Problem I encountered: Canadian Government has barely any data and statistics about renewable energy. This says quite a bit about their commitment towards the fastest growing energy market in the world! The US has more data and so I have been building sometimes on that, with the idea that if the US can, so can Canada.

1. INFO ON RENEWABLES/GREEN ENERGY

According to Wikipedia:

Green energy includes natural energetic processes that can be harnessed with little pollution. Anaerobic digestion, geothermal power, wind power, small-scale hydropower, solar energy, biomass power, tidal power, wave power, and some forms of nuclear power (ones which are able to "burn" nuclear waste through a process known as nuclear transmutation, such as an Integral Fast Reactor, and therefore belong in the "Green Energy" category). Some definitions may also include power derived from the incineration of waste.

- **WIND** (http://en.wikipedia.org/wiki/Wind_power)
  - On land and off-shore
  - Wind energy as an alternative to fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation and uses little land. The effects on the environment are generally less problematic than those from other power sources.
  - Wind power is capital intensive, but has no fuel costs. The price of wind power is therefore much more stable than the volatile prices of fossil fuel sources. The marginal cost of wind energy once a station is constructed is usually less than 1cent per kW·h.
  - For some numbers about wind energy:
    - http://www.windenergyfoundation.org/interesting-wind-energy-facts
  - Worldwide More than 35 GW of wind power capacity was added in 2013, bringing the global total above 318 GW. In 2013 the share of Denmark’s electricity covered by wind was 33.2% (source:
  - “Most of the components of wind turbines installed in the United States are manufactured here. There are more than 500 manufacturing facilities located
throughout the United States, and the U.S. wind energy industry currently employs more than 50,000 people.” (Source: http://energy.gov/articles/top-10-things-you-didnt-know-about-wind-power)

- **SOLAR:** (http://en.wikipedia.org/wiki/Solar_energy)
  - Solar thermal: water heating, cooling/heating/ventilation, process heat (manufacturing plants), water treatment, solar cookers. Solar thermal heating and cooling contribute significantly to hot water production in many countries, and increasingly to space heating and cooling as well as industrial processes. The majority is installed in China.
  - Solar Power: photovoltaic (think solar panels) or Concentrated solar power (CSP) Photovoltaic plants: biggest in the USA and India CSP: biggest capacity plants in Spain and the USA

- **GEOTHERMAL:** (http://en.wikipedia.org/wiki/Geothermal_energy)
  - Thermal energy generated and stored in the Earth. Especially in zones with high earthquake risks!
  - From hot springs, geothermal energy has been used for bathing since Paleolithic times and for space heating since ancient Roman times, but it is now better known for electricity generation.
  - Geothermal power is cost effective, reliable, sustainable, and environmentally friendly
  - Worldwide, 11,700 megawatts (MW) of geothermal power is online in 2013
  - In 2010, the United States led the world in geothermal electricity production with 3,086 MW of installed capacity from 77 power plants. The Philippines is the second highest producer, with 1,904 MW of capacity online. Geothermal power makes up approximately 27% of Philippine electricity generation.
• SMALL SCALE HYDRO POWER:  (http://en.wikipedia.org/wiki/Hydropower)
  – The key word here is small scale. Examples of BIG projects like Three Gorges Dam and Aswan Dan show the negative environmental impact they have. Run-of-river plants usually have a lower impact on upstream and downstream environments and communities because local habitats and the flow of silt and nutrients in the river are less affected by diverting than damming water.
  – Hydropower is used primarily to generate electricity. Broad categories include:
    – Conventional hydroelectric, referring to hydroelectric dams.
    – Run-of-the-river hydroelectricity, which captures the kinetic energy in rivers or streams, without the use of dams.
    – Small hydro projects are 10 megawatts or less and often have no artificial reservoirs.
    – Micro hydro projects provide a few kilowatts to a few hundred kilowatts to isolated homes, villages, or small industries.
    – Conduit hydroelectricity projects utilize water which has already been diverted for use elsewhere; in a municipal water system for example.
    – Pumped-storage hydroelectricity stores water pumped during periods of low demand to be released for generation when demand is high.
  – Over the last decade, the small-scale hydroelectric industry has contributed about $100 million per year to the Canadian economy in manufacturing and services and added about 30 to 50 MW yearly to Canada's power supply. (http://www.pembina.org/re/sources/hydro-power)

