

Renewable Energy : Opportunities in Power Generation

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ENERGY FUTURES WORKSHOP
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ENVINT Consulting

- Energy technology assessments
- Economic analysis
- Emissions trading and offsets
- Energy Policy
- Energy life-cycle analysis
- Clients: governments, utilities, ENGOs, associations (e.g. CEA)
- Advises Clean Air Renewable Energy Coalition

Clean Air Renewable Energy Coalition

BC Hydro

BP Canada Energy Company

Canadian Hydro Developers

Cloudworks

Creststreet

Friends of the Earth

International Institute for Sustainable Development

Invenergy Canada

Ontario Power Generation Inc.

Pembina Institute

Pollution Probe

Sage Climate Project

Shell Canada Limited

Suncor Energy

The Delphi Group

Toronto Atmospheric Fund

Toronto Environmental Alliance

Toronto Hydro

Western GeoPower Corp

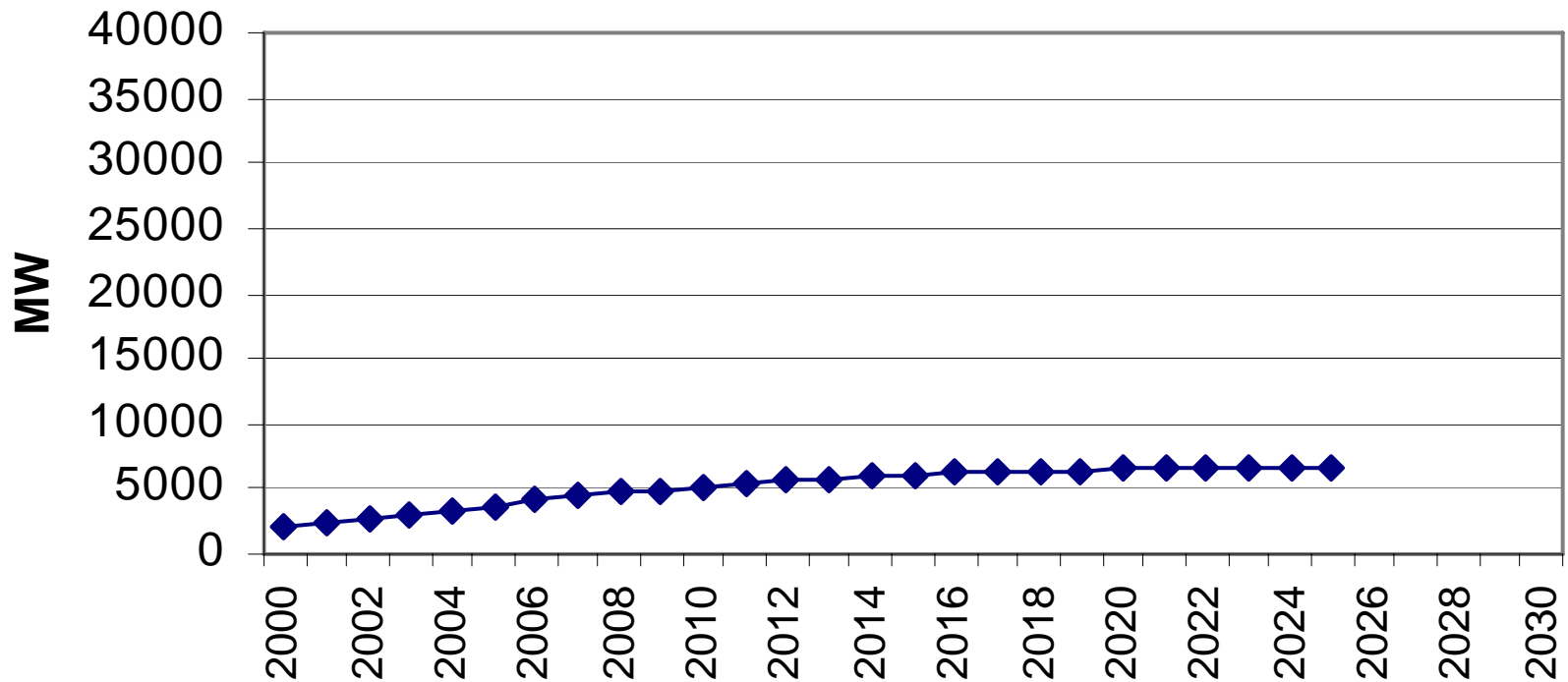
World Wildlife Fund Canada

15% of
generation by
2020



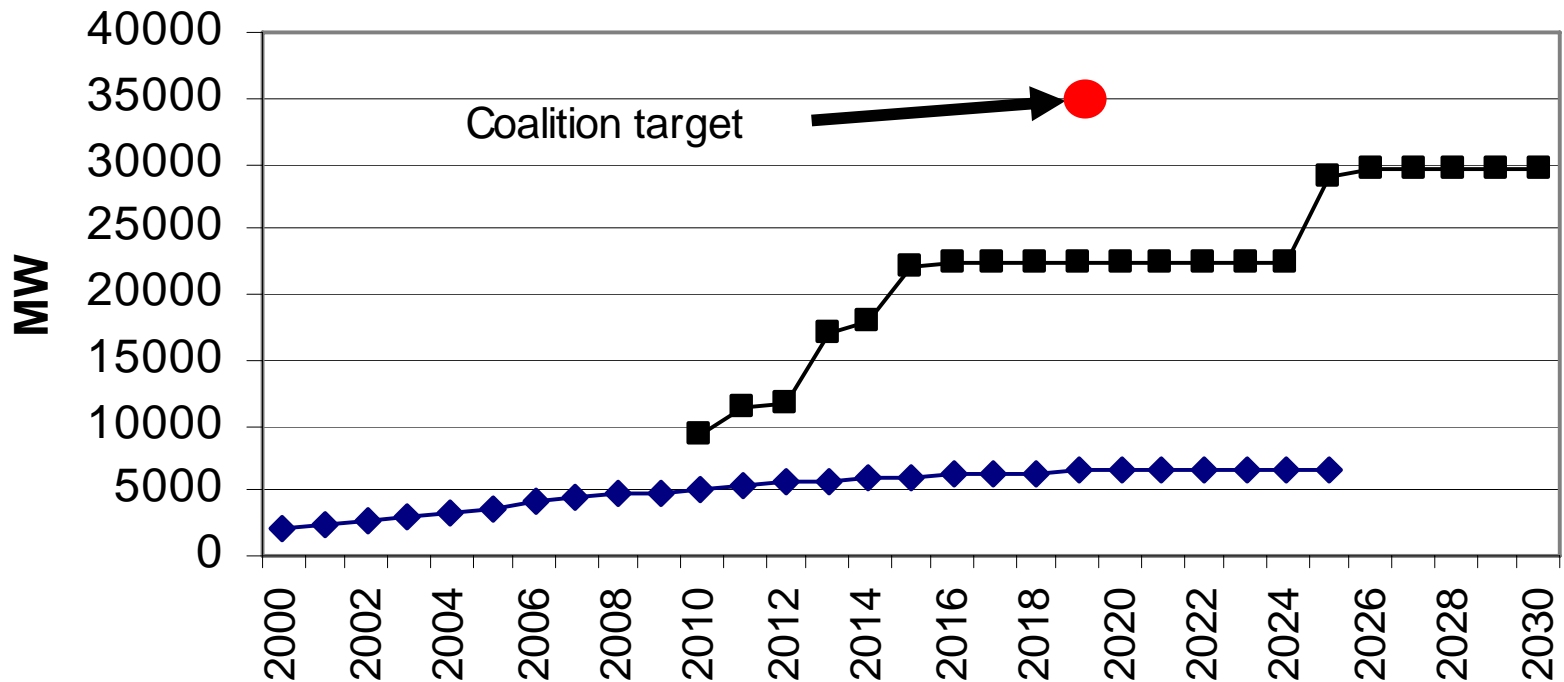
Comparison – all Renewables w/o Large Hydro (1)

NEB 2003 "Techno-Vert"



