

# Methodology Report

Tracking the Energy Revolution Global

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# Clean Energy Canada

Clean Energy Canada is an initiative of Simon Fraser University's Centre for Dialogue. We work to accelerate Canada's transition to a clean and renewable energy system. We build awareness of and support for solutions that address climate disruption and foster an energy efficient, environmentally responsible, and prosperous economy. We do so in collaboration with civil society, governments, and the private sector.

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## Outline

Tracking the Energy Revolution Global is a data rich summary of the ten biggest trends and news stories in 2014. Clean Energy Canada compiled the information from a range of sources and attempts to present in a way that is meaningful to a broad audience. The report contains all the sources for direct references. For example, in 2014 the world invested \$295 billion in clean energy and this was sourced directly from Bloomberg New Energy Finance. However, in some instances the report includes Clean Energy Canada's own estimates. This document summarizes the approach, assumptions and results of these calculations. The report is divided into 2 sections. Section 1 – Common Sources and Assumptions are those sources and assumptions that apply to most calculations in the report. Section 2 – summarizes the calculations and assumptions per trend.

## Section 1 – Common Sources and Assumptions

This section includes estimates, assumptions and sources for new capacity, investment, renewable electricity generation and the electricity intensity of homes.

### New Capacity

All capacity estimates come from Bloomberg New Energy Finance's Market Size Database. The estimates include capacity for the following renewable energy types:

- **Biomass & Waste:** Biogas, biomass, landfill gas and waste-to-energy projects
- **Geothermal:** Electricity from geothermal heat
- **Marine:** Tidal and wave installations
- **Hydro:** Both small <50 MW and large >50 MW
- **Solar:** Includes both PV and solar thermal at utility and rooftop scales
- **Wind:** Both onshore and offshore

Table 1 summarizing annual capacity for each renewable electricity type from 2010 to 2014.

**Table 1: Global renewable energy capacity estimates**

	2010	2011	2012	2013	2014
<i>Hydro</i>	918.82	951.93	978.24	1,019.85	1,038.21
<i>Wind</i>	188.96	229.71	276.62	309.55	358.84
<i>Solar</i>	43.52	72.46	104.29	145.00	192.33
<i>Biomass &amp; Waste</i>	63.12	68.81	73.34	79.17	86.91
<i>Geothermal</i>	10.71	10.85	11.30	11.78	12.39
<i>Marine</i>	0.26	0.52	0.52	0.52	0.52
<b>Total</b>	<b>1,225.39</b>	<b>1,334.28</b>	<b>1,444.30</b>	<b>1,565.88</b>	<b>1,689.21</b>

## Investment

Investment estimates are also from Bloomberg New Energy Finance's market database. The estimates included in the report are for "new investments" of renewable energy included in Table 1 with the following investment flows:

- **Asset finance:** Funding for new renewable energy projects.
- **Public markets:** New equity raised through public capital markets.
- **Venture capital/private equity:** New equity raise by private renewable energy companies
- **Small distributed capacity:** Top down estimate of investment for residential and commercial-scale solar PV projects.
- **Corporate and Government R&D:** Annual top down estimate

Table 2 summarizes total annual investment from these sources per renewable energy type.

**Table 2: Annual new investment per renewable energy type**

	2010	2011	2012	2013	2014
<i>Solar</i>	103.30	155.66	144.34	119.80	149.59
<i>Wind</i>	98.88	84.18	84.11	89.31	99.48
<i>Biomass &amp; Waste</i>	16.01	17.37	12.43	9.31	8.41
<i>Small Hydro (&lt;= 50 MW)</i>	5.70	7.19	6.42	5.50	4.55
<i>Geothermal</i>	3.03	3.71	1.84	2.18	2.68
<i>Marine</i>	0.26	0.26	0.26	0.19	0.41
<b>Total</b>	<b>227.19</b>	<b>268.37</b>	<b>249.41</b>	<b>226.30</b>	<b>265.11</b>

Bloomberg New Energy Finance does not include investments figures for large hydro projects above 50 MW. Tracking the Energy Revolution includes estimates of \$30 billion for 2015 and \$35 billion for 2014<sup>1</sup>.

