



ONTARIO POWER AUTHORITY

February 20, 2007



# The Role of Wind Power in the Integrated Power System Plan

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# Purpose and Scope of this Presentation

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- **Review of the status of power system planning in Ontario**
- **Highlight planning priorities**
- **Provide an overview of plan results**
- **Discuss the role of wind power within the Integrated Power System Plan**

# OPA's four main functions

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## 1. Conservation

- Execute conservation and demand management initiatives
- Build conservation capabilities across all sectors
- Advance a sustained conservation culture

## 2. Planning

- Develop and deliver a comprehensive long-term plan that addresses CDM, generation and transmission

## 3. Supply

- Obtain needed generation capacity in a timely way that also supports long-term sector development

## 4. Development

- Facilitate risk transfer from electricity customers to investors
- Promote development of new renewable, CDM and supply technologies

# Ontario's Integrated Power System Plan

## Electricity Act

### Integrated power system plan

**25.30 (1)** Once during each period prescribed by the regulations, or more frequently if required by the Minister or the Board, the OPA shall develop and submit to the Board an integrated power system plan,

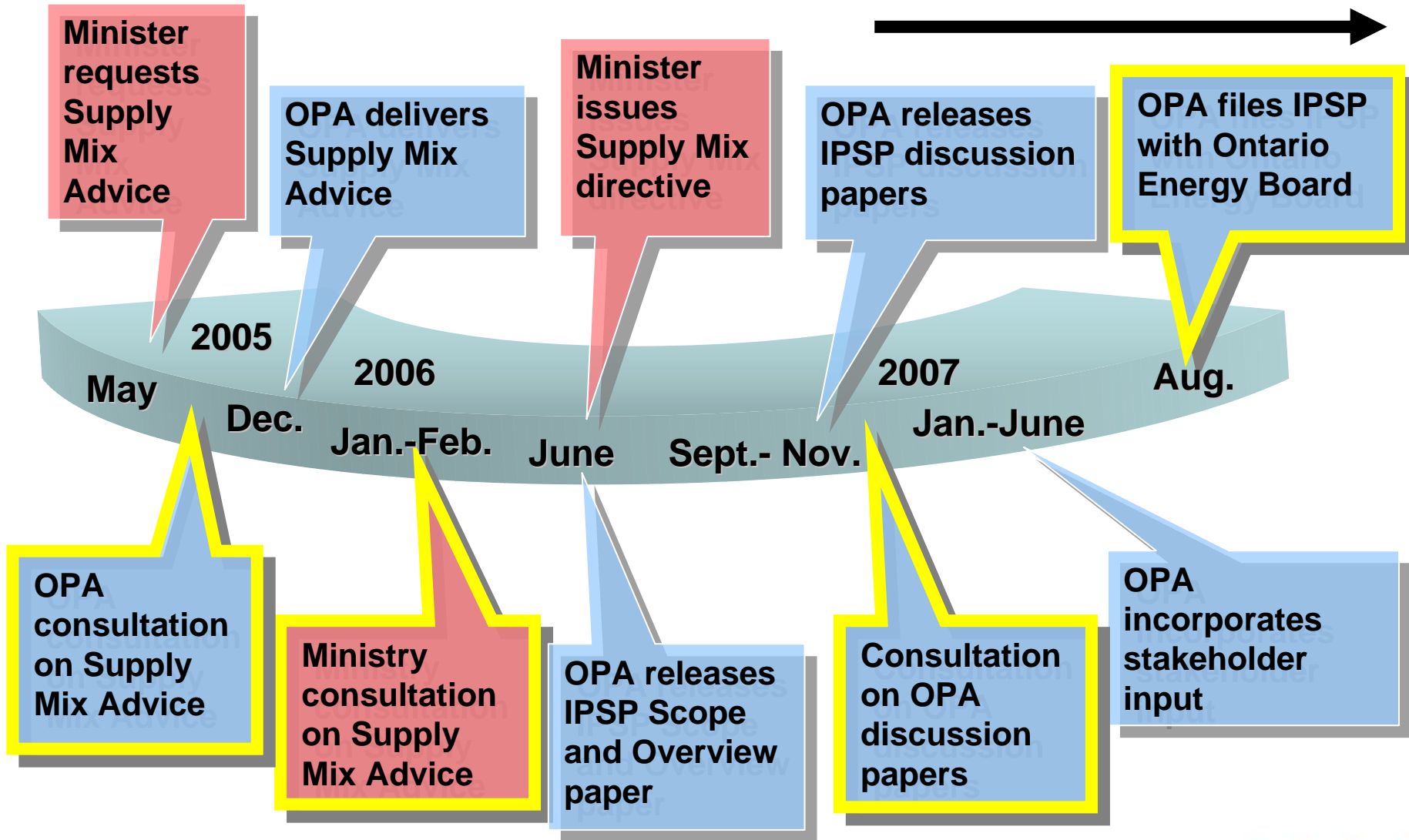
- IPSP is the abbreviation
- Foundation in the *Electricity Act* and its Regulations
- Shaped by three government policy priorities:
  - Creation of a “conservation culture”
  - Preference for renewable sources of energy
  - Replacement of coal-fired generation
- 20-year rolling plan with 3-year update cycle

# Two years of policy development and consultation

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- **The IPSP is the product of over two years of consultation and planning. It started with public consultations in the fall of 2005 and is now heading for regulatory review at the OEB.**
- **The Plan:**
  - Recommends infrastructure development, and procurement processes
  - Engaged the public interest in electricity through open processes
  - Becomes a reference to evaluate future options
  - Enables implementation to achieve policy priorities
  - Will be updated in three years
- **Scope of OEB review:**
  - Compliance with supply mix directive
  - Whether plan is economically prudent and cost effective