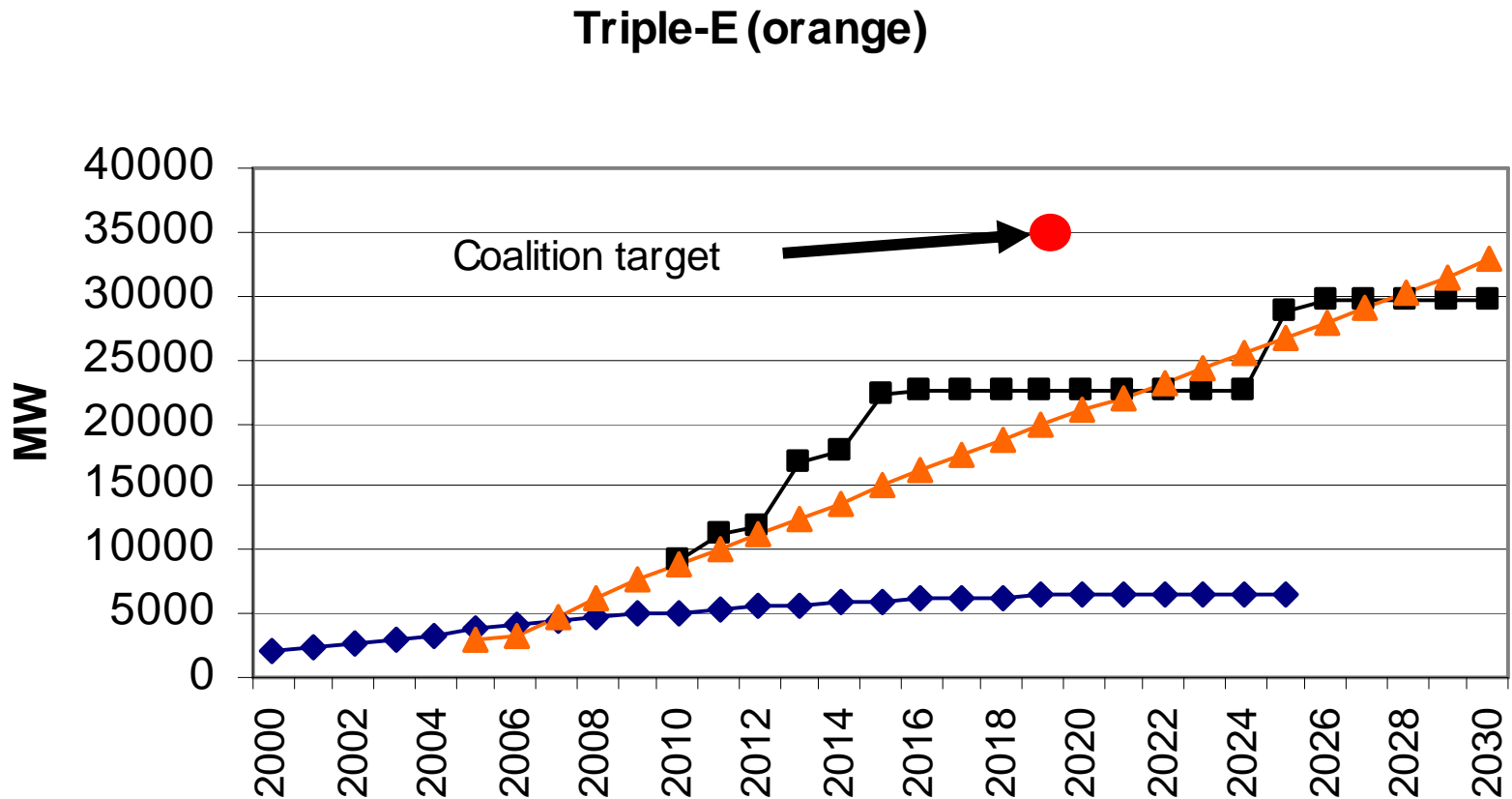
Comparison – All Renewables w/o Large Hydro (2)

Currently Planned (minimum)