## Renewable Electricity Generation

Bloomberg New Energy Finance does not track or estimate the renewable electricity produced from the renewable energy technologies included in the report. Clean Energy Canada estimated energy production using global average capacity factors from the International Renewable Energy Agency's 2014 Renewable Power Generation Costs report<sup>2</sup>. Capacity factors range considerably between projects and countries. The values below are a global average, not best or worst case scenarios. Table 3 summarizes the renewable energy type and capacity factor.

**Table 3: Summary of capacity factors by technology type**

<b>Renewable Energy Type</b>	<b>Capacity Factor</b>	<b>Source/comment</b>
<i>Hydro</i>	0.50	IRENA: Weighted average for all projects, same for large and small hydro. Range between 25% and 80%.
<i>Wind</i>	0.321	IRENA: Average for 2006 to 2013
<i>Solar</i>	0.17	IRENA: Weighted global average by installed capacity as of 2014
<i>Biomass &amp; Waste</i>	0.70	IRENA: "rest of world" value in IRENA database. Factors of 85 to 90% are regularly met in North America and Europe.
<i>Geothermal</i>	0.83	Tidball, R., Bluestein, J., Rodriguez, N., & Knoke, S. <sup>3</sup>
<i>Marine</i>	NA	Excluded, no average capacity factor. Less than 0.03% of total renewable energy capacity

Electricity generation is calculated by multiplying the total capacity (GW), by the capacity factor and then by the hours per year (hrs). Marine power is excluded because of lack of

<sup>1</sup> Frankfurt School for Climate and Sustainable Energy Finance. (2014). Global Trends in Renewable Energy

<sup>2</sup> International Renewable Energy Agency. (2014). *Renewable Power Generation Costs* (p. 164). Retrieved from [http://www.irena.org/DocumentDownloads/Publications/IRENA\\_RE\\_Power\\_Costs\\_2014\\_report.pdf](http://www.irena.org/DocumentDownloads/Publications/IRENA_RE_Power_Costs_2014_report.pdf)

<sup>3</sup> Tidball, R., Bluestein, J., Rodriguez, N., & Knoke, S. (2010). *Cost and performance assumptions for modeling electricity generation technologies*. Retrieved from <http://www.nrel.gov/docs/fy11osti/48595.pdf>

data on average capacity factor. This doesn't affect the total power since it only represents 0.03% of total capacity. Table 4 summarizes global 2010-2014 electricity generation by renewable energy type.

**Table 4: Estimated global 2010-2014 electricity production by renewable energy type**

	2010	2011	2012	2013	2014
Hydro	4,024,451	4,169,465	4,284,700	4,466,953	4,547,358
Wind	531,354	645,936	777,831	870,452	1,009,050
Solar	64,502	107,403	154,578	214,919	285,075
Biomass & Waste	387,041	421,929	449,718	485,492	532,933
Geothermal	77,842	78,854	82,136	85,647	90,104
Marine	NA	NA	NA	NA	NA
<b>Total</b>	<b>5,085,191</b>	<b>5,423,587</b>	<b>5,748,963</b>	<b>6,123,463</b>	<b>6,464,519</b>

## Electricity intensity of homes

Tracking the Energy Revolution includes many comparisons between a certain amount of renewable electricity generation and the number of homes that energy could supply. These comparisons are intended to communicate the scale of renewable electricity generation. The report includes comparisons to average global homes, Canadian homes and Chinese homes. Table 5 summarizes the number of homes that could be powered by 1 GWhr of electricity for a year.

**Table 5: Home electricity intensity estimates**

Type of Home	Estimate (homes per GWh)	Source and Assumptions
Average Canadian Home	91	NRCan <sup>4</sup>
Average Global Home	300	World Energy Council <sup>5</sup>
Average Chinese Home	740	World Energy Council <sup>6</sup>

<sup>4</sup> Adapted from Natural Resources Canada. (2013). *Energy Use Data Handbook 1990 to 2010*. Retrieved from <http://oee.nrcan.gc.ca/publications/statistics/handbook2010/handbook2013.pdf>

<sup>5</sup> World Energy Council (2013) *Energy Efficiency Indicators – Average electricity consumption per electrified household*. Retrieved April 2015 <http://www.wec-indicators.enerdata.eu/household-electricity-use.html>

<sup>6</sup> IBID

## Section 2 – Calculations and Assumptions per Trend

This section includes specific calculations for specific statements for each of the ten trends in Tracking the Energy Revolution. Each statement is first labelled and then the calculation explained below.