# The Timeline: Development of the IPSP

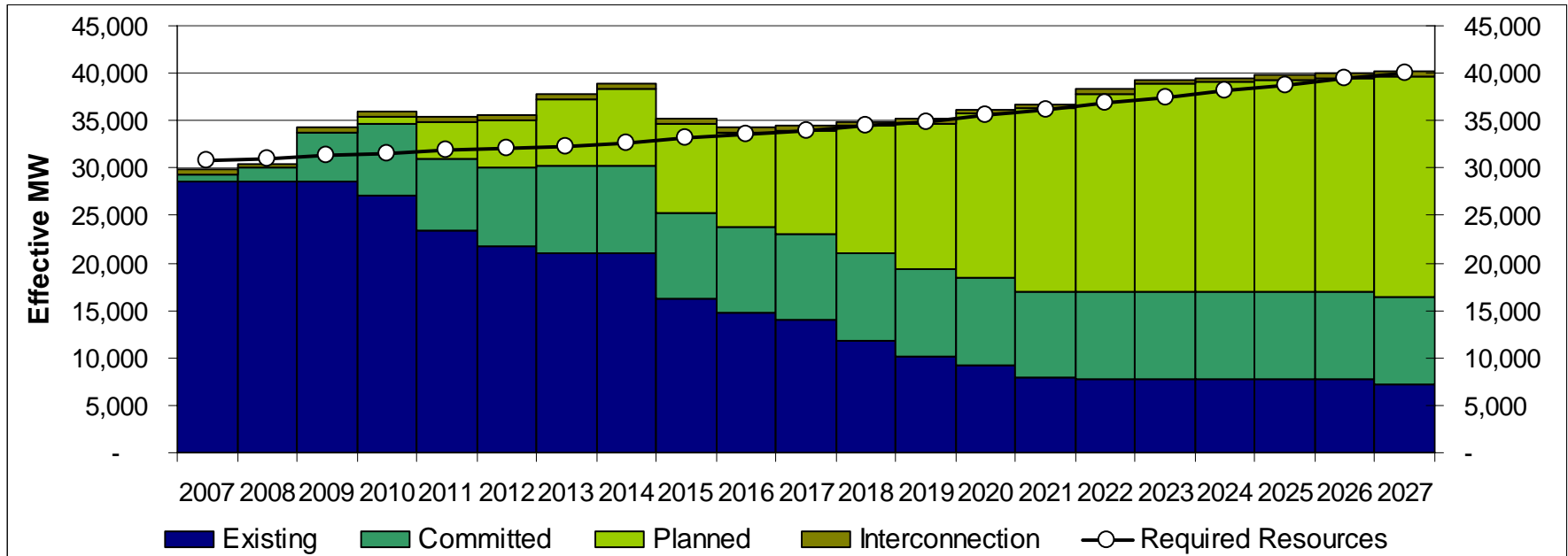


# The plan in brief

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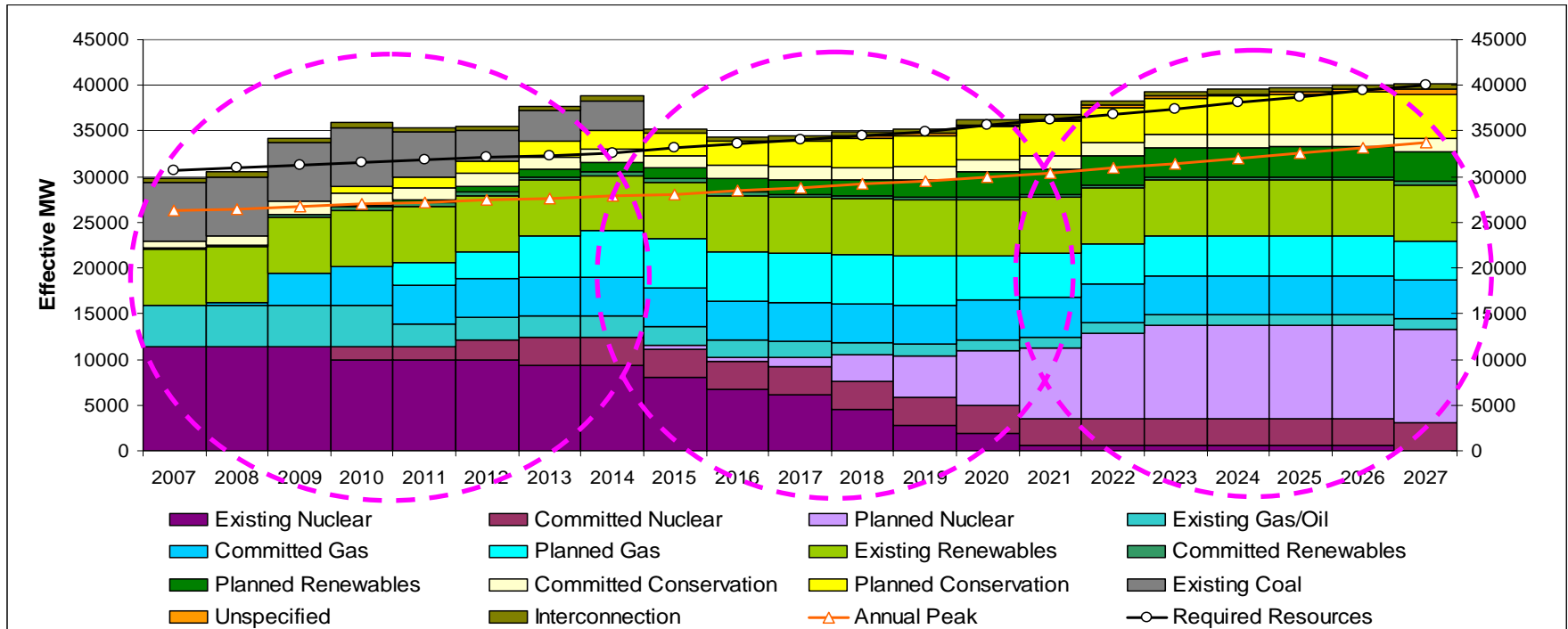
- **Maximize feasible cost-effective conservation**
- **Maximize feasible cost-effective renewables**
- **Meet remaining baseload needs through refurbishment and new build of nuclear capability**
- **Replace coal by cleaner committed and planned new resources**
- **Plan transmission for reliability, incorporation of generation, and system efficiency**

# Resource requirements are to be met with existing, committed and planned resources



- Requirements are met through existing and committed resources until about 2011
- Requirements are met over mid-to-long term through existing, committed and planned resources