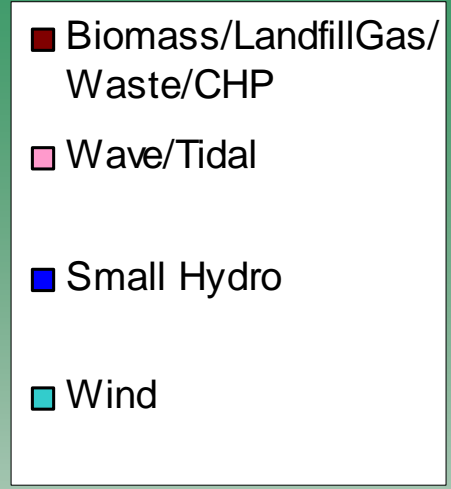
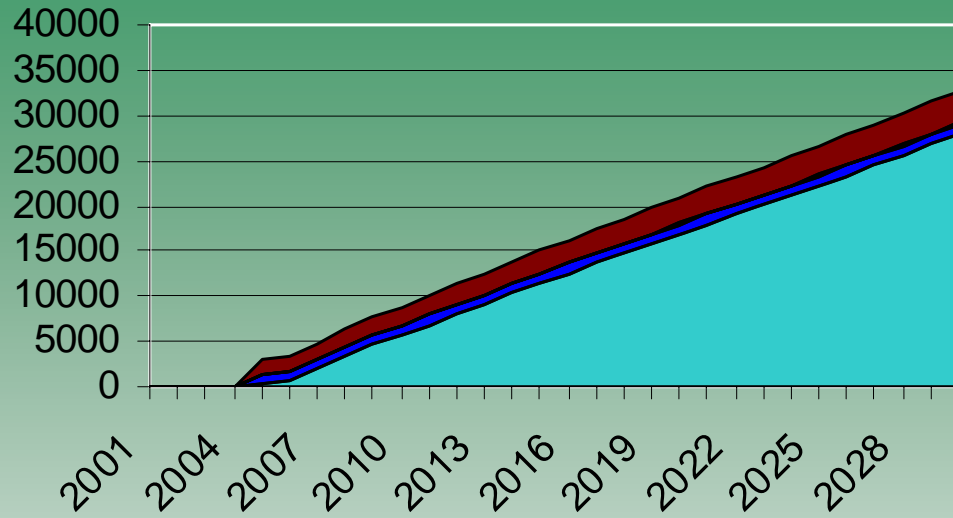
(Only includes plans for BC, ON, AB)

Comparison – All Renewables w/o Large Hydro (3)

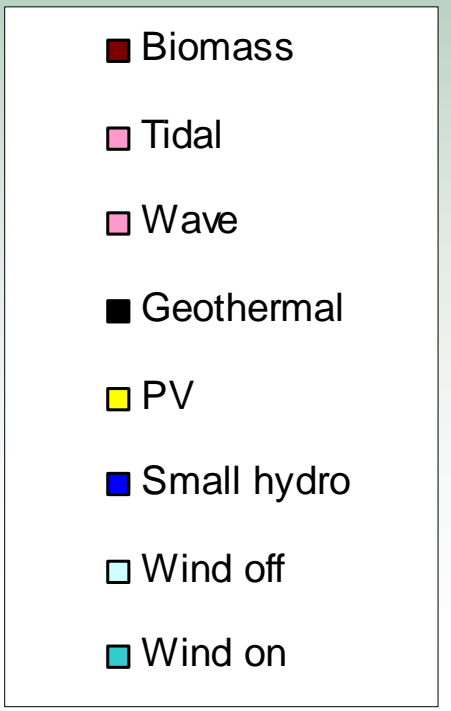
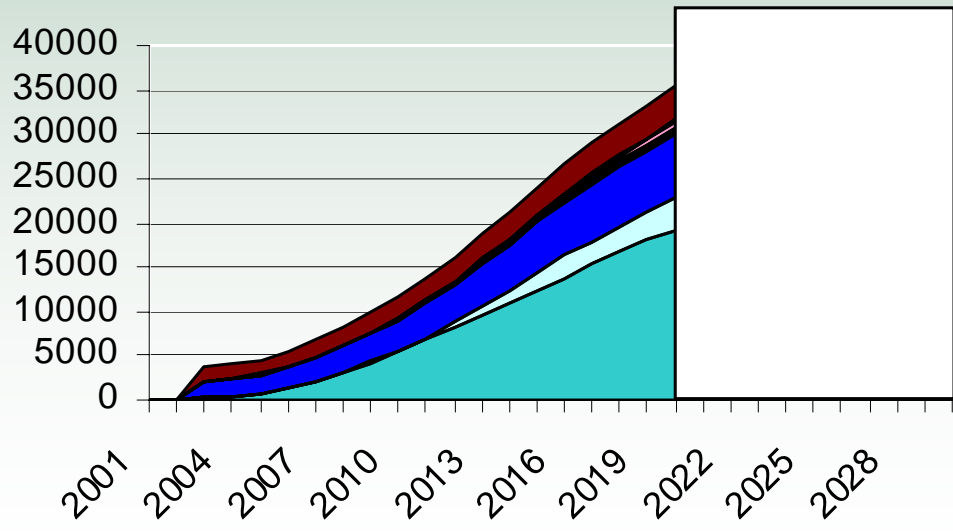


