destroying greenhouse gases mean that the Pacific Northwest, the US, and the world must and will transition to a new energy system. This report shows that Grays Harbor – and places like Grays Harbor – need not be left behind.

Nor need their workers be left behind. This report shows that investments in the Pacific Northwest in renewable energy and energy efficiency can generate more jobs in construction, transportation, supply chains, and operations and maintenance than a similar dollar investment in oil, coal, and natural gas infrastructure. The alternatives laid out for western Washington in this report can be an integral part of the great transition from fossil fuels to clean energy.

Pursuing that course toward a fossil free economy will provide many benefits. It will eliminate the health and safety threats created by exploding oil trains, coal pollution, and fracking contamination of water. It will help halt the drive to devastating climate change. It will provide communities a secure source of energy that does not depend on the gyrations of the global fossil fuel market. And it will provide a source of jobs that do not depend on the gyrations of the global economy.

This transition will not happen by itself, however. Because energy infrastructure is based on long-term investment and planning, it must be guided by economic strategies that are sustainable in the long term. The transition to worker- and community-friendly clean energy will require deliberate decisions at every level of government and economy to expand clean energy infrastructure rather than infrastructure based on fossil fuels.

There is not an automatic fit between workers who need jobs and the types and locations of jobs that any particular project will require. To make the energy transition both worker- and environment-friendly will require planning for an orderly, sustainable transition. For example, as the report points out, the ongoing development of solar energy resources throughout the Pacific Northwest would require building new plants throughout the region over many years. With proper planning, construction workers could find steady employment building these facilities one after another.

Similarly, a well-designed transition plan can consider the needs and harness the underutilized human and material resources of places like Grays Harbor. Its goal should be to ensure that no Grays Harbor is left behind in the transition to the clean energy future.

BIBLIOGRAPHY

Ahearn, Ashley. 2015. "More Northwest Oil Trains Could Result From Lifting Export Ban." *OPB: Oregon Public Broadcasting.* December 16. Accessed December 19, 2015. http://www.opb.org/news/article/more-northwest-oil-trains-could-result-from-lifting-export-ban.

Anderson, D.M., O.V. Livingston, D.B. Belzer, and M.J. Scott. 2014. *Assessing National Employment Impacts of Investment in Residential and Commercial Sector Energy Efficiency: Review and Example Analysis.* Richland, WA: U.S. Department of Energy, Pacific Northwest National Laboratory.

BLS. 2016. "Producer Price Indexes." *Bureau of Labor Statistics.* Accessed January 21, 2016. http://www.bls.gov/ppi/data.htm.

Bolinger, Mark; Seel, Joachim. 2015. *Utility-Scale Solar 2014.* Berkeley, CA: USDOE.

Bureau of Labor Statistics. 2012. "Industry-occupation matrix data, by industry." *Bureau of Labor Statistics.* Accessed December 28, 2015. http://www.bls.gov/emp/ep_table_109.htm.

Business Wire. 2015. "Renewable Energy Group Acquire Imperium Renewables." *Business Wire.* July 31. Accessed December 31, 2015. http://www.businesswire.com/news/home/20150731005890/en/Renewable-Energy-Group-Acquire-Imperium-Renewables.

De Place, Eric, and Deric Gruen. 2015. "The Thin Green Line Is Stopping Coal and Oil In Their Tracks." *Sightline Institute.* August 13. Accessed December 31, 2015. http://www.sightline.org/2015/08/13/the-thin-green-line-is-stopping-coal-and-oil-in-their-tracks/.

Eisenthal, Jonathan. 2009. "Studying Cellulose: 75 Billion Gallons Feasible by 2030." *Ethanol Today.* Accessed January 5, 2016. http://www.ethanoltoday.com/index.php?option=com_content&task=view&id=5&Itemid=6&fid=66.

Gold, Russell. 2014. "Bakken Shale Oil Carries High Combustion Risk." *Wall Street Journal*, February 23: http://www.wsj.com/articles/SB10001424052702304834704579401353579548592.

Gonzalez, Angel. 2016. "Grays Harbor Biodiesel Plant Cancels Plan to Ship Crude Oil." *Seattle Times*, January 6: http://www.seattletimes.com/seattle-news/environment/grays-harbor-biodiesel-plant-cancels-plan-to-ship-crude-oil/.

Hart, Erin. 2014. "Aberdeen council votes unanimously against crude-by-rail ." *The Daily World.* September 15. Accessed December 29, 2015. http://thedailyworld.com/news/local/aberdeen-council-votes-unanimously-against-crude-rail.

Industrial Economics, Inc. . 2012. *Made in Oregon: A Case Study Examining the Impacts in Oregon of Local Purchasing and Manufacturing of Solar Photovoltaics.* Case Study , Cambridge, MA: Industrial Economics, Inc.

Josephson, Alec. 2014. *Economic Impacts from Energy Trust of Oregon 2013 Program Activities.* Camas, WA: Pinnacle Economics.