# Meeting resource requirements: Planning horizon drivers, risks and opportunities

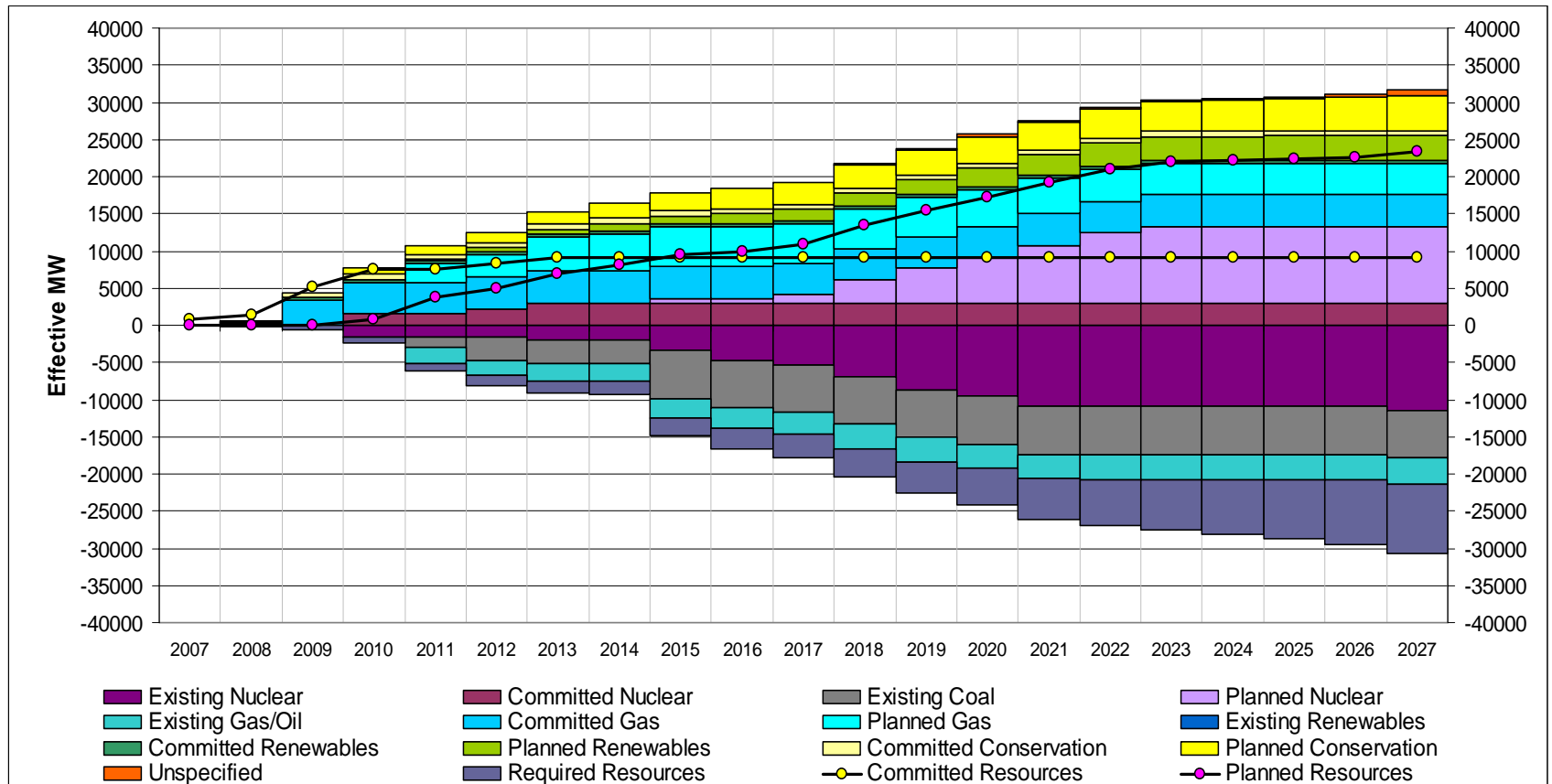


- Coal replacement
- Establish Conservation infrastructure
- Transmission catch-up
- Major uncertainties relate to implementation of currently planned resources
- Uncertainty managed by existing resources (coal, imports)

- Nuclear refurbishment
- Conservation transformation
- Market-based mechanisms in wider use
- Transmission to enable resources
- Major uncertainties relate to feasibility of future options
- Uncertainty managed by developing a broad portfolio of options

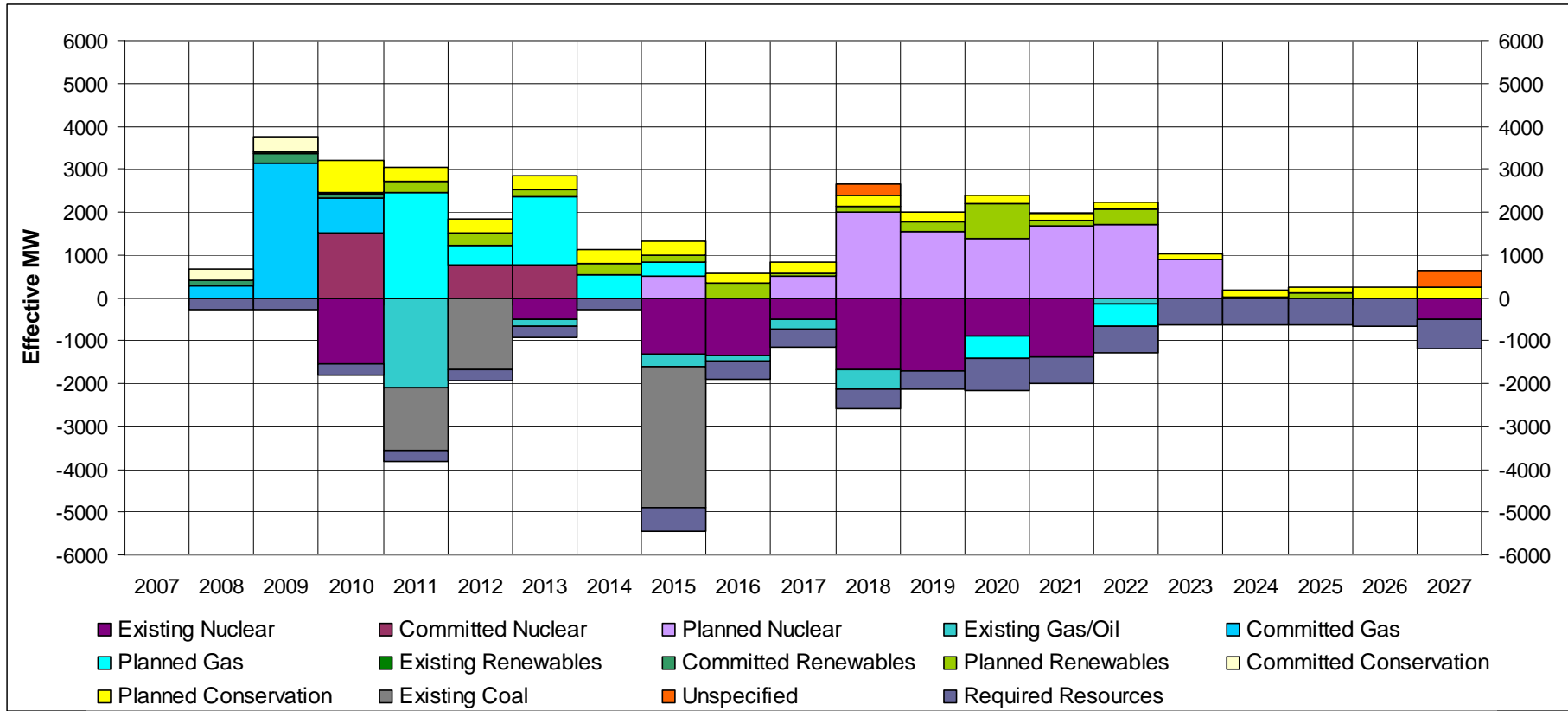
- Technology breakthroughs (e.g. storage, gasification, end-use, transmission)
- Conservation / price / technology interaction
- Major uncertainties from demand / economy / energy prices / environmental policies
- Uncertainties managed by updating plans every 3 years