(small hydro = Techno-Vert 2003)

Triple-E



Clean Air Renewable Energy C.



Potentials

Grid-Power RET (Environmental Choice Certifiable)	Capacity Factor	Technical (Total) Resource Potential			
		Capacity [MW]		Supply [GWh/yr]	
		Low	High	Low	High
Wind (On-shore)	35%	28,000	100,000	85,800	306,600
Hydro	60%	11,000	14,000	57,800	73,600
Solar PV	14%	9,800	100,000	12,000	122,600
Landfill Gas (LFG)	90%	350	700	2,700	5,500
Biomass	80%	6,800	1,190,000	47,700	8,333,000
Ocean Energy	35%	12,600	39,600	38,700	121,500
Geothermal (Large)	95%	no data	3,000	no data	25,000

(from: Ecological Fiscal Reform and Energy Case Study on Renewable Grid Power Electricity, Marbek Resource Consultants, 2004)

My Best Bet for 2030

Technology	Realistic by 2030	CF	Annual Generation
Wind power	30-40,000 MW	30%	78,840 GWh
Small hydro	10,000 MW	45%	39,420 GWh
PV	12,000 MW	10%	10,512 GWh
Ocean energy	4,000 MW	35%	12,264 GWh
Geothermal	1,000 MW	95%	8,322 GWh
Biomass	4,000 MW	80%	28,032 GWh
TOTAL	61-71 GW		177+ TWh

(total expected generation in 2030 = 686 TWh; RE could deliver roughly 25%)

Large Hydro

- CANMET thinks technical potential is three times today's capacity
- Probably not more than doubling by 2050 for environmental, social reasons
- Projects fairly well known (Site C, MB, Niagara, Lower Churchill, QC)
- NEB Hydro forecast for 2030 (413 TWh) + about 155 TWh from other RE would be 83% of total power generation

Wildcard Solar PV

- Some larger projects coming on-line in ON with standard offer contracts
- DoE R&D program aims at 6¢/kWh by 2020
- Thin-film announced for this year @ \$2/Watt
- Cost reductions to \$1/Watt expected in coming decade
- *“Several thin-film companies say they will offer full solar panels at around a dollar per Watt and grid parity of about \$0.10 within the next few years.”* (RE World, Nov.-Dec. 2007)
- Some countries aim for net-zero energy homes by 2015-2030

What are the Drivers?

- Three NEB scenarios only partly relevant for renewables
- **At the moment, almost 100% POLICY-DRIVEN!**
- Probably from 2020, economically driven – already, wind power costs about the same as electricity from natural gas
- Beyond 2020, grid capacities, need for storage will become limiting factors (already now the case in several regions)

Some Suggestions

- Current policies/provincial targets suggest growth of non-large hydro RE will be faster than most optimistic NEB scenario
- Wave/Tidal should be in ALL scenarios; already projects foreseen on both coasts (MTEC, NS and Clean Current, BC)
- Solar PV and geothermal should be included
- Small Hydro has larger potential than reflected in NEB forecast
- Biomass/large hydro seems correct
- Wind power likely to grow as forecast or stronger (mega-projects such as Kai-Nun), but less than 50% of generation in 2030

A Note at the End

“The best way to predict the future is to create it.”