• BIOMASS / BIOFUEL:  (http://en.wikipedia.org/wiki/Biofuel)
  – A biofuel is a fuel that is derived from biological materials, such as plants, animals and fish. These fuels are produced from living organisms. This biomass can be converted to convenient energy containing substances in three different ways: thermal conversion, chemical conversion, and biochemical conversion. This biomass conversion can result in fuel in solid, liquid, or gas form. This new biomass can be used for biofuels.
  – Examples: bio-ethanol (fermentation from carbohydrates in sugar or starch crops) and bio-diesel (transesterification of farts/oils)
  – In 2010, worldwide biofuel production reached 105 billion liters, up 17% from 2009
  – Global ethanol fuel production reached 86 billion liters (23 billion gallons US) in 2010, with the United States and Brazil as the world's top producers, accounting together for 90% of global production.
  – The world's largest biodiesel producer is the European Union, accounting for 53% of all biodiesel production in 2010.
• **ANAEROBIC DIGESTION:** ([http://en.wikipedia.org/wiki/AAnaerobic_digestion](http://en.wikipedia.org/wiki/AAnaerobic_digestion))
  - Collection of processes by which microorganisms break down biodegradable material in the absence of oxygen. The process is used for industrial or domestic purposes to manage waste and/or to produce fuels.
  - Anaerobic digestion is widely used as a source of renewable energy. The process produces a biogas, consisting of methane, carbon dioxide and traces of other ‘contaminant’ gases. This biogas can be used directly as fuel, in combined heat and power gas engines or upgraded to natural gas-quality biomethane. The nutrient-rich digestate also produced can be used as fertilizer.
  - With the re-use of waste as a resource and new technological approaches which have lowered capital costs, anaerobic digestion has in recent years received increased attention among governments in a number of countries, among these the United Kingdom (2011), Germany and Denmark (2011).

• **MARINE/OCEAN ENERGY:** ([http://en.wikipedia.org/wiki/Marine_energy](http://en.wikipedia.org/wiki/Marine_energy))
  - Ocean energy refers to any energy harnessed from the ocean by means of ocean waves, tidal range (rise and fall), tidal currents, ocean (permanent) currents, temperature gradients, and salinity gradients.
  - The oceans have a tremendous amount of energy and are close to many if not most concentrated populations. Ocean energy has the potential of providing a substantial amount of new renewable energy around the world.
  - Canada has the largest coast line on the world with more than 200,000km and access to three oceans (Pacific, Artic, Atlantic)
  - Indonesia is an archipelagic country with three quarter of the area ocean, has 49 GW recognized potential ocean energy and has 727 GW theoretical potential ocean energy

• **ENERGY CONSERVATION AND ENERGY EFFICIENCY:** ([http://en.wikipedia.org/wiki/Efficient_energy_use](http://en.wikipedia.org/wiki/Efficient_energy_use))
  - The goal to reduce the amount of energy used or energy required to provide products and services.

• **MORE INFO:**
2. WHY GREEN ENERGY?


Renewable energy provides substantial benefits for our climate, our health, and our economy:

- **Little to no global warming emission:** Compared with natural gas, which emits between 0.6 and 2 pounds of carbon dioxide equivalent per kilowatt-hour (CO2E/kWh), and coal, which emits between 1.4 and 3.6 pounds of CO2E/kWh, wind emits only 0.02 to 0.04 pounds of CO2E/kWh, solar 0.07 to 0.2, geothermal 0.1 to 0.2, and hydroelectric between 0.1 and 0.5.

- **Increased health:** The air and water pollution emitted by coal and natural gas plants is linked to breathing problems, neurological damage, heart attacks, and cancer. Replacing fossil fuels with renewable energy has been found to reduce premature mortality and lost workdays, and it reduces overall healthcare costs. The aggregate national economic impact associated with these health impacts of fossil fuels is between 361.7 and 886.5 billion USD, or between 2.5 percent and 6 percent of gross domestic product (GDP) of the USA.