# Cumulative changes in resources and resource requirements (effective MW)

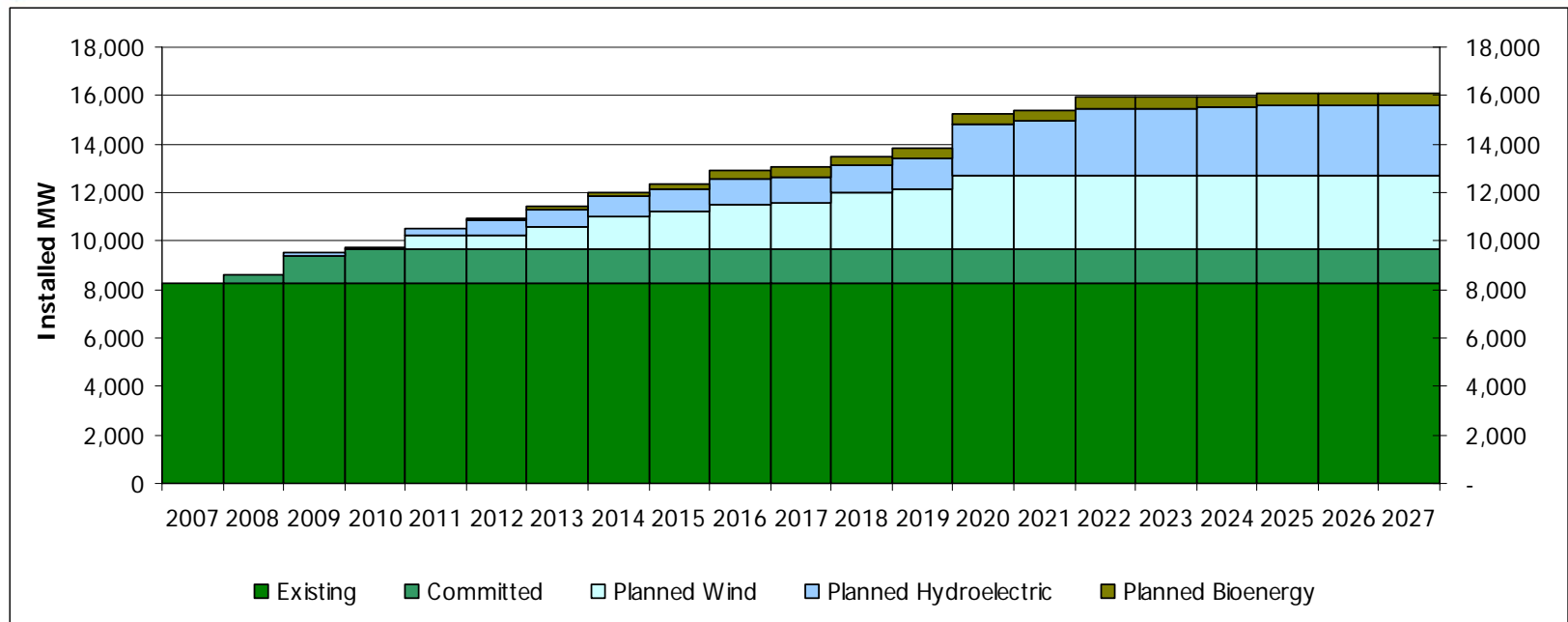


- 30,000 MW of resource additions
- 30,000 MW of resource reductions plus increase in resource requirements

# Annual changes in resources and resource requirements (effective MW)



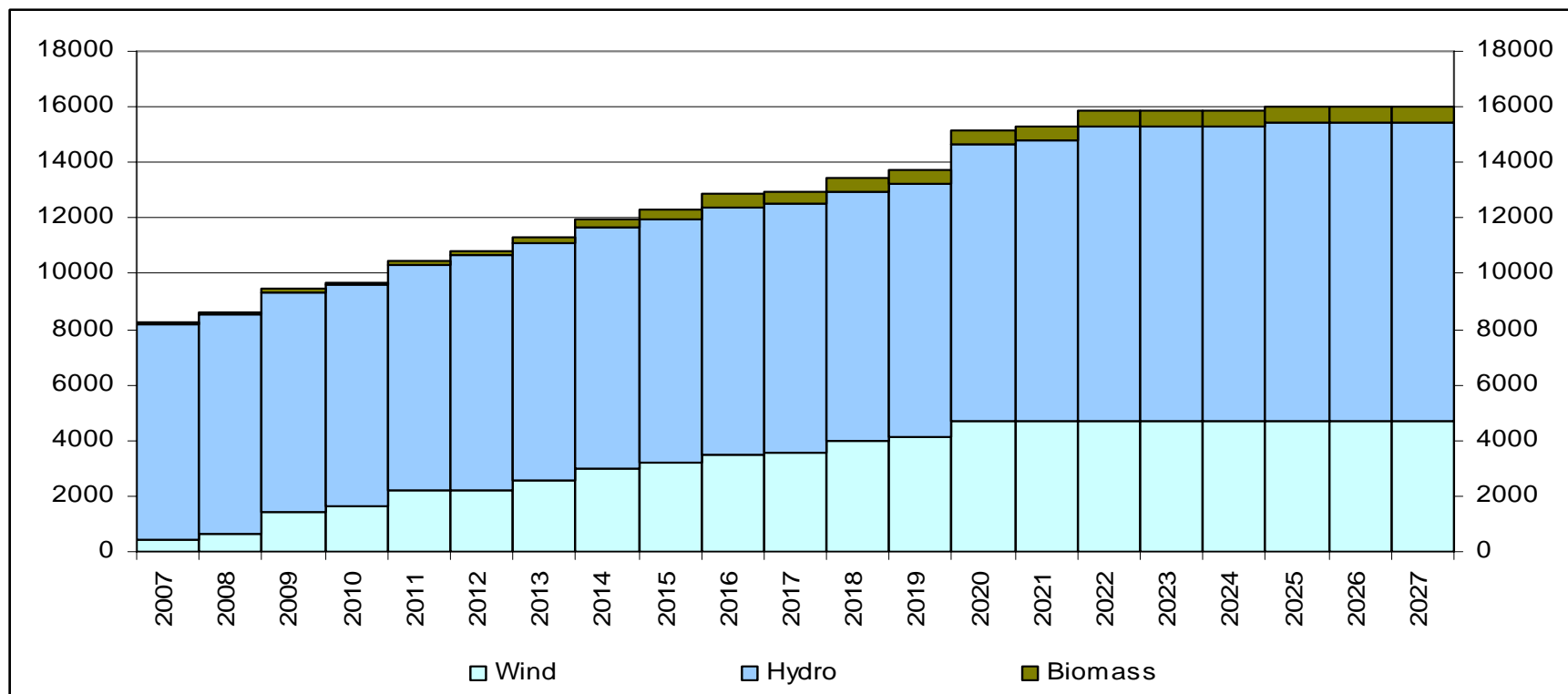
# Cumulative changes in renewable resources



