NFAT Review

Comments, Questions and Concerns about Manitoba Hydro's Preferred Development Plan

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Overview

1. My background and experience
2. Socio-economic considerations
3. Demand side management issues
4. Renewables and future load growth
5. Conclusions

My background and experience

- More than three decades of experience at local and national levels
  - Focus on improving the energy and environmental performance of new and existing buildings and communities
  - 18 years with Manitoba Energy and Mines; 3 years with CANMET Energy Technology Centre; 10 years as consultant

My background and experience

- Areas of energy expertise:
  - Policy and legislation (e.g., Green Building Policy, The Energy Act)
  - Energy codes (e.g., Model National Energy Code of Canada, BECC)
  - Product standards (e.g., CACEE, furnace and boiler regulation)
  - Research and demonstration (e.g., BIPV and CSP at RRC)
  - Program design and delivery (e.g., Home CHEC-UP, R-2000, C-2000)
  - Consumer education and awareness (e.g., home retrofit booklets)
  - Post-secondary and industry training (e.g., guest lecturer, workshops)

My background and experience

- Perspective is also shaped by international experience
  - North America (U.S., Mexico)
  - Europe (UK, Ireland)
  - Asia (China, South Korea, Japan)
  - Middle East (UAE, Jordan)

Socio-economic considerations

Employment impacts

Employment creation

- Employment projections and comparisons are problematic
  1. Cost per person year of employment from Preferred Development Plan appears exceptionally high
  2. Remarkably few permanent jobs created given high level of investment and risk
  3. Employment advantages of DSM has not been assessed or acknowledged

Wuskwatim employment creation

- Assumptions:
  - Capital cost = **$1.771 billion***

**Source: Manitoba Hydro - see: http://www.pub.gov.mb.ca/exhibits/mh-gra-2012-14/Exhibit-91.pdf*

  - Direct construction employment = **3,535 person years***

**Source: Deloitte and Manitoba Hydro - see: http://www.pub.gov.mb.ca/nfat/mhel_128.pdf*

Wuskwatim employment creation

- Calculation:
  - $\frac{\$1.771 \text{ billion}}{3{,}535}$ = **$500,990** per person year

Keeyask + Conawapa employment creation

- Assumptions
  - Capital cost = $6.5 billion (Keeyask)* + $10.7 billion (Conawapa)*
    = **$17.2 billion**

**Source: Manitoba Hydro – see: http://www.hydro.mb.ca/projects/keeyask/project_overview.shtml and http://www.hydro.mb.ca/projects.mb.ca/projects/conawapa/index/index.shmtl?WT.mc_id=2608*

  - Direct and indirect construction employment = **19,200 person years***

**Source: Deloitte and Manitoba Hydro – see: http://www.pub.gov.mb.ca/nfat/mhel_128.pdf*

Keeyask + Conawapa employment creation

- Calculation:
  - $\frac{\$17.2 \text{ billion}}{19{,}200}$ = **$895,833** per person year

Comparison: B.C. LNG Projects

- Employment impact review for B.C. government by Grant Thorton
  - Construction of five LNG export terminals over nine years
  - Capital cost = **$98.4 billion***
  - Employment impacts = **102,500** direct FTEs*
    198,700 indirect FTEs*
    53,000 induced FTEs*

**Source: http:www.empr.gov.bc.ca/OG/Documents/Grant _Thorton_LNG_Employment_Impacts.pdf)*
(Note: 1 FTE (full-time equivalent) = 1 person year of employment)

Comparison: B.C. LNG Projects

- Calculations:

$$\frac{\$98.4 \text{ billion}}{(102{,}500 + 198{,}700)} = \textbf{\$326,693} \text{ per direct and indirect FTE}$$

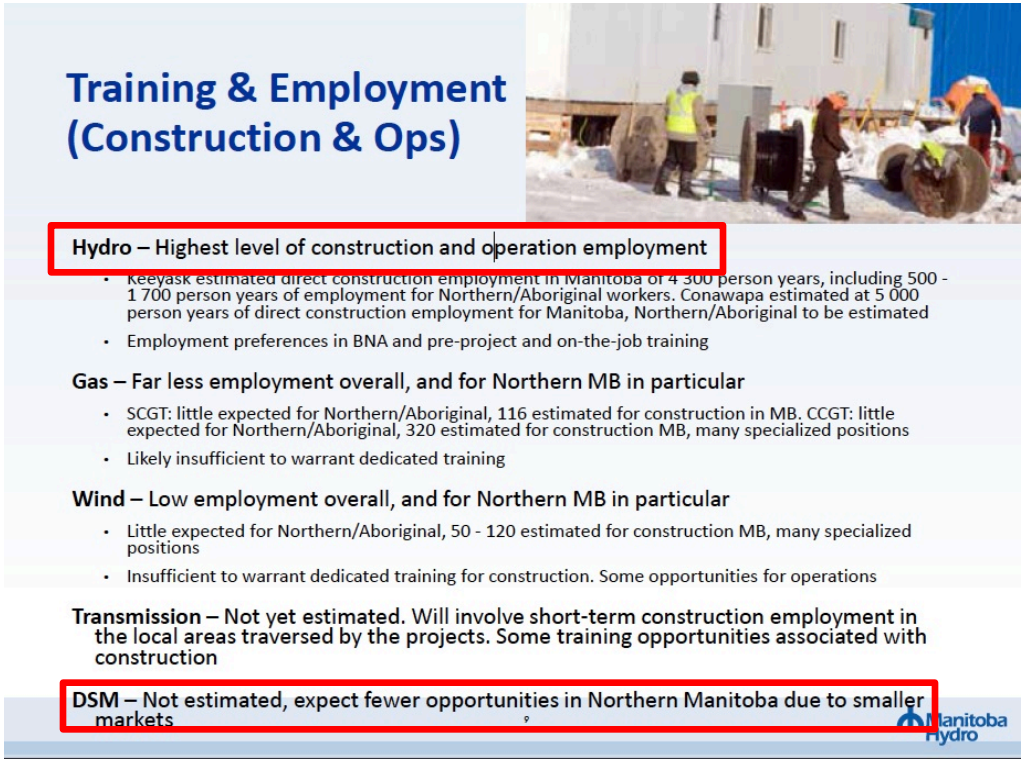
$$\frac{\$98.4 \text{ billion}}{(102{,}500+198{,}700+53{,}000)} = \textbf{\$277,809} \text{ per direct, indirect and induced FTE}$$

Comparison: Permanent job creation

- Hydro electric dams and associated transmission lines create very few permanent jobs
  - Keeyask and Conawapa = only **300** permanent jobs ($17.2-billion)
  - B.C. LNG Projects = **75,000** permanent jobs ($98.4-billion)