### 1. A New Hope: Renewables Stall out Carbon Pollution

**Statement:** In total, investors poured twice as much money into new renewable-electricity projects than into new fossil fuel projects.

In 2014 global new fossil fuel capacity investment was \$132 billion. This excludes spending on fossil fuels generation capacity to replace existing capacity. By contrast renewable electricity capacity investment was \$273.5 billion in 2014. Both of these values exclude investment in replacing existing capacity. For example, a coal plant that was built to replace and existing plant is not included in the \$132 billion estimate. If we include replacements total spending on new fossil fuel generation was \$289 billion in 2014, while renewable electricity capacity was \$295 billion. By contrast new renewable electricity facilities totaled \$265 billion in 2014, or \$242.5 billion when discounted replaced capacity. Therefore, new renewable electricity capacity investment was just over double that in new fossil fuel capacity investment. All data from Global Trends in Renewable Energy Investment<sup>7</sup>.

**Statement:** That’s enough to power roughly half of all homes on Earth.

$$\% \text{ homes} = \frac{RE \text{ Gen}_{2014} \times GH_{ei}}{\text{Total Households}}$$

Where:

*RE Gen<sub>2014</sub>*: 2014 global renewable electricity generation = 6,464,519 GWhr<sup>8</sup>

*GH<sub>ei</sub>*: Houses powered per GWhr = 300 hh/GWhr<sup>9</sup>

*Total Households* = 3.5 billion<sup>10</sup>

<sup>7</sup> Frankfurt School for Climate and Sustainable Energy Finance. (2014). *Global Trends in Renewable Energy*

<sup>8</sup> See Table 4

<sup>9</sup> See Table 5

<sup>10</sup> Assumes two people per household. Country averages range significantly, 2 per household is a lower bound according to UNECE Statistical Database [http://w3.unece.org/pxweb/dialog/varval.asp?ma=08\\_GEFHPrivHouse\\_r&path=../database/STAT/30-GE/02-Families\\_households/&lang=1&ti=Private+households+by+household+type](http://w3.unece.org/pxweb/dialog/varval.asp?ma=08_GEFHPrivHouse_r&path=../database/STAT/30-GE/02-Families_households/&lang=1&ti=Private+households+by+household+type)

% homes: percentage homes that renewable electricity generation in 2014 could have provided electricity for

$$\% \text{ homes} = \frac{6,464,519 \text{ (GWhr)} \times 300 \left(\frac{\text{hh}}{\text{GWhr}}\right)}{3,500,000,000 \text{ (hh)}} \times \frac{1}{100}$$

% homes = 55%

**Statement:** Put another way, the world’s current total supply of renewable electricity could have powered nearly everything on the planet in 1980.

Global renewable electricity generation in 2014 was 6,464,519 (GWhr). In 1980 total global electricity generation was 6,901,000 (GWhr)<sup>11</sup>, just slightly higher than total renewable electricity generation in 2014.

## 2. As Solar Prices Drop, Affordability Rises

**Statement:** In 30 countries, electricity from residential solar panels are now cheaper than wholesale grid electricity.

Deutsche Bank compared the levelized cost of electricity of residential solar with the cost of residential electricity in 60 countries around the world<sup>12</sup>. They found that in 30 of them the cost of residential solar was lower than grid electricity. Table 6 summarizing the levelized cost of new solar compared with grid electricity costs. Additional assumptions such as discount rates, capital cost, and maintenance costs are available in the Deutsche Bank report.