MW	
<b>Existing Resources</b>	
Hydroelectric	7,788
Wind	395
Bioenergy	75
<b>Total Existing Resources</b>	<b>8,258</b>
<b>Committed Resources</b>	
Hydroelectric	62
Wind	1,251
Bioenergy	14
Solar	88
<b>Total Committed Resources</b>	<b>1,415</b>
<b>Planned Resources</b>	
Hydroelectric	2,921
Wind	3,039
Bioenergy	450
<b>Total Planned Resources</b>	<b>6,411</b>
<b>TOTAL RENEWABLES</b>	<b>16,084</b>
<b>TARGET RENEWABLES</b>	<b>15,700</b>

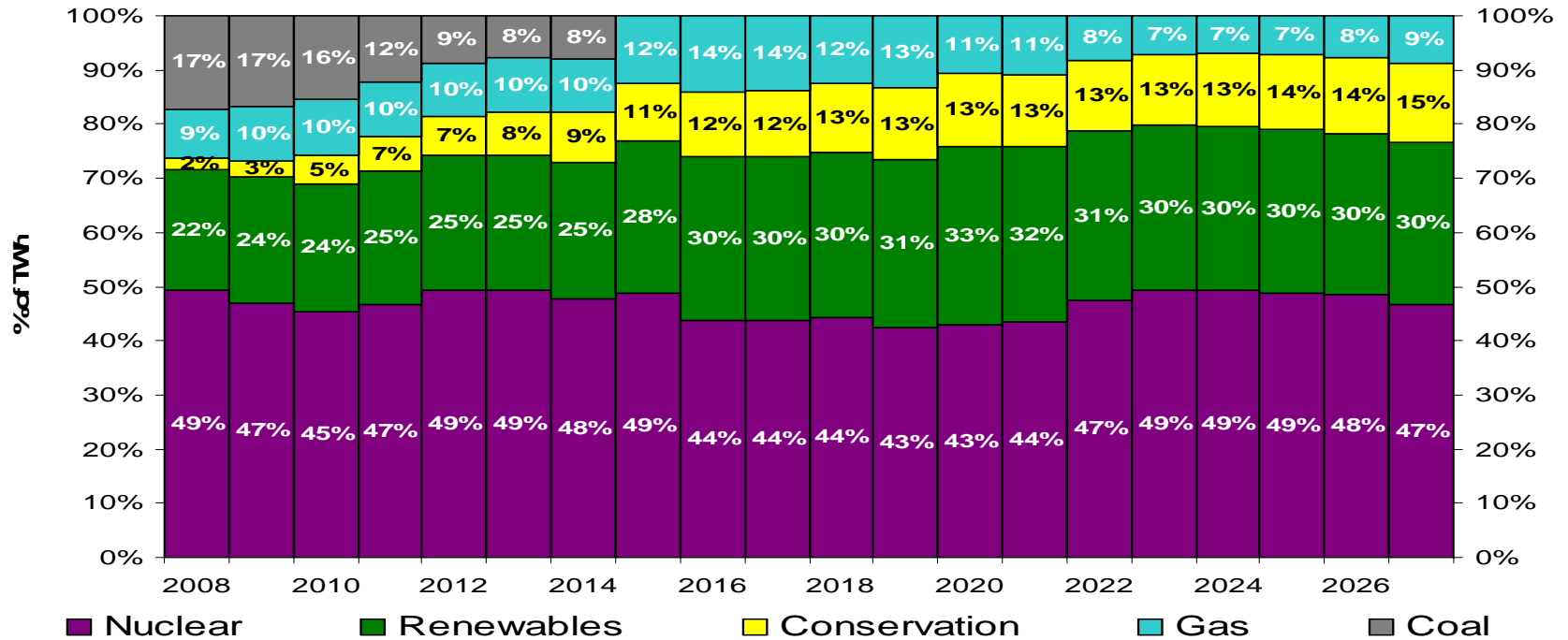
- **16,000 MW installed renewables by 2025**
- Planned renewables consist of:
  - 3,000 MW water
  - 3,000 MW wind
  - 500 MW bioenergy

# Renewable resources by 2027



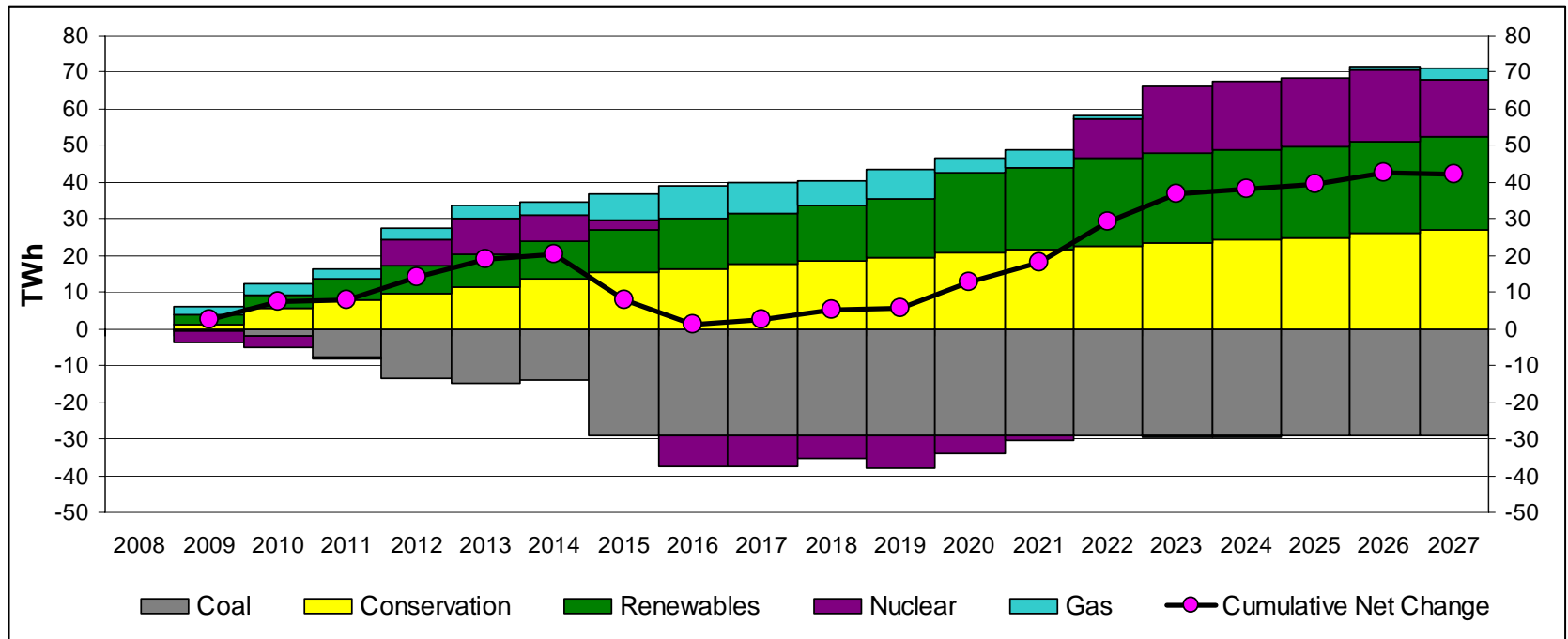
- ~ 5,000 MW Wind
- ~ 11,000 MW Hydro
- ~ 500 MW Biomass