- **Vast and inexhaustible energy supply:** These diverse sources of renewable energy have the technical potential to provide all the electricity the world needs many times over.

- **Job creation:** Compared with fossil fuel technologies, which are typically mechanized and capital intensive, the renewable energy industry is more labor-intensive. This means that, on average, more jobs are created for each unit of electricity generated from renewable sources than from fossil fuels.

- **Stable prices:** Renewable energy is providing affordable electricity across the country right now, and can help stabilize energy prices in the future. The costs of renewable energy technologies have declined steadily, and are projected to drop even more. In contrast, fossil fuel prices can vary dramatically and are prone to substantial price swings.

- **More reliable and resilient energy system:** Wind and solar are less prone to large-scale failure because they are distributed and modular. Distributed systems are spread
out over a large geographical area, so a severe weather event in one location will not cut off power to an entire region. Modular systems are composed of numerous individual wind turbines or solar arrays. Even if some of the equipment in the system is damaged, the rest can typically continue to operate.

- **Accessibility for small communities, and developing nations:** Not having access to electricity means missing out on many opportunities in life. This is still reality for about 1.3 billion people in the world. But now, renewable energy is making energy access more achievable. Its technologies are by now significantly cheaper than diesel or kerosene-based systems, and cheaper than extending the grid in areas with low populations and per capita energy demand. Local, clean solutions, like microgrids running on solar, give poorer smaller communities control over their own energy destiny. The systems are relatively cheap to maintain and the people living off of their own renewably sourced electricity are not beholden to volatile fossil fuel prices or the unsustainable demands of the massive energy conglomerates.

- **Cheaper to produce:** The cost to produce the energy will be lower as their fuel is derived from natural and available resources. It also requires less energy to produce than fossil fuels, further reducing the costs of operation.

- **BUT:** All energy sources have some **impact on our environment.** Fossil fuels — coal, oil, and natural gas — do substantially more harm than renewable energy sources by most measures, including air and water pollution, damage to public health, wildlife and habitat loss, water use, land use, and global warming emissions. It is still important, however, to understand the environmental impacts associated with producing power from renewable sources. Negative effects from renewables can be found here: [http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-of.html#.VOFCpvnF8nc](http://www.ucsusa.org/clean_energy/our-energy-choices/renewable-energy/environmental-impacts-of.html#.VOFCpvnF8nc)

### 3. POTENTIAL FOR RENEWABLES

100% renewables is possible!

- Renewable energy can meet all our energy needs. As the IPCC finds, the technical potential is much higher than all global energy demands. [file:///C:/Users/Owner/Downloads/ipcc_wg3_ar5_final-draft_postplenary_chapter7.pdf](file:///C:/Users/Owner/Downloads/ipcc_wg3_ar5_final-draft_postplenary_chapter7.pdf)
- 100% clean energy in the USA according to Mark Ruffalo [http://www.motherjones.com/environment/2014/01/inquiring-minds-mark-ruffalo-fracking-solar](http://www.motherjones.com/environment/2014/01/inquiring-minds-mark-ruffalo-fracking-solar)
4. AN EMERGING MARKET: GREEN ENERGY AND TECHNOLOGY

- REN 21: Renewables 2014, Global Status Report

  It states:
  
  - “Renewable energy provided an estimated 19% of global final energy consumption in 2012, and continued to grow in 2013. [...] As renewable energy markets and industries mature, they increasingly face new and different challenges, as well as a wide range of opportunities.”
  - “Markets, manufacturing, and investment expanded further across the developing world, and it became increasingly evident that renewables are no longer dependent upon a small handful of countries.”
  - “Solar photovoltaic has continued to expand at a rapid rate, with growth in global capacity averaging almost 55% annually over the past five years. Wind power has added the most capacity of all renewable technologies over the same period. In 2013, renewables accounted for more than 56% of net additions to global power capacity and represented far higher shares of capacity added in several countries.”
  - Global investment in Green energy in 2013 was 214 billion USD.