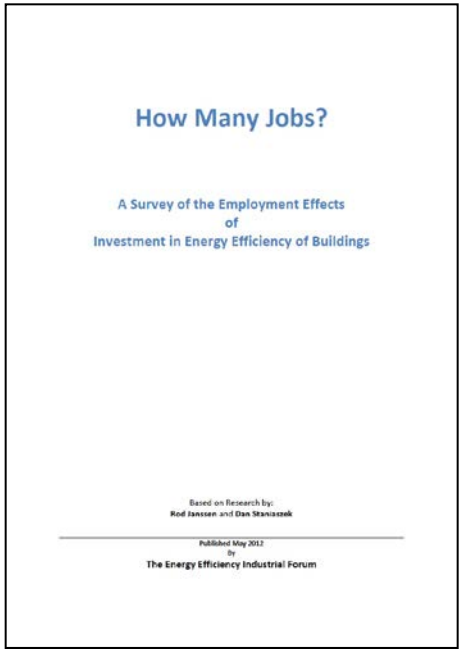
Comparison: Hydro vs. DSM employment

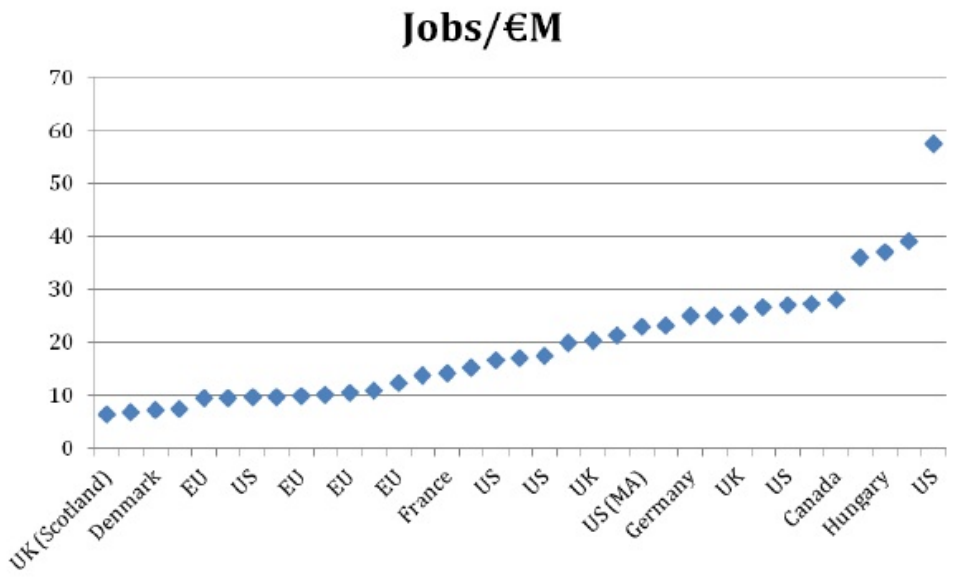
- Highly questionable that hydro offers “Highest level of construction and operation employment”
  - Multiple studies that DSM creates more employment
  - Unclear why Hydro hasn’t calculated DSM employment creation



Comparison: Hydro vs. DSM employment

- Example: EU study of upgrading building stock
  - 20 different sources from Europe and North America
  - Wide variation in estimated employment impacts
  - Average of 19 jobs created per € million investment in upgrading energy efficiency of buildings (**about $80K per job**)





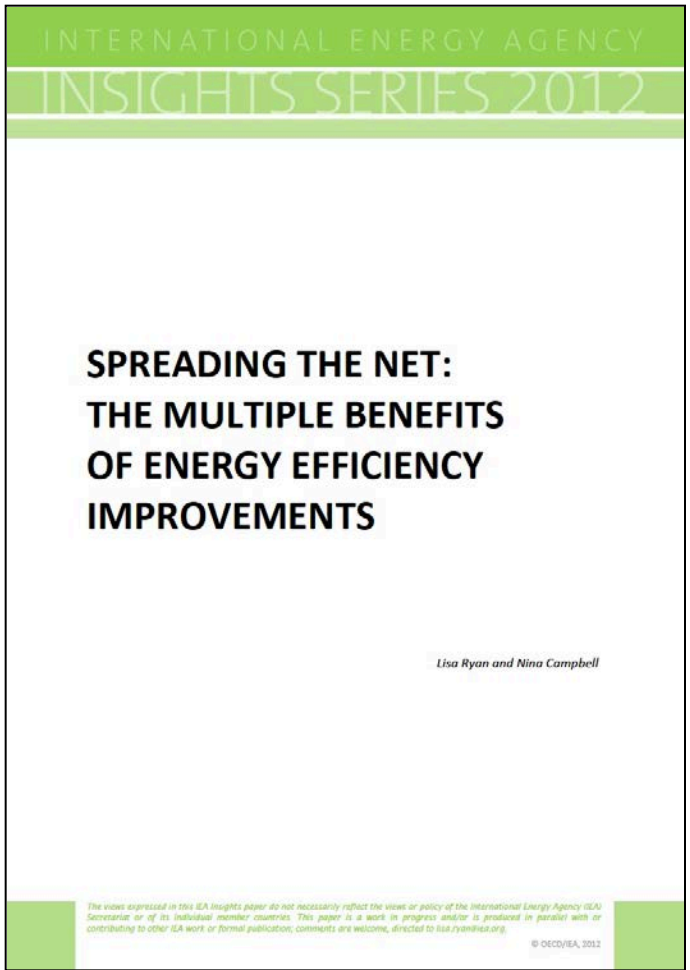
Comparison: Hydro vs. DSM employment

- Focus needs to also be on quality of employment opportunities, not just quantity
  - Numerous advantages for DSM employment

- avoids ‘boom and bust cycles’
- higher fraction of employment in Manitoba
- stimulates local business opportunities
- better geographic distribution of jobs
- skills acquired are more relevant to needs of First Nations and northern communities

Other benefits of DSM

- Many other advantages of DSM beyond employment



Demand Side Management

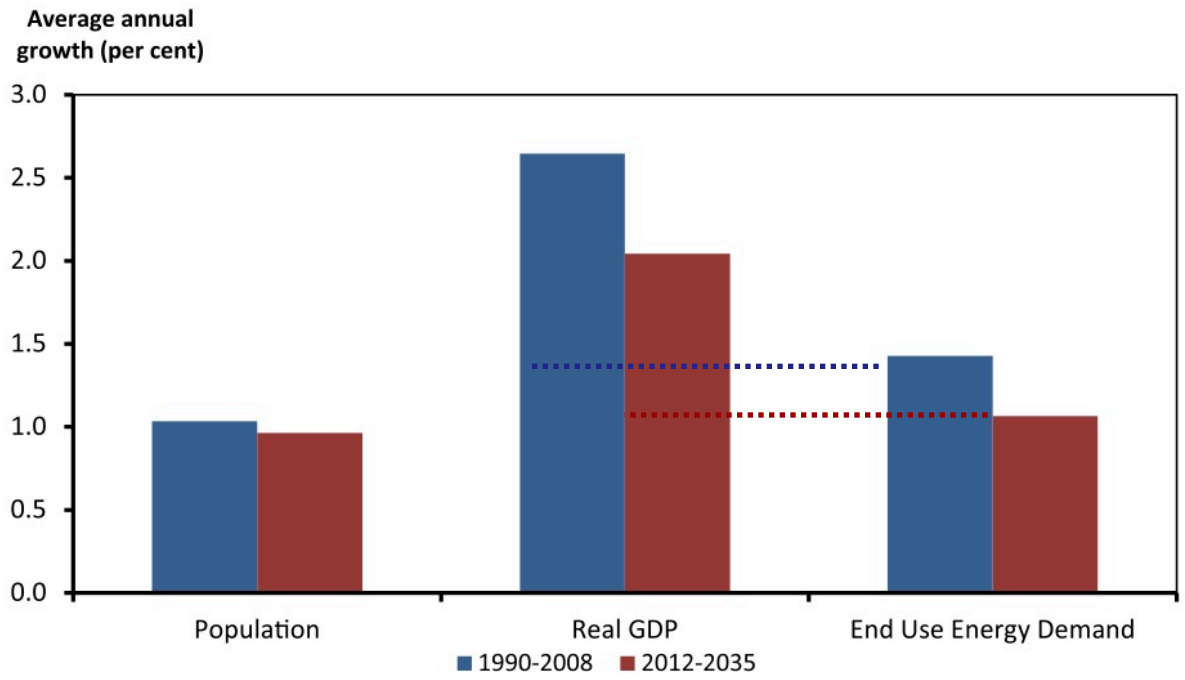
Energy vs. energy services

- Manitobans want the services that energy provides, not energy per se
  - Improved comfort, not ‘kilowatt hours’