# Annual Energy Production (TWh and Percent of Total)



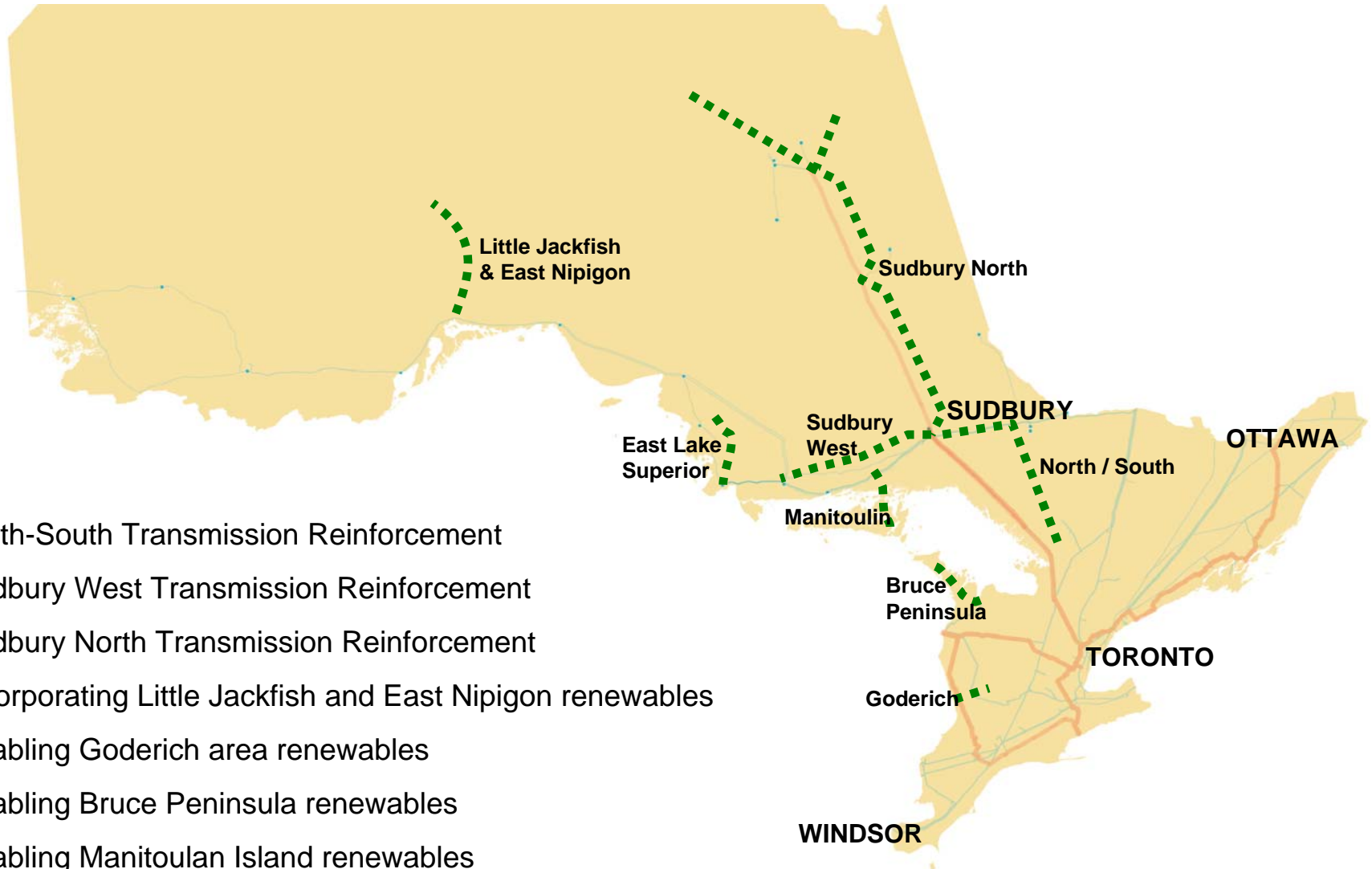
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Conservation	4	5	9	12	13	15	17	19	20	21	22	23	24	25	26	27	28	28	30	31
Renewables	38	40	41	43	45	46	48	49	51	51	53	53	59	60	62	62	62	63	63	63
Nuclear	83	80	80	82	90	92	90	82	71	68	66	64	71	81	95	102	103	102	104	100
Gas	15	17	18	18	18	19	19	22	26	26	25	27	23	23	16	15	14	15	16	18
Coal	29	28	27	21	16	14	15	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	168	170	175	176	182	187	188	172	168	167	166	167	178	189	198	205	207	208	212	212

# Cumulative change in energy production (TWh)



- Production from renewables increases by 25 TWh between 2008 and 2027, of which about 11 TWh is from wind power.