<sup>11</sup> The Shift Project (2015) Breakdown of Electricity Generation by Energy Source 1980 <http://www.tsp-data-portal.org/Breakdown-of-Electricity-Generation-by-Energy-Source#tspQvChart> adapted from US EIA Historical Statistics and the World Bank – World Bank Development Indicators

<sup>12</sup> Deutsche Bank. (2015). *F.I.T.T. for investors Crossing the Chasm*. Retrieved from [https://www.db.com/cr/en/docs/solar\\_report\\_full\\_length.pdf](https://www.db.com/cr/en/docs/solar_report_full_length.pdf)

**Table 6: Summary of residential installed solar costs and residential grid costs**

Country	Grid Parity	Insolation (kWh/m2/year)	Cost of Electricity Comp (\$/kWh)	LCOE	Solar Premium Discount
Australia	Yes	1833	\$0.49	\$0.15	-\$0.35
Belgium	Yes	867	\$0.32	\$0.24	-\$0.08
Brazil	Yes	1667	\$0.37	\$0.18	-\$0.19
Chile	Yes	1750	\$0.25	\$0.12	-\$0.14
Denmark	Yes	813	\$0.44	\$0.35	-\$0.09
France	Yes	1083	\$0.21	\$0.16	-\$0.05
Germany	Yes	958	\$0.33	\$0.19	-\$0.15
Guyana	Yes	1667	\$0.28	\$0.12	-\$0.16
Hungary	Yes	1042	\$0.26	\$0.24	-\$0.02
Ireland	Yes	750	\$0.31	\$0.27	-\$0.04
Israel	Yes	1917	\$0.16	\$0.14	-\$0.02
Italy	Yes	1292	\$0.31	\$0.14	-\$0.17
Japan	Yes	1167	\$0.28	\$0.14	-\$0.14
Mexico	Yes	1792	\$0.20	\$0.13	-\$0.08
Netherlands	Yes	917	\$0.32	\$0.27	-\$0.05
New Zealand	Yes	1167	\$0.20	\$0.18	-\$0.03
Papua New Guinea	Yes	1417	\$0.30	\$0.17	-\$0.13
Peru	Yes	1667	\$0.13	\$0.12	-\$0.01
Philippines	Yes	1583	\$0.34	\$0.10	-\$0.24
Portugal	Yes	1458	\$0.28	\$0.25	-\$0.02
Singapore	Yes	1500	\$0.22	\$0.16	-\$0.06
Spain	Yes	1500	\$0.24	\$0.14	-\$0.10
Solomon Islands	Yes	1417	\$0.87	\$0.14	-\$0.73
Sweden	Yes	833	\$0.30	\$0.29	\$0.00
Tonga	Yes	1583	\$0.63	\$0.13	-\$0.50
Turkey	Yes	1500	\$0.14	\$0.14	-\$0.01
USA Virgin Islands	Yes	1667	\$0.56	\$0.20	-\$0.37
Vanuatu	Yes	1417	\$0.60	\$0.19	-\$0.41
China	Yes vs High Electricity Price	1333	\$0.11	\$0.11	\$0.00
Hong Kong	Yes vs High Electricity Price	1333	\$0.25	\$0.15	-\$0.09
India	Yes vs High Electricity Price	1604	\$0.12	\$0.10	-\$0.02
Iran	Yes vs High Electricity Price	1583	\$0.21	\$0.16	-\$0.05
Jamaica	Yes vs High Electricity Price	1750	\$0.18	\$0.14	-\$0.04
Jordan	Yes vs High Electricity Price	1917	\$0.35	\$0.13	-\$0.22
Pakistan	Yes vs High Electricity Price	1833	\$0.16	\$0.13	-\$0.03
South Africa	Yes vs High Electricity Price	1833	\$0.17	\$0.13	-\$0.04
Taiwan	Yes vs High Electricity Price	1583	\$0.18	\$0.15	-\$0.03
United States	Yes vs High Electricity Price	1400	\$0.07-0.39	\$0.17	-\$0.01
Uruguay	Yes vs High Electricity Price	1500	\$0.25	\$0.17	-\$0.08
<b>Total Count</b>		<b>39</b>			

Note: Calculations do not account for any subsidies current or future. Electricity Prices are estimated for residential consumers.

**Statement:** The International Renewable Energy Agency forecasts that onshore wind, offshore wind, and solar will compete directly with fossil fuels in most markets by 2025.