Energy efficiency vs. energy supply

- Efficiency is our largest resource for energy services
  - Improved end-use efficiency is our largest source of energy services for a growing population and economy

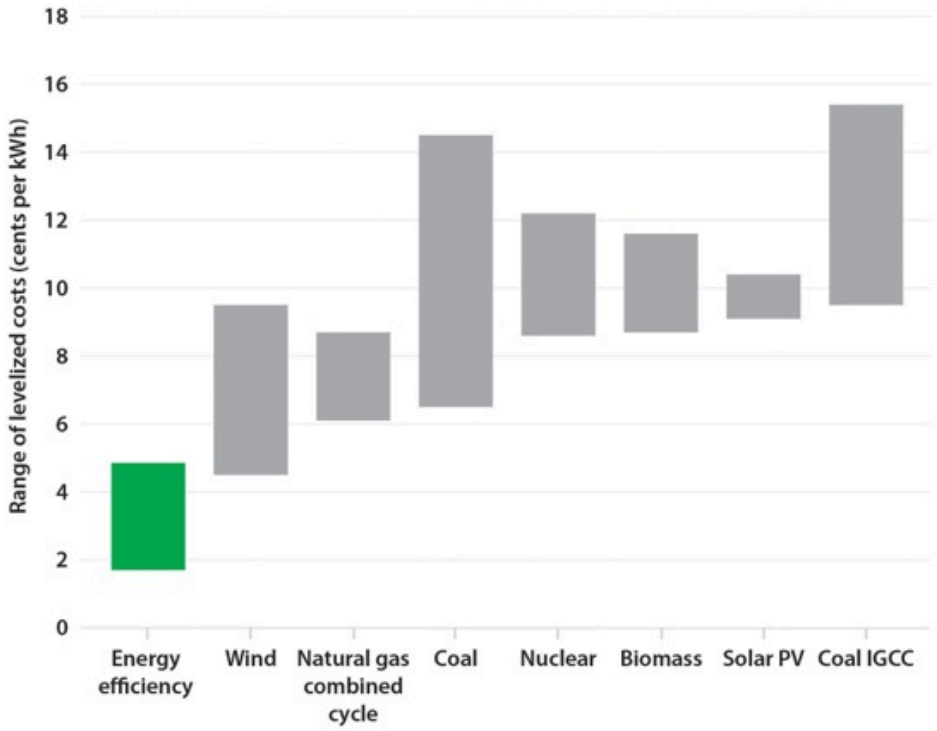
Canada's historical and projected end-use energy demand



Source: Canada's Energy Future 2013 (Conference Board of Canada)

Energy efficiency vs. energy supply

- Efficiency is lowest cost source of electricity services
  - Average cost in 20 states from 2009 to 2012: 2.8 cents per kWh
  - One-half to one-third of new electricity resource options

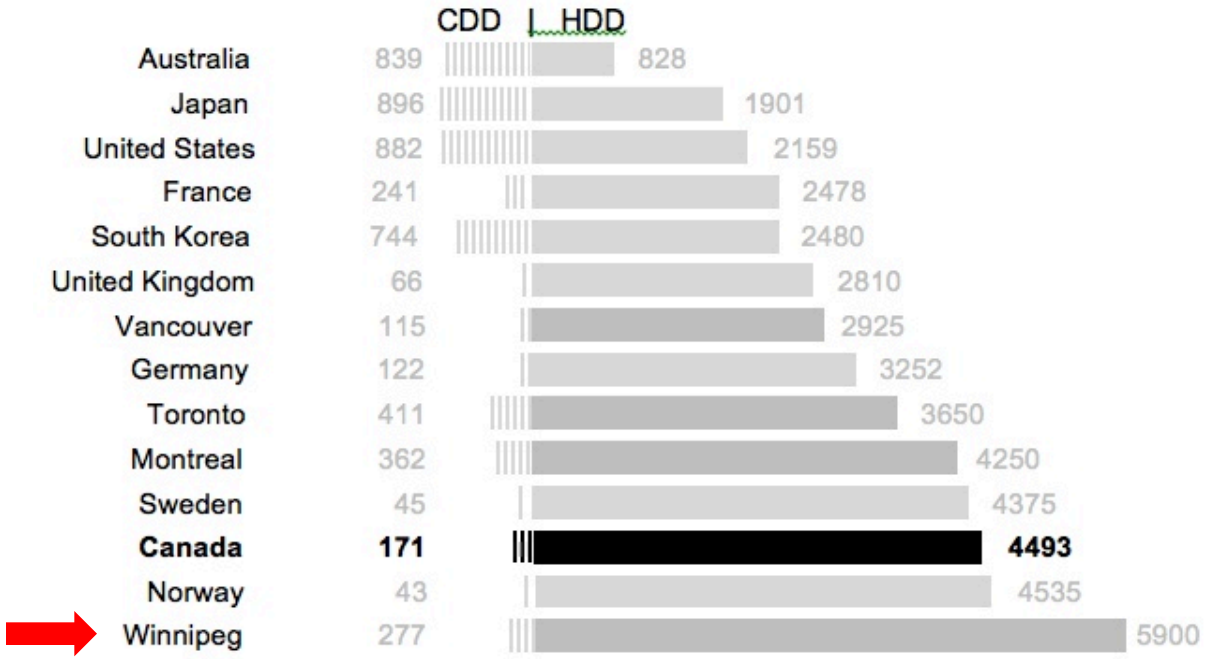


Source: Best Value for America's Energy Dollar (American Council for an Energy Efficient Economy, March 2014)

Impact of climate

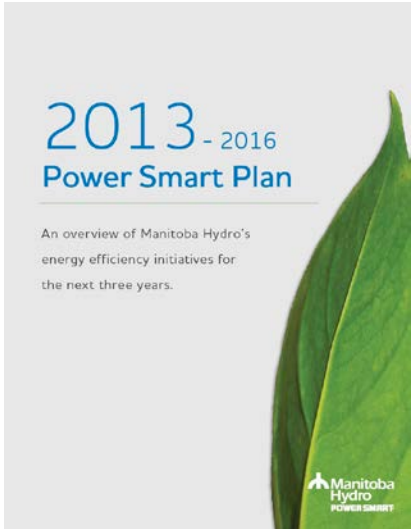
- Much of Manitoba's relatively low electricity prices are offset by our harsh climate
  - Large portion of Manitoba Hydro's load is weather-dependent

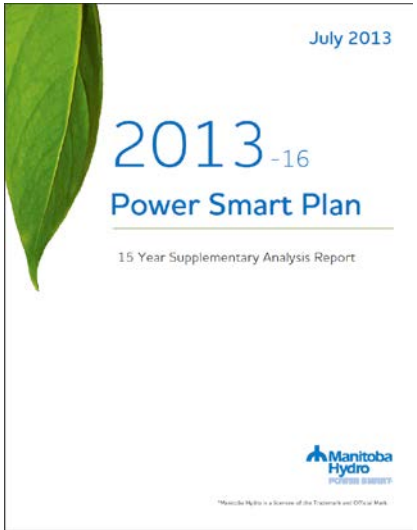
Population-weighted heating and cooling degrees days