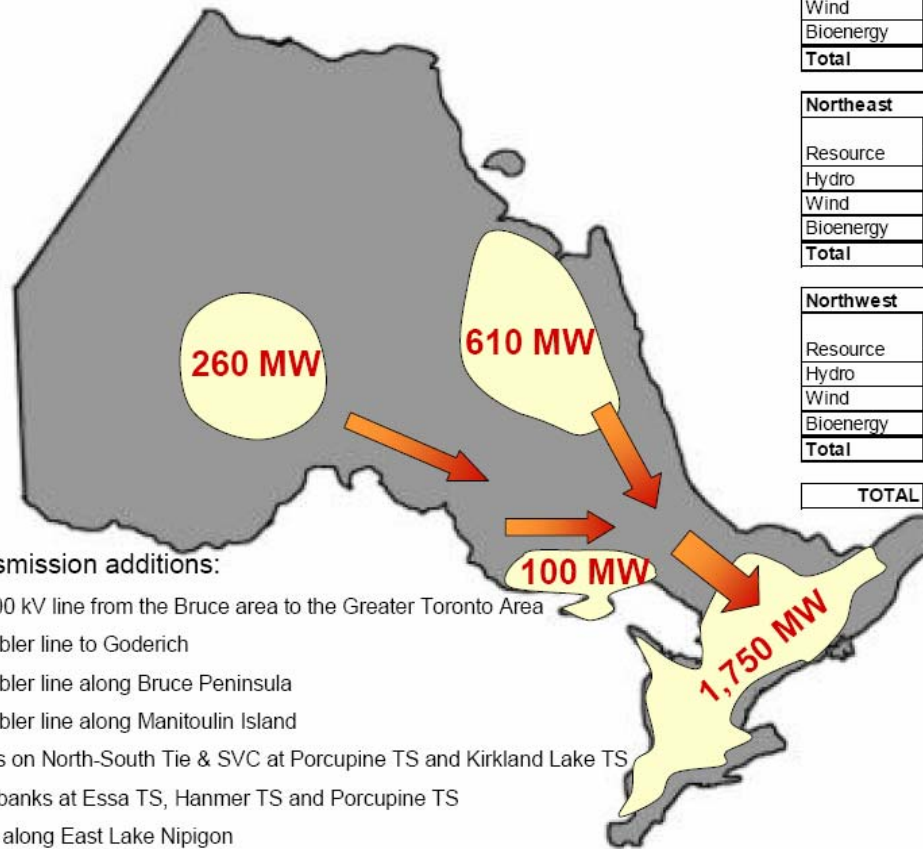
# Connecting Renewables: Recommended Developments



- North-South Transmission Reinforcement
- Sudbury West Transmission Reinforcement
- Sudbury North Transmission Reinforcement
- Incorporating Little Jackfish and East Nipigon renewables
- Enabling Goderich area renewables
- Enabling Bruce Peninsula renewables
- Enabling Manitoulan Island renewables
- East Lake Superior transmission reinforcement

# Connecting Renewables: "Stage 1"

**Stage 1 – 2010-2015**  
**Total: 2,720 MW of Renewable Generation**



**Required transmission additions:**

- Completion of 500 kV line from the Bruce area to the Greater Toronto Area
- New 230 kV enabler line to Goderich
- New 230 kV enabler line along Bruce Peninsula
- New 230 kV enabler line along Manitoulin Island
- Series capacitors on North-South Tie & SVC at Porcupine TS and Kirkland Lake TS
- Shunt capacitor banks at Essa TS, Hanmer TS and Porcupine TS
- New 230 kV line along East Lake Nipigon

**Planned Developments:**

South	
Resource	Capacity (MW)
Hydro	150
Wind	1,500
Bioenergy	100
<b>Total</b>	<b>1,750</b>

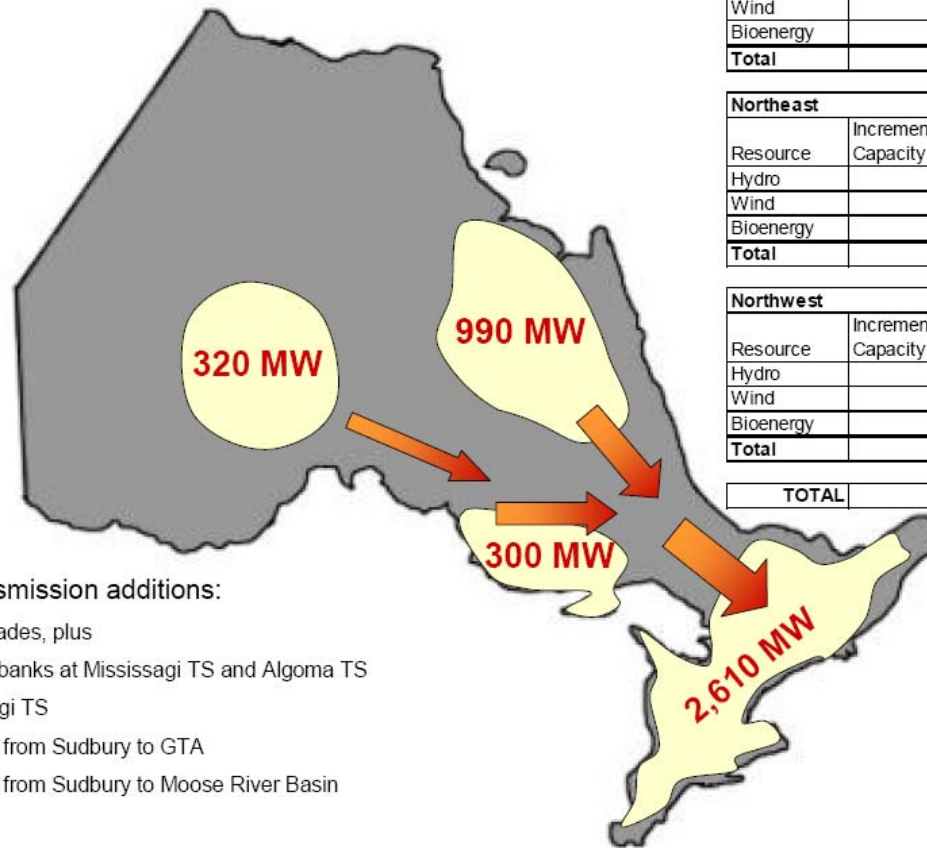
Northeast	
Resource	Capacity (MW)
Hydro	550
Wind	100
Bioenergy	60
<b>Total</b>	<b>710</b>

Northwest	
Resource	Capacity (MW)
Hydro	200
Wind	10
Bioenergy	50
<b>Total</b>	<b>260</b>

<b>TOTAL</b>	<b>2,720</b>
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# Connecting Renewables: "Stage 2"

**Stage 2 – 2016-2019**  
**Total: 4,220 MW of Renewable Generation**



**Required transmission additions:**

- All Stage 1 upgrades, plus
- Shunt capacitor banks at Mississagi TS and Algoma TS
- SVC at Mississagi TS
- New 500 kV line from Sudbury to GTA
- New 500 kV line from Sudbury to Moose River Basin

**Planned Developments, in addition to Stage 1:**

South		
Resource	Incremental Capacity (MW)	Cumulative Capacity (MW)
Hydro	0	150
Wind	700	2,200
Bioenergy	160	260
<b>Total</b>	<b>860</b>	<b>2,610</b>