The International Renewable Energy Agency (IRENA) has collected capacity investments and costs for most renewable energy projects built around the world and compared their cost ranges with those of fossil fuel projects. On-shore wind projects are already cost competitive with fossil fuel technologies in the majority of jurisdictions around the world. However, off-shore wind and solar PV for the grid remain – except in a few jurisdictions – more expensive than fossil fuel alternatives. However, by 2025 on and off-shore wind as well as solar PV for the grid are expected to be cost competitive with fossil fuel generation in most jurisdictions around the world. Figure 1 summarizes IRENA’s estimates.

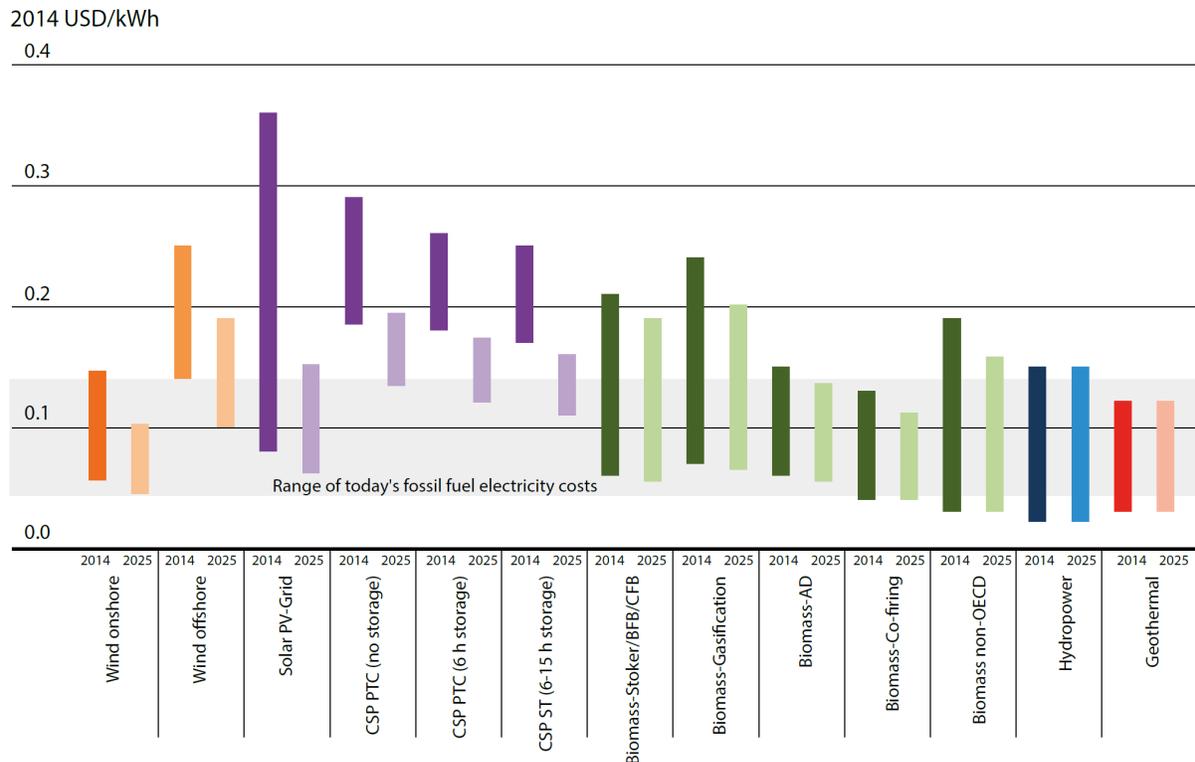


Figure 1: 2014 and 2025 levelized costs for renewable electricity sources compared with fossil fuel

### 3. Tesla’s Gigafactory Poised to Unleash Battery Revolution

**Statement:** Electric vehicle battery prices have plunged in the past five years, and a looming supply surge could drop them an additional 30 percent.

Tesla has provided no public information on the expected price of batteries from its Gigafactory. However, it is possible to estimate the costs from public sources. Nykvist et al. (2015) estimate that Tesla produces batteries for its vehicles at \$300/kWh<sup>13</sup> today. Tesla has also said it expects the Gigafactory to reduce its production costs by more than 30%<sup>14</sup>. That would bring costs to \$210/kWh.