- Report 2014 from Clean Energy Canada:” Tracking the Energy Revolution Globally”.
  Numbers and results globally. Handy brochure with quick overview of the global results. Some good graphics

- Report 2014 from Clean Energy Canada:” Tracking the Energy Revolution Canada”.
  http://cleanenergycanada.org/2014/12/02/tracking-the-energy-revolution-canada/

- Report 2014: Canadian Clean Technology Industry Report
  http://www.analytica-advisors.com/sites/default/files/Stand%20alone%20ES.pdf
5. **IF THE WORLD IS TURNING TO CLEAN ENERGY, WHO WILL NEED CANADIAN OIL?**

- In 2013 China and the USA, the biggest buyers of Canadian crude, have made again the biggest investments in green energy worldwide. China alone invested 56.3 billion USD, the USA invested 35.8 billion USD. By comparison, Canada invested 6.5 billion USD. ([www.REN21.net](http://www.REN21.net))
- By the end of 2013 the top countries for non-hydro capacity were again China, the United States, and Germany, followed by Spain, Italy, and India. ([www.REN21.net](http://www.REN21.net))
- China’s new renewable power capacity surpassed new fossil fuel and nuclear capacity for the first time in 2013. ([www.REN21.net](http://www.REN21.net))

http://treealerts.org/region/europe/2013/12/the-rise-of-renewable-energy/

6. **CANADA IS NOT FOLLOWING THE TREND TOWARDS GREEN ENERGY IN SAME SPEED/AMOUNT**

The world is turning to green/clean energy (solar, wind the biggest players), but Canada is not following this global trend.


“At a time when investment in clean energy technologies is growing worldwide, Canada is “looking the other way” and risks missing out on trade and growth opportunities.[...] Canada spent $6.5 billion on the renewable energy transition last year. That is minuscule compared to the $207 billion spent worldwide, including $55 billion in China alone.[...] While major trading partners such as China, the U.S., Japan and Germany are big spenders on wind and solar, both to reduce pollution and provide clean sources of energy, Canada is not developing its industries quickly enough to take advantage of the shift.”

- **IRENA: International Renewable Energy Agency** [www.irena.org](http://www.irena.org)
  - Intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of
excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

- Currently IRENA has 139 members and 32 states in accession (started the formal process to become a member). **Canada is NOT one of them.**

- “**A Canadian Energy Strategy: Why Local Governments Should Care**”, released by the Centre for Civic Governance and Columbia Institute, May 2013
  http://cleanenergycanada.org/2013/05/30/why-local-governments-care-about-the-canadian-energy-strategy/
- Local governments are as yet uninvolved with Canada’s developing national energy strategy, but have much to gain by engaging with their provincial counterparts now, while the plan is in its formative stages.

7. **JOB OPPORTUNITIES IN GREEN ENERGY PLUS OTHER BENEFITS**
- Canada’s green energy sectors now employs more than its tar sands.
  http://www.huffingtonpost.ca/2014/12/02/green-energy-jobs-canada-oilsands_n_6252910.html
  AND
  http://thinkprogress.org/climate/2014/12/02/3598312/canada-green-energy-tar-sands/
  AND

- There were **23,700 people directly employed by the clean energy industry in 2013**, compared to 22,340 jobs in the oilsands, the report found. Those green jobs include people employed in clean power production, energy efficiency, biofuels and manufacturing of green energy technologies.

  Key Facts from the report:
IRENA estimates that renewable energy jobs reached 6.5 million in 2013 (this exclude large hydropower). In decreasing order, the largest employers were China, Brazil, the United States, India, Germany, Spain and Bangladesh.

Regional shifts from developed to emerging countries continued in wind and solar technologies, predominantly in the manufacturing and installation segments of the value chain.

Solar photovoltaic and wind power remain the most dynamic renewable energy technologies.

In 2013, the solar photovoltaic sector accounted for 2.3 million jobs, largely concentrated in China. The trends show an increase in Chinese installation jobs, while manufacturing jobs remain stable as growing demand is absorbing the oversupply of photovoltaic panels.

Liquid biofuels, modern biomass and biogas are large employers (1.4 million, 0.8 million and 0.3 million) and jobs are mainly concentrated in feedstock production.

Wind employment remains relatively stable at 0.8 million jobs. Policy changes in several countries have reduced installation jobs, while those in operations and maintenance have experienced some growth.