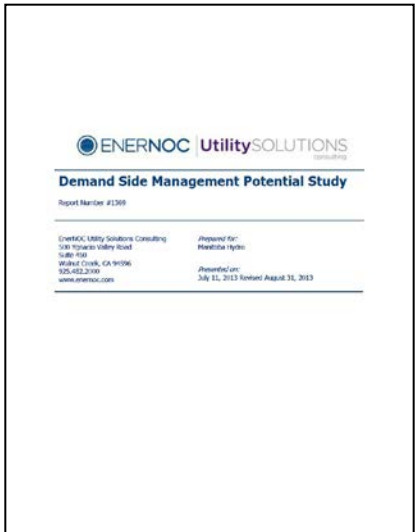


Stakeholder consultation

- Appears to have been lack of meaningful consultation with local energy efficiency experts and other stakeholders for:
  - Power Smart Plan and 15 Year Supplementary Report
  - EnerNOC Demand Side Management Potential Study
  - Elenchus Review of Manitoba Hydro's DSM Plan

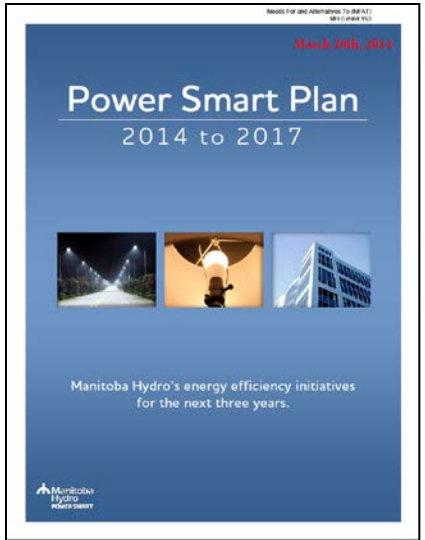






Stakeholder consultation

- Multiple questions/concerns about new 2014 to 2017 Power Smart Plan
  - What (if any) consultation with stakeholders?
  - Why sudden doubling of targets vs. previous plan?
  - Where is budget and plan to support implementation of codes and standards plus innovation?
  - Where is longer-term (15 year) projections?

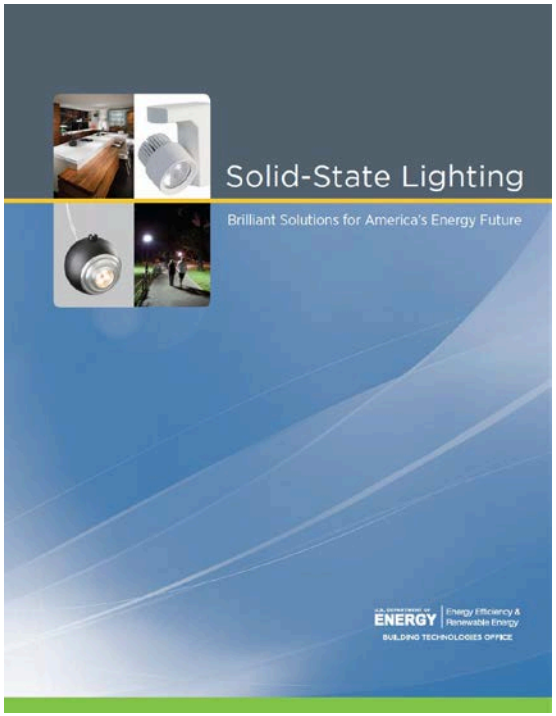


Energy efficiency measures

- Are we running out of energy efficiency opportunities?
  - While some opportunities are being exhausted, new ones are constantly emerging
  - Unprecedented number of new and innovative technologies

Energy efficiency measures

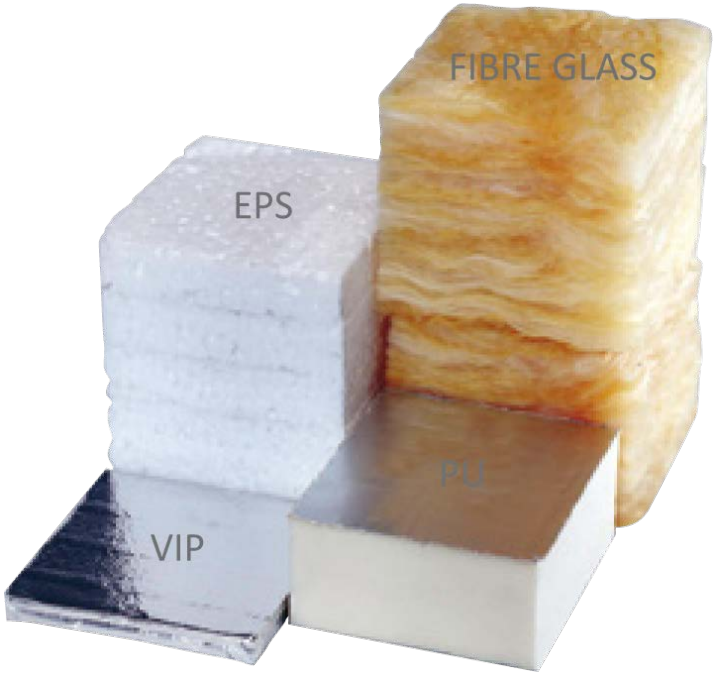
- Some examples of new and emerging technologies
  - Solid-state lighting (LED, OLED) and advanced controls
    - potential to reduce lighting energy use by half by 2030*



*Source: Solid-State Lighting – Brilliant Solutions for America's Energy Future (U.S. Department of Energy)[1].

Energy efficiency measures

- Some examples of new and emerging technologies
  - High performance insulation (vacuum insulation panels, aerogels) - up to 10x more thermally efficient than conventional insulations*



Source: Construction Innovation (National Research Council Council Canada)

Energy efficiency measures

- Some examples of new and emerging technologies
  - Cold climate, air source heat pumps
    - 300 demonstration installations across Canada by end of 2014*

Source: Cold Climate Air-Source Heat Pump Demonstration, Ecologix Heating Technologies (Natural Resources Canada)

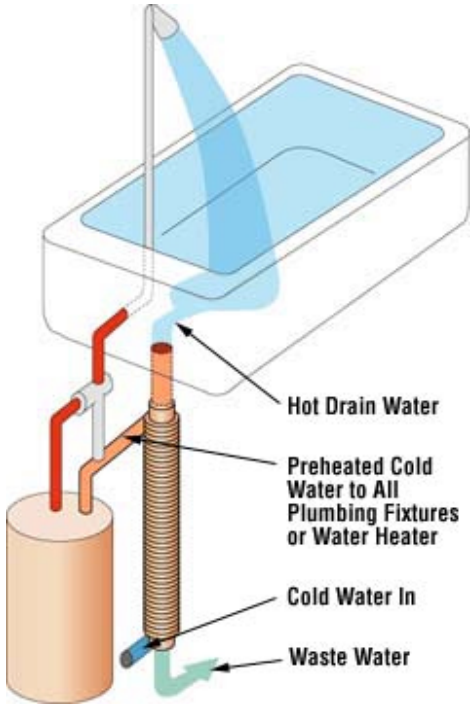
Energy efficiency measures

- Some examples of new and emerging technologies
  - Hybrid heat pump water heaters
    - up to 62% reduction in electricity use*
    - can shift portion of electric water heating to gas furnace

Source: Based on U.S. DOE testing procedures (GE Appliances, MABE Canada)

Energy efficiency measures

- Some examples of new and emerging technologies
  - Drainwater heat recovery
    - <u>can recover up to 2/3 of energy</u> from simultaneous hot water draws and warm water waste flows (e.g., showers and sinks)*