<sup>13</sup> Nykvist, B., & Nilsson, M. (2015). Rapidly falling costs of battery packs for electric vehicles. *Nature Climate Change*, 5(April), 100–103. doi:10.1038/nclimate2564

<sup>14</sup> Tesla (2015) Gigafactory Blog. [http://www.teslamotors.com/sites/default/files/blog\\_attachments/gigafactory.pdf](http://www.teslamotors.com/sites/default/files/blog_attachments/gigafactory.pdf)

## 4. 100 Percent Renewable Energy Goes Mainstream

**Statement:** If California were to commit to 100 percent renewable energy, it would create 160,000 jobs and the initiative would pay for itself in only three years via air and climate pollution cost savings.

Mark Jacobson’s work is well documented in peer reviewed journals. The numbers above come from a summary of this work available through the Solutions Projects website<sup>15</sup>. Additional information is available in Jacobson et al. 2015 paper – 100% clean and renewable wind, water, and sunlight (WWS) all-sector energy roadmaps for the 50 United States<sup>16</sup>.

## 5. Climate Diplomacy Rising: Superpowers Move From Finger-Pointing to Handshaking

**Statement:** When China reaches its goal, it will have added 5,290 terawatt-hours’ (TWhr) worth of renewable and non-renewable nuclear power to its grids. That’s enough to power everything with a switch in Canada twice over.

The International Energy Agency projects that China’s 2030 energy demand will be 3,485 million tons of oil equivalent (Mtoe). Twenty percent of that is 697 Mtoe. Minus the 242 Mtoe of energy that already comes from renewable sources and nuclear, then we have 455 Mtoe of new low-carbon supply that China is committing to build. Converted to Peta Joules that’s the same as 19,000 PJ. Canada’s total energy use in 2012 was 8,319 PJ. So China has committed to build out a low-carbon energy system equivalent to twice all the energy demand in Canada.

**Statement:** On both counts, that’s good news for Canada. We already send enough electricity south each year to light up 4.3 million Canadian homes.

$$CA_{homes} = CA_{el} \times CAH_{ei}$$

Where:

$CA_{homes}$ : Canadian Homes

<sup>15</sup> The Solutions Project (2015) 100% California. <http://thesolutionsproject.org/infographic/#ca>

<sup>16</sup> Jacobson, M. Z., DeLucchi, M., Bazouin, G., Bauer, Z. a. F., Heavey, C. C., Fisher, E., Yeskoo, T. W. (2015). 100% clean and renewable wind, water, and sunlight (WWS) all-sector energy roadmaps for the 50 United States. *Energy Environ. Sci.* doi:10.1039/C5EE01283J

$CA_{ei}$ : Net Canadian Exported Electricity 47 TWhr<sup>17</sup>

$CA_{Hei}$ : Canadian Average Home Electricity Intensity: 91 hh/GWhr<sup>18</sup>

$$CA_{homes} = 47 (TWhr) \times 1000 \frac{GWhr}{TWhr} \times 91 \frac{hh}{GWhr}$$

## 6. Wind Spreads Like Wildfire

**Statement:** The world added 50 GW of new wind capacity in 2014, add that to the 300 GW of wind that was already on the grid and there's now enough wind energy produced globally to power the Canadian economy nearly twice over.

Wind turbines now produces 1,009,050 GWhr of electricity<sup>19</sup>. In 2012 Canada's total electricity was 562,000 GWhr. Twice that number is 1,124,000 GWhr. Therefore, wind turbines around the world produce enough electricity to power the economy nearly twice over.

**Statement:** That's nearly 3 wind turbines an hour.

$$Turbine\ per\ hour = \frac{WC_{2014}}{AVGWT \times Hrs}$$

Where:

$WC_{2014}$ : Wind Capacity installed in 2014 = 49,290 MW<sup>20</sup>

AVGWT: Average Wind Turbine Size = 1.87 MW<sup>21</sup>

Hrs: Hours in a year = 8,760 hrs

$$Turbine\ per\ hour = \frac{49,290\ MW}{1.87\ MW \times 8,760\ hrs}$$

<sup>17</sup> National Energy Board (2015) Market Snapshot: Canadian Electricity Export Revenue Rebound Continues in 2014. <https://www.neb-one.gc.ca/nrg/ntgrtd/mrkt/snpsht/2015/03-02lctrcrxprtrvn-eng.html>