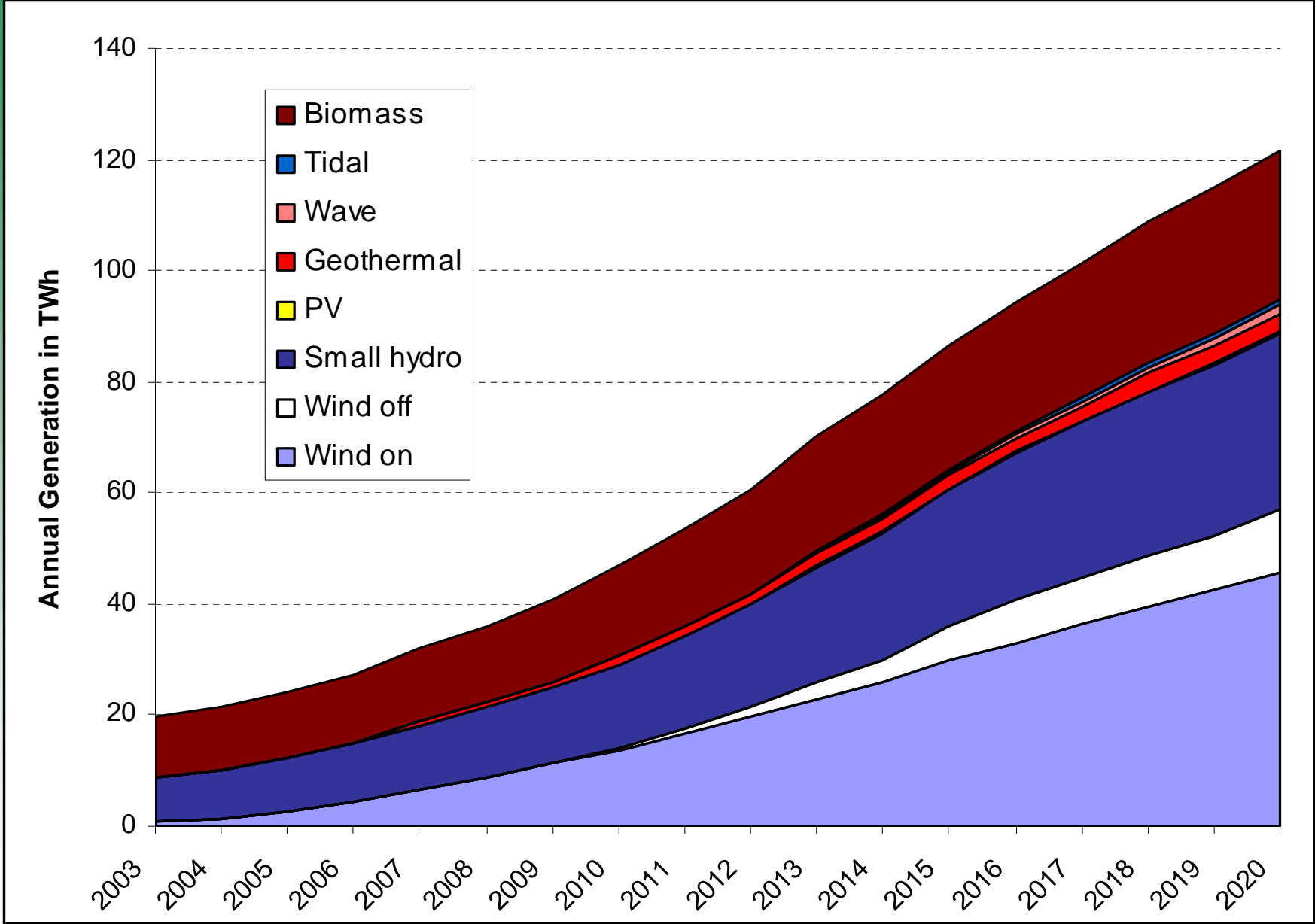
(Peter F. Drucker, economist)

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Province	BC	AB	SK	MB	ON	QC	NB	PEI	NS	NF
Target	90% green	3.5%	100% of new facilities	1,000 MW (wind)	10%	4,000 MW (wind)	10%	100% (wind)	20%	150 MW (wind)
Date	2012	2008	2010	2014	2010	2015	2016	2015	2013	
Estimated MW	2000	900	200	1,000	2,700	4,000	400	200	500	150
2030	800	5000			6400					