Source: Drainwater Heat Recovery Performance Testing at CCHT (Canada Mortgage and Housing Corporation)

Energy efficiency measures

- Some examples of new and emerging technologies
  - Web-enabled ‘smart’ thermostats, energy monitors and ‘dashboards’

Energy efficiency measures

- Some examples of new and emerging technologies
  - High performance windows and advanced glazing (e.g., electrochromatic and thermochromatic glass)

Energy efficiency measures

- Some examples of new and emerging technologies
  - ‘Net zero energy’ houses and buildings
    - produce as much energy as they use on an annual basis

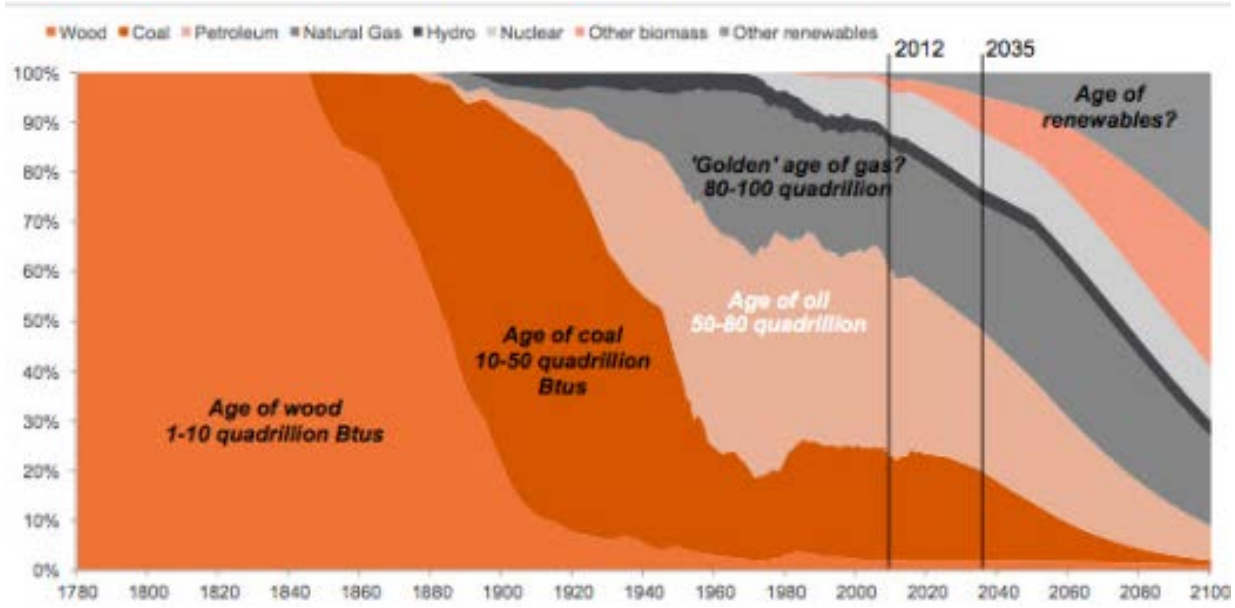
Net Zero Energy Super E® House
(Sapporo, Japan)

EcoTerra™ EQuilibrium Project
(Eastman, Quebec)