<sup>18</sup> Table 5

<sup>19</sup> Table 4

<sup>20</sup> Table 3

<sup>21</sup> U.S. Department of Energy (2014) 2013 Wind Technologies Report [http://emp.lbl.gov/sites/all/files/2013\\_Wind\\_Technologies\\_Market\\_Report\\_Final3.pdf](http://emp.lbl.gov/sites/all/files/2013_Wind_Technologies_Market_Report_Final3.pdf)

*Turbines per hour = 3*

**Statement:** Humans are now harvesting enough wind to meet the electricity needs of roughly 300 million homes.

$$AVG_{homes} = WE_{2014} \times GH_{ei}$$

Where

*AVG<sub>homes</sub>: Average number of homes*

*WE<sub>2014</sub>: Wind Electricity Generation 2014 = 1,009,050 GWhr<sup>22</sup>*

*GH<sub>ei</sub>: Global Housing Electricity Intensity = 300 homes/GWhr<sup>23</sup>*

## 7. Developing World Plugging In To Renewable Power

**Statement:** Over a year, those stations will produce enough electricity to light up the equivalent of 1.7 million Chinese homes

$$CH_{homes} = (PR_1 + PR_2) \times hrs_{yr} \times W_{cf} \times CH_{ei}$$

Where:

*CH<sub>homes</sub>: Number of Chinese Homes Powered*

*PR<sub>1</sub>: Project One = 400 MW*

*PR<sub>2</sub>: Project Two = 400 MW*

*Hrs<sub>yr</sub>: hours per year = 8,760*

*W<sub>cf</sub> = Wind Capacity Factor = 0.321*

*CH<sub>ei</sub>: Chinese home electricity intensity = 740 homes/GWhr*

$$CH_{homes} = (400 MW + 400 MW) \times 8760 \times 0.321 \times 740 \text{ homes/GWhr}$$

$$CH_{homes} = 1.7 \text{ million}$$

## 8. Carbon Pricing is Fast Becoming the New Normal

**Statement:** We are approaching a tipping point; within a couple of years, more than half of the global economy will be subject to some kind of carbon price.

<sup>22</sup> Table 4

<sup>23</sup> Table 5

Table 7 summarizes the countries and regions with a carbon tax (CT) or emission trading system (ETS) or both around the world as well as the GDP per region. Total GDP for these regions adds to \$37 trillion which is 49% of the global GDP in 2013. This table does not include regions within countries that have national carbon pricing schemes.

**Table 7: Summary of type of carbon pricing scheme and GDP**

<b>Country or Region</b>	<b>Type</b>	<b>2013 GDP</b>	<b>Source</b>
<i>British Columbia</i>	CT	\$229,685,000,000.00	Statistics Canada <sup>24</sup>
<i>Alberta</i>	ETS	\$338,166,000,000.00	Statistics Canada
<i>Quebec</i>	ETS	\$362,846,000,000.00	Statistics Canada
<i>California</i>	ETS	\$2,212,991,000,000.00	U.S. Department of Commerce <sup>25</sup>
<i>Connecticut</i>	ETS	\$246,897,000,000.00	U.S. Department of Commerce
<i>Delaware</i>	ETS	\$60,816,000,000.00	U.S. Department of Commerce
<i>Maine</i>	ETS	\$54,609,000,000.00	U.S. Department of Commerce
<i>Maryland</i>	ETS	\$339,409,000,000.00	U.S. Department of Commerce
<i>Massachusetts</i>	ETS	\$441,467,000,000.00	U.S. Department of Commerce
<i>New Hampshire</i>	ETS	\$68,701,000,000.00	U.S. Department of Commerce
<i>New York</i>	ETS	\$1,341,591,000,000.00	U.S. Department of Commerce
<i>Rhode Island</i>	ETS	\$53,000,000,000.00	U.S. Department of Commerce
<i>Vermont</i>	ETS	\$28,838,000,000.00	U.S. Department of Commerce
<i>Washington</i>	ETS or CT	\$407,160,000,000.00	U.S. Department of Commerce
<i>Oregon</i>	ETS or CT	\$204,867,000,000.00	U.S. Department of Commerce
<i>Boulder, Colorado</i>	CT	\$21,260,000,000.00	U.S. Department of Commerce <sup>26</sup>
<i>Ukraine</i>	ETS + CT	\$177,430,609,756.10	World Bank 1 <sup>27</sup>
<i>Mexico</i>	CT	\$1,260,914,660,977.10	World Bank 1
<i>Iceland</i>	ETS + CT	\$15,330,057,867.10	World Bank 1
<i>Japan</i>	CT	\$4,919,563,108,372.50	World Bank 1
<i>Australia</i>	ETS	\$1,560,372,473,125.20	World Bank 1
<i>New Zealand</i>	ETS	\$185,787,824,483.10	World Bank 1