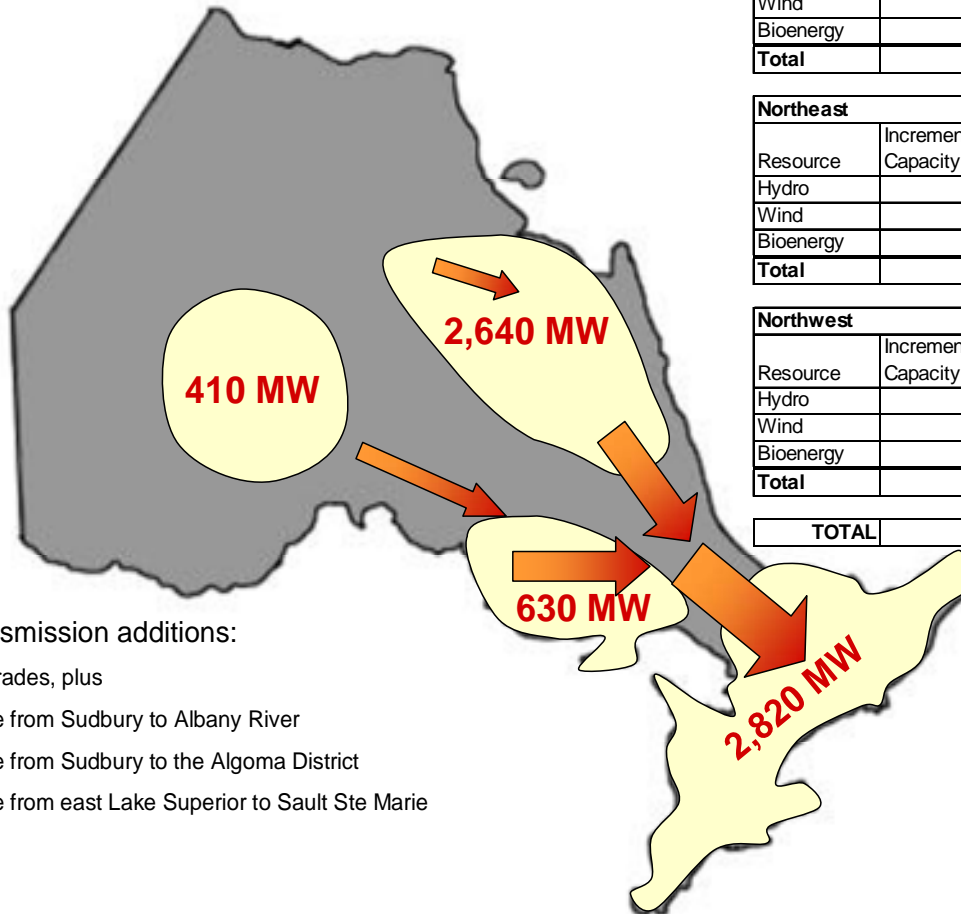
Northeast		
Resource	Incremental Capacity (MW)	Cumulative Capacity (MW)
Hydro	350	900
Wind	200	300
Bioenergy	30	90
<b>Total</b>	<b>580</b>	<b>1,290</b>

Northwest		
Resource	Incremental Capacity (MW)	Cumulative Capacity (MW)
Hydro	40	240
Wind	10	20
Bioenergy	10	60
<b>Total</b>	<b>60</b>	<b>320</b>

<b>TOTAL</b>	<b>1,500</b>	<b>4,220</b>
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# Connecting Renewables: "Stage 3"

**Stage 3 – 2020 and beyond**  
**Total: 6,500 MW of Renewable Generation**



Required transmission additions:

- All Stage 2 upgrades, plus
- New 500 kV line from Sudbury to Albany River
- New 500 kV line from Sudbury to the Algoma District
- New 230 kV line from east Lake Superior to Sault Ste Marie

**Planned Developments, in addition to Stage 2:**

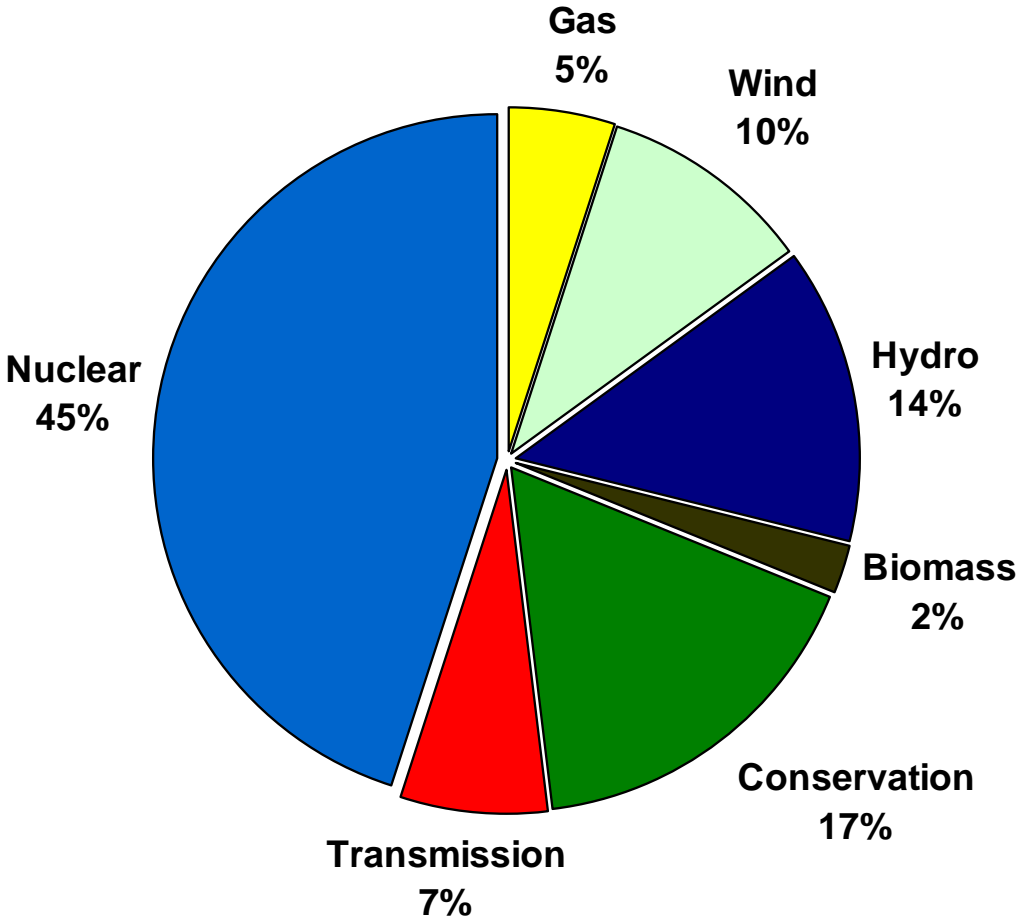
South		
Resource	Incremental Capacity (MW)	Cumulative Capacity (MW)
Hydro	0	150
Wind	210	2,410
Bioenergy	0	260
<b>Total</b>	<b>210</b>	<b>2,820</b>

Northeast		
Resource	Incremental Capacity (MW)	Cumulative Capacity (MW)
Hydro	1,600	2,500
Wind	330	630
Bioenergy	50	140
<b>Total</b>	<b>1,980</b>	<b>3,270</b>

Northwest		
Resource	Incremental Capacity (MW)	Cumulative Capacity (MW)
Hydro	60	300
Wind	30