The age of renewables and future load growth

The age of renewables

- History reveals a process of energy substitution

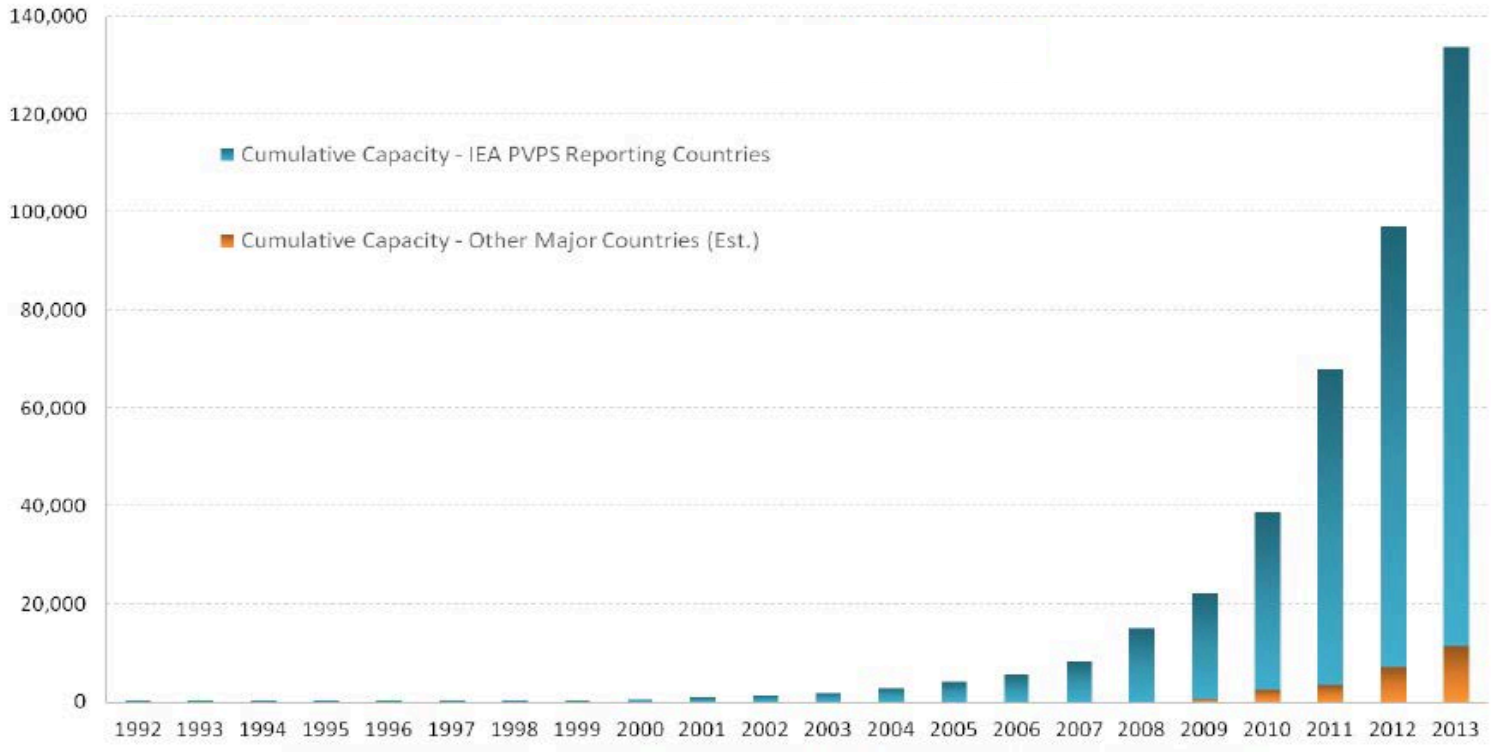


Sources: IEA, EIA, Citi Research

The age of renewables

- PV-generated electricity has seen high rates of growth

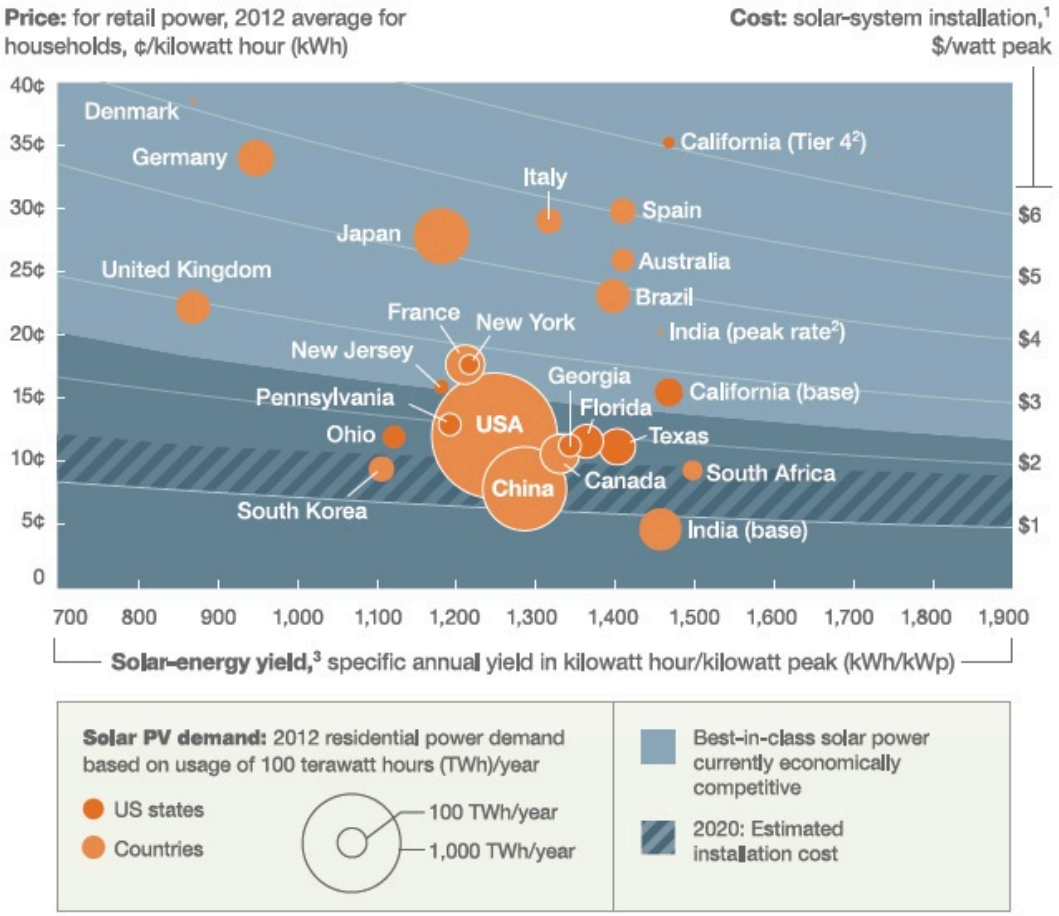
Total Installed Global PV Capacity (MWp) from 1992 to 2013



Source: Snapshot of Global PV 1992-2013 (International Energy Agency)

The age of renewables

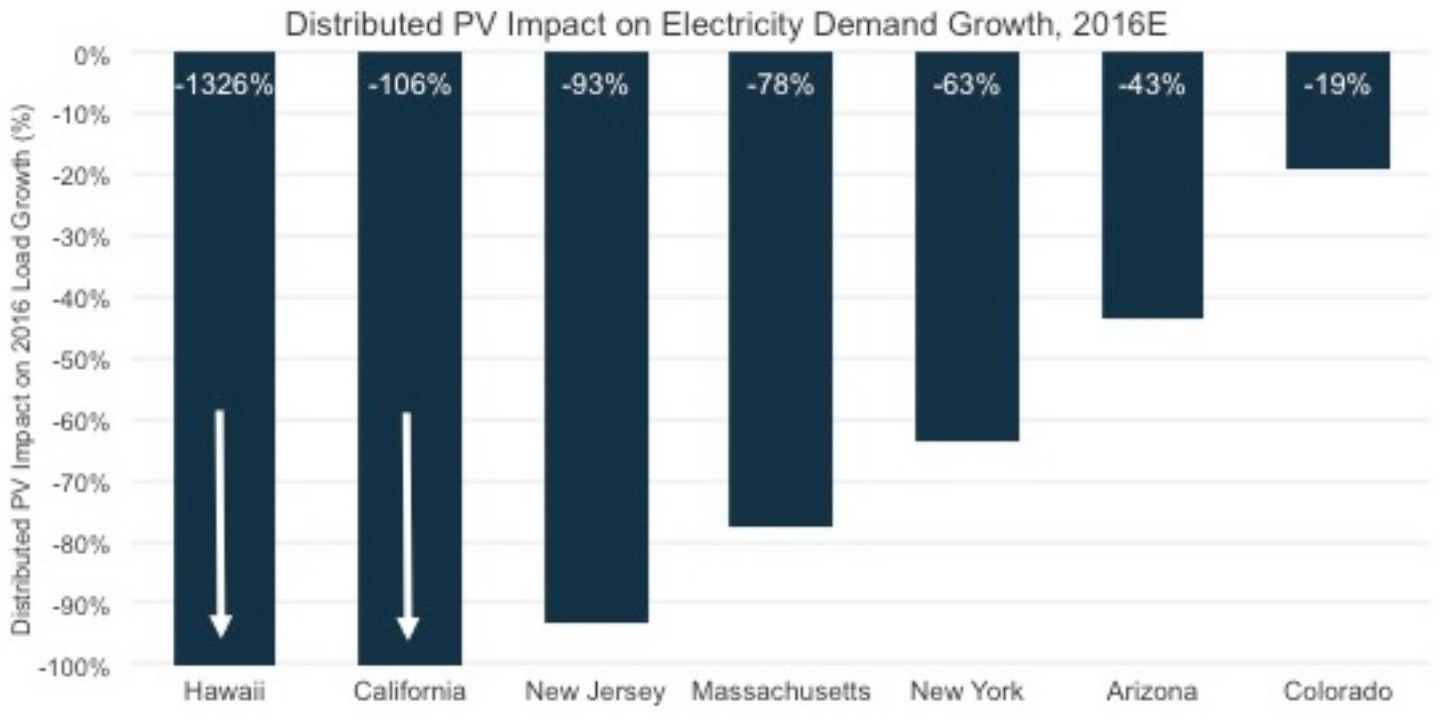
- PV-generated electricity is a disruptive technology



Source: The disruptive potential of solar power (McKinsey Quarterly, April 2014)

The age of renewables

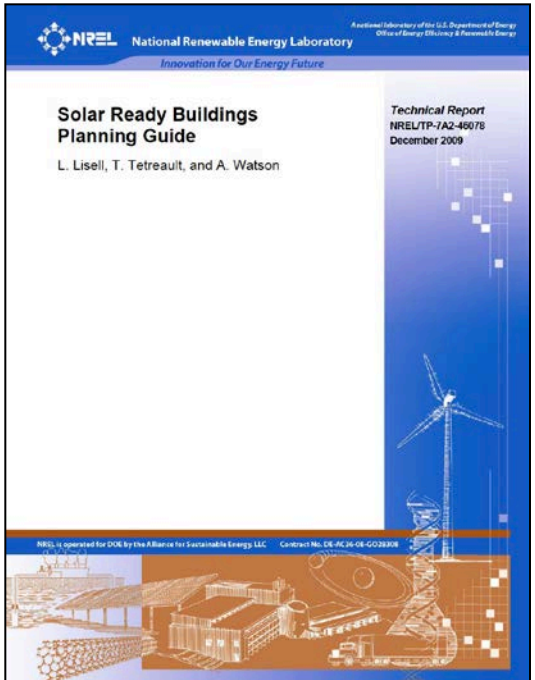
- Distributed PV is beginning to have profound impact on projected electricity load growth for utilities