<sup>24</sup> Statistics Canada (2015) *Gross Domestic Product, Expenditure Based*. <http://www.statcan.gc.ca/tables-tableaux/sum-som/I01/cst01/econ15-eng.htm>

<sup>25</sup> U.S. Department of Commerce (2015) *Table 4 Current-Dollar GDP per State, 2011-2014*. [https://www.bea.gov/newsreleases/regional/gdp\\_state/2015/xls/gsp0615.xlsx](https://www.bea.gov/newsreleases/regional/gdp_state/2015/xls/gsp0615.xlsx)

<sup>26</sup> U.S. Department of Commerce (2014) *Economic Growth Widespread Across Metropolitan Areas in 2013*. [http://www.bea.gov/newsreleases/regional/gdp\\_metro/2014/pdf/gdp\\_metro0914.pdf](http://www.bea.gov/newsreleases/regional/gdp_metro/2014/pdf/gdp_metro0914.pdf)

<sup>27</sup> World Bank (2014) *GDP – Current USD*. <http://data.worldbank.org/indicator/NY.GDP.MKTP.CD>

<i>Beijing</i>	ETS	\$314,000,000,000.00	National Bureau of Statistics China
<i>Tianjin</i>	ETS	\$231,400,000,000.00	National Bureau of Statistics China
<i>Hubei</i>	ETS	\$397,200,000,000.00	National Bureau of Statistics China
<i>Chongqing</i>	ETS	\$203,810,000,000.00	National Bureau of Statistics China
<i>Shanghai</i>	ETS	\$347,875,000,000.00	National Bureau of Statistics China
<i>Guandong</i>	ETS	\$1,020,000,000,000.00	National Bureau of Statistics China
<i>Kazakhstan</i>	ETS	\$231,876,282,133.90	World Bank 1
<i>Norway</i>	ETS + CT	\$512,580,425,531.90	World Bank 1
<i>EU</i>	ETS	\$17,960,000,000,000.0 0	World Bank 2 <sup>28</sup>
<i>Turkey</i>	ETS or CT	\$822,135,183,160.00	World Bank 1
<i>Thailand</i>	ETS or CT	\$387,252,164,290.80	World Bank 1
<i>South Africa</i>	CT	\$366,057,913,367.10	World Bank 1
<b>Totals</b>		<b>\$37,325,888,703,06 4.80</b>	Sum of jurisdictions above
<b>Global Total</b>		<b>\$75,621,858,000,00 0.00</b>	World Bank 1

<sup>28</sup> World Bank (2015) *European Union GDP 2013*. <http://data.worldbank.org/country/EUU>

## 9. Global Clean Energy Economy Surging

**Statement:** In 2013, these three leaders controlled 40 percent of the clean-technology export market, worth some CAD\$400 billion, and employed 3.6 million people.

Market estimates are from Analytica’s 2015 Clean Technology Industry Report. Job estimates are from the International Renewable Energy Agency’s renewable energy employment database<sup>29</sup>. Table 8 summarizes exports, market share and jobs per country.

**Table 8: Summary of clean technology exports, market share and jobs for leading countries**

Country	Exports (\$Billion)	% Market	Jobs
China	195	20%	2,640,000
Germany	115	12%	371,000
The United States	92	9.5%	624,000
<b>Total</b>	<b>402</b>	<b>41.5%</b>	<b>3,635,000</b>

## 10. Divestment Movement Gains Allies

No unique calculations.

<sup>29</sup> IRENA (2015) *Renewable Energy Employment by Country*