Kelly, Sharon. 2015. "Coal Mining's Financial Failures: Two Thirds of World's Production Now Unprofitable." *Resilience.org.* December 15. Accessed December 27, 2015. http://www.resilience.org/stories/2015-12-21/coal-mining-s-financial-failures-two-thirds-of-world-s-production-now-unprofitable.

Khosla, Vinod. 2008. *Where Will Biofuels and Biomass Feedstocks Come From?* White Paper, Menlo Park, CA: Khosla Ventures.

Kitchen, Matthew, Tessa Krebs, and Robert Whelan. 2013. *Economic Impact of Bulk Liquid Storage Facilities at the Port of Grays Harbor.* Portland, Oregon: ECONorthwest.

Koch, Wendy. 2016. "Why Solar and Wind Are Thriving Despite Cheap Fossil Fuels." *National Geographic.* January 22. Accessed January 28, 2016. http://news.nationalgeographic.com/energy/2016/01/160122-why-solar-and-wind-thrive-despite-cheap-oil-and-ga/.

Kruse, Dylan. 2015. "Biomass Opportunities in Washington State." *Sustainable Northwest.* May 23. Accessed December 29, 2015. http://www.sustainablenorthwest.org/blog/posts/biomass-opportunities-in-washington-state.

Lane, Jim. 2015. "Washington State Nixes Low Carbon Fuel Standard Via Transport Bill Poison Pill." *Biofuels Digest.* July 3. Accessed December 31, 2015. http://www.biofuelsdigest.com/bdigest/2015/07/03/washington-state-nixes-low-carbon-fuel-standard-via-transport-bill-poison-pill/.

Multnomah County. 2015. "Commercial Property Assessed Clean Energy in Multnomah County." *Multnomah County.* Accessed January 5, 2016. https://multco.us/sustainability/commercial-property-assessed-clean-energy-multnomah-county.

National Renewable Energy Laboratory. 2012. "Biomass Maps." *National Renewable Energy Laboratory (NREL).* Accessed January 5, 2016. http://www.nrel.gov/gis/biomass.html.

—. 2015. "Jobs and Economic Development Impact (JEDI) Model." *National Renewable Energy Laboratory.* Accessed January 5, 2016. http://www.nrel.gov/analysis/jedi/.

Niemi, Ernie. 2014. *Potential Socio-Economic Impacts of the Proposed Shipment of Crude Oil from Grays Harbor.* Eugene, OR: Natural Resource Economics.

Oregon DEQ. 2015. "Oregon Clean Fuels Program." *Oregon Department of Environmental Quality* . Accessed December 29, 2015. http://www.deq.state.or.us/aq/cleanFuel/.

Pollin, Robert, James Heintz, and Heidi Garrett-Peltier. 2009. *The Economic Benefits of Investing in Clean Energy* . Amherst, MA and Washington, DC: Political Economy Research Institute and Center for American Progress.

Powell, Tarika. 2015. "What the Northwest Needs to Know About the Crude Oil Export Ban Lift." *Sightline*. December 16. Accessed December 19, 2015. http://www.sightline.org/2015/12/16/what-the-northwest-needs-to-know-about-the-crude-oil-export-ban-lift/.

Powell, Tarika, and Eric De Place. 2015. "The Impact of a Grays Harbor Oil Spill, in 13 Slides." *Sightline Institue*. September 17. Accessed December 29, 2015. http://www.sightline.org/2015/09/17/the-impacts-of-a-grays-harbor-oil-spill-in-13-slides/.

Pozdena, Randall, and Alec Josephson. 2011. *Economic Impact Analysis of Property Assessed Clean Energy (PACE) Programs*. Portland, OR: ECONorthwest; PACENow.

Randall, Tom. 2015. "What Just Happened in Solar Is a Bigger Deal Than Oil Exports." *Bloomberg Business*. December 17. Accessed January 28, 2016. http://www.bloomberg.com/news/articles/2015-12-17/what-just-happened-to-solar-and-wind-is-a-really-big-deal.

Renewable Energy Group Inc. 2015. "About Renewable Energy Group." *Renewable Energy Group Inc.* Accessed December 31, 2015. http://www.imperiumrenewables.com/about-reg.

Resource Dimensions. 2015. *Economic Impacts of Crude Oil Transport on the Quinault Indian Nation and the Local Economy*. Gig Harbor, WA: Resource Dimensions.

Sightline Institute. 2015. "Series: Northwest Coal and Oil Exports." *Sightline Institute*. December 16. Accessed December 31, 2015. http://www.sightline.org/series/northwest-coal-oil-gas-exports-thin-green-line/.

Whelan, Robert, Tessa Krebs, and Tina Morgan. 2013. *The Economic Impacts and Macroeconomic Benefits of Energy Efficiency Programs in Oregon.* Portland, OR: ECONorthwest and Northwest Energy Efficiency Council.

White, Eric. 2009. *Woody Biomass for Bioenergy and Biofuels in the United States*. Briefing Paper, Corvallis, OR: Oregon State University.

Williams-Derry, Clark. 2015. "Coal Export Markets in Freefall." *Sightline Institute*. February 2. Accessed December 31, 2015. http://www.sightline.org/2015/02/02/coal-export-markets-in-freefall/.