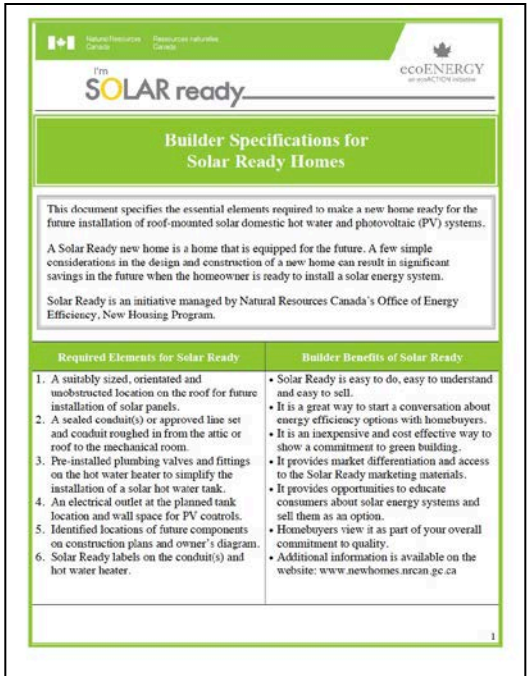


Source: How to really disrupt the retail energy market with solar (GTM Research, April 2014)

The age of renewables

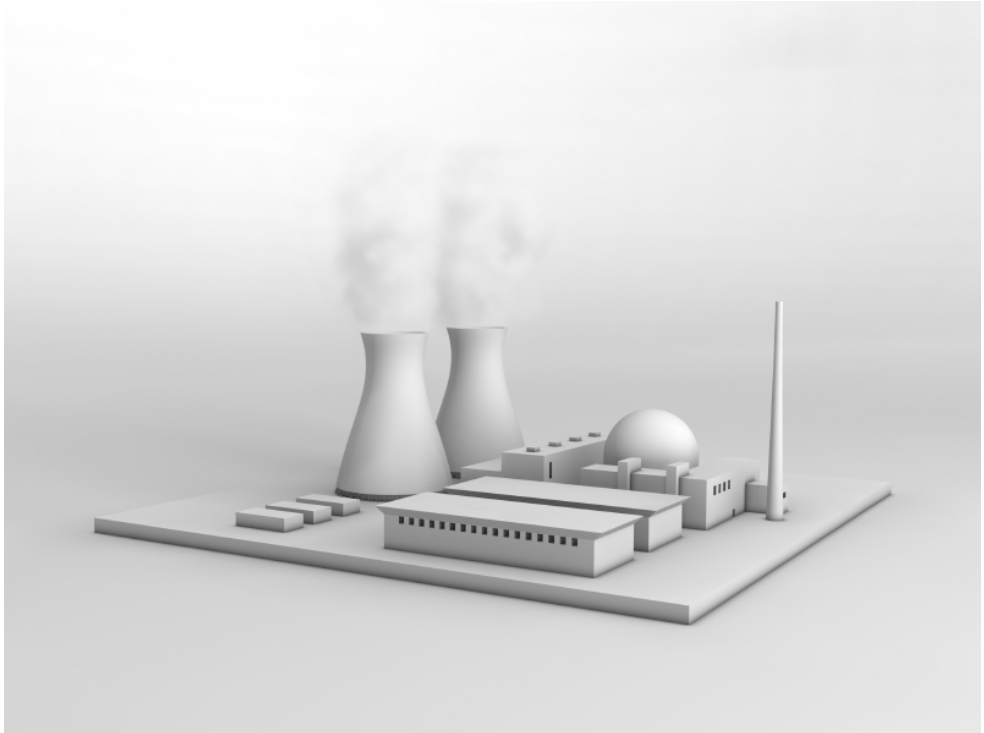
- Strong probability that PV will become cost-effective alternative to grid electricity in Manitoba
  - Need to ‘future-proof’ new homes, buildings and communities
  - Simple no-cost/low cost measures can make future addition of PV more feasible when economics improve





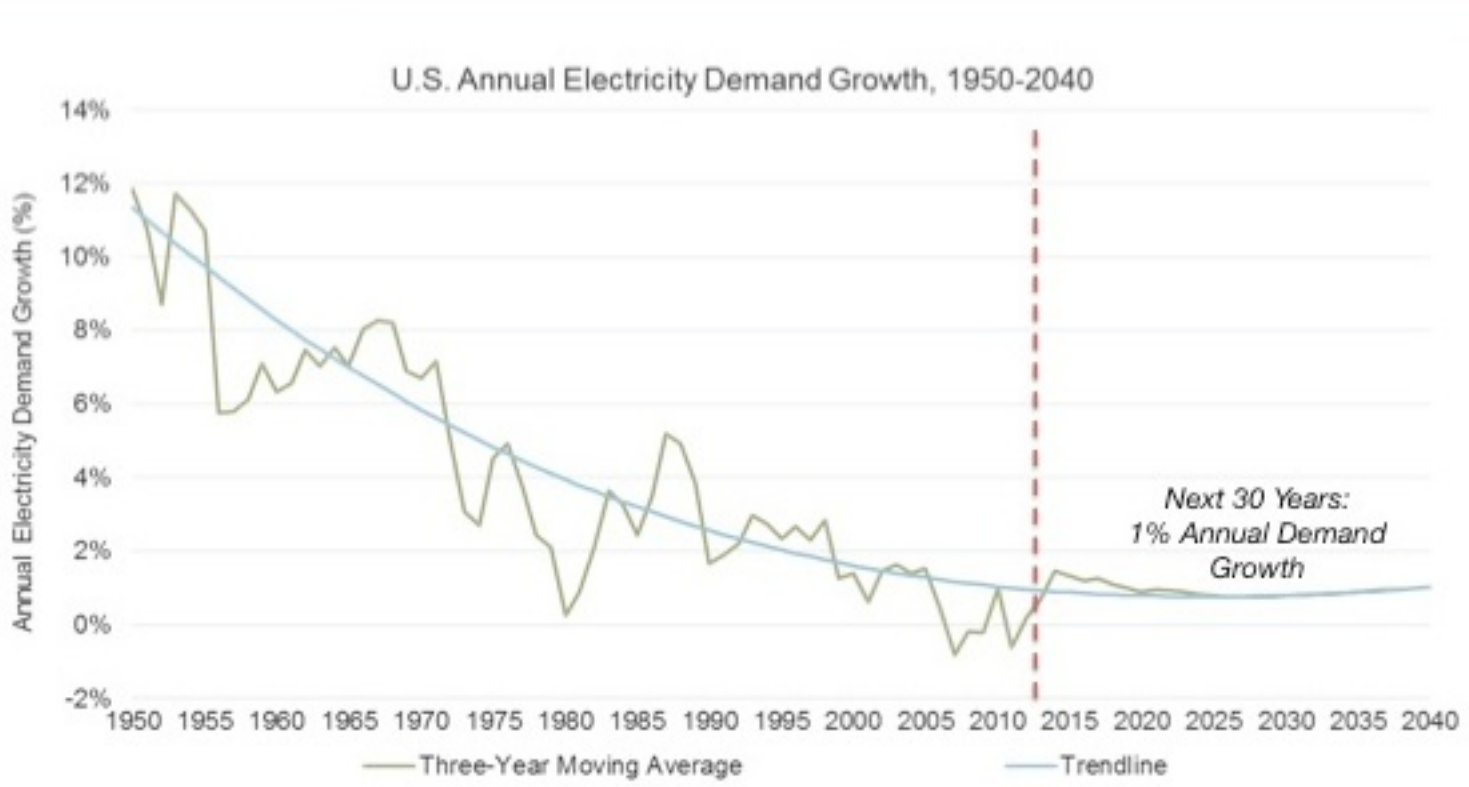
Reliability of load forecasts

- Previous forecasts have grossly overestimated long-term load growth in electricity demand
  - Earlier load forecasts predicted that Manitoba's hydro resources would be fully developed by now and nuclear was next option