Solar heating employed 0.5 million people, around 70% were in China. Data availability for solar heating, small hydro and geothermal is low, hence there is a potential for underestimation of jobs.

The policy context is vital – steadiness and predictability are essential to ensure sustained growth in renewable energy employment.

Education and training are critical enablers for employment in this relatively new and highly dynamic sector. Skill shortages are already creating bottlenecks for deployment in some countries.

- **Infographic “Made in America – Clean Energy Jobs”**

- **Scientific Article from the University of Berkeley**, 2013 “Putting Renewables and Energy Efficiency To Work: How Many Jobs Can The Clean Energy Industry Generate in the U.S.?“
  [http://rael.berkeley.edu/sites/default/files/green_jobs_paper_Oct1809_0.pdf](http://rael.berkeley.edu/sites/default/files/green_jobs_paper_Oct1809_0.pdf)

  It states:

  “*Our modeling approach yields the following key conclusions:*

  *(1) The renewable energy and low carbon sectors generate more jobs per unit of energy delivered than the fossil fuel-based sector.*
(2) Among the common RPS technologies, solar photo voltaics (PV) creates the most jobs per unit of electricity output.

(3) Energy efficiency and renewable energy can contribute to much lower CO2 emissions and significant job creation. Cutting the annual rate of increase in electricity generation in half and targeting a 30% RPS in 2030 each generates about two million job-years through 2030.

(4) A combination of renewable energy, Energy efficiency, and low carbon approaches such as nuclear and CCS can yield over four million job-years through 2030 with over 50% of the electricity supply from non-fossil supply sources.”


  This report shows that cutting electricity and natural gas use by 25 per cent by 2025 in Ontario alone would create 25,000 new jobs, reduce federal and provincial deficits, boost GDP by $3.7 billion and reduce greenhouse gas emissions by nine per cent. This may sound ambitious, but it’s readily achievable. Ontario’s energy use is 50 per cent greater than New York State and double that of the U.K.


  This report shows if the $1.3 billion in government subsidies, now given to the oil and gas sector, were instead invested in renewable energy and energy efficiency, Canada would create more jobs: 18,000 more. We also discuss in detail the economic risks of relying increasingly on the volatile oil market.

- The grant reskilling:
  Geothermal = oil
  Hydro = tidal

  [https://www.cangea.ca/cangea-events/geothermal-technology-transfer-workshop-oil-gas](https://www.cangea.ca/cangea-events/geothermal-technology-transfer-workshop-oil-gas)
Jobs in the solar energy sector 2013, USA

The study says:
Solar jobs increased nearly 20 percent since the fall of 2012, which is ten times the national average job growth rate. There are 142,698 solar workers in the United States, up from 119,016 in 2012. Not only did the industry exceed growth expectations, but the hiring pace has quickened, at a rate 50 percent higher than last year, suggesting that the trajectory for growth is even stronger than previously expected. 77 percent of the nearly 24,000 new solar workers are new jobs (rather than existing positions that have added solar responsibilities), representing 18,211 new jobs created. Since data were collected for Census 2012, one in every 142 new jobs in the U.S. were created by the solar industry. Solar employment is expected to grow by 15.6 percent over the next year, representing the addition of approximately 22,240 new solar workers.

Some graphics around green economy / clean energy
THE TRUTH ABOUT JOB CREATION

INVEST $1,000,000 IN THE FOLLOWING INDUSTRIES, YOU GET THIS MANY JOBS:

- Natural Gas: 5
- Coal: 7
- Smart Grid: 12
- Wind: 13
- Solar: 14
- Biomass: 16
- Building Retrofits: 17
- Mass Transit/Freight Rail: 22

Source: Political Economy Research Institute at the University of Massachusetts
Jobs in Renewable Energy

- Bioenergy (Biomass, Biofuels, Biogas)
- Geothermal
- Hydropower (Small-scale)\(^1\)
- Solar Energy (Solar PV, CSP, Solar Heating/Cooling)
- Wind Power

= 40,000 jobs

World Total

6.5 Million Jobs

\(^1\) Employment information for large-scale hydropower is incomplete and not included.

Data source: IRENA