Reliability of load forecasts

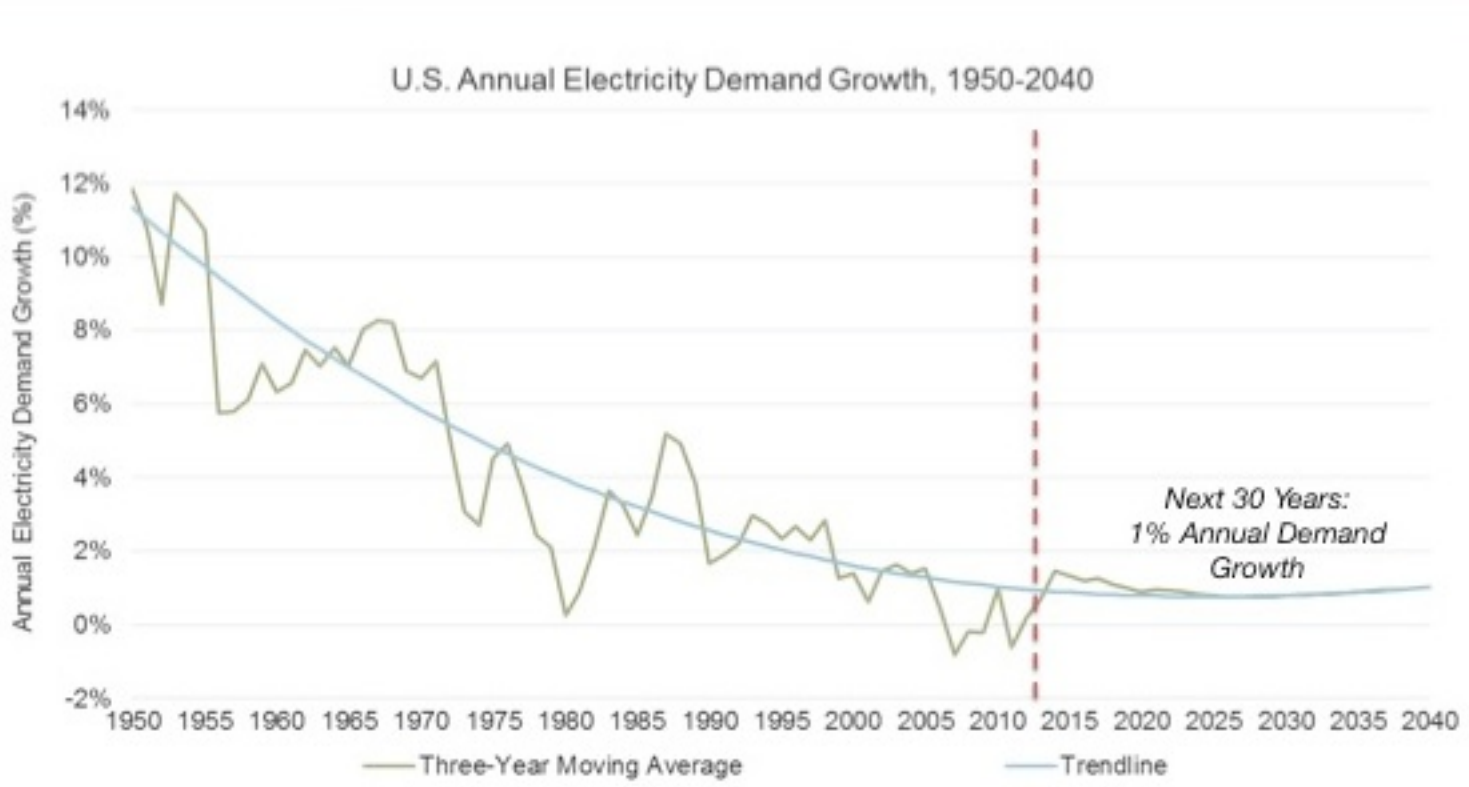
- U.S. Electricity Demand Growth 1950-2040



Source: EIA Annual Energy Outlook

Reliability of load forecasts

- U.S. Electricity Demand Growth 1950-2040



Source: EIA Annual Energy Outlook

Reliability of DSM

- DSM has proven to be reliable
  - April 2014 ACEEE study of energy efficiency resource standards:
    - More than half of U.S. states have an EERS
    - In 2012, 15 states met or exceeded electricity savings targets and 6 others came within 90%
    - Only one state met less than 80% of its target

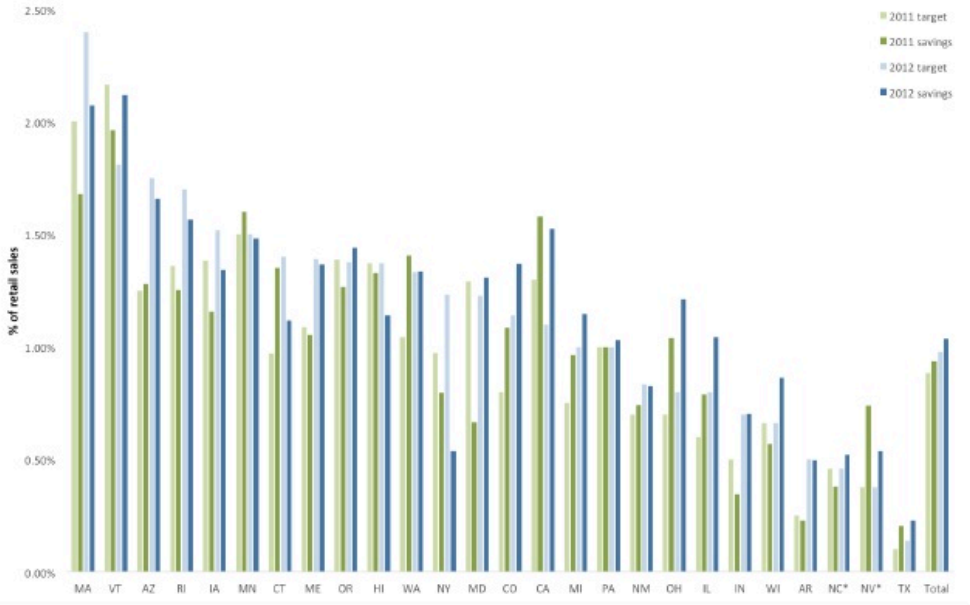


Figure E1. Annual incremental targets and savings for electricity, 2011 and 2012. Targets and savings are shown as a percent of retail sales covered by EERS rules.

Reliability of DSM

ENERGY EFFICIENCY

The Pacific Northwest is a leader in acquiring energy efficiency, which is our second largest resource after hydropower. The Northwest Power Act defines it as an energy resource and makes it the region's top priority.

(Source:

Since 1980, over half of the region's growth in demand for electricity has been met with energy efficiency, resulting in:

- Over 5,300 average megawatts saved—enough to power the state of Oregon
- Billions of dollars saved each year—$3.2 billion in 2012
- Lower annual carbon dioxide emissions—20.8 million tons less in 2012

Conclusions

- Manitoba Hydro's Preferred Development Plan
  - Product of a flawed process and analysis
  - Enormous risks for far too little gain
  - Other alternatives exist (long-term DSM, wind and eventually PV) that provide more socio-economic gain and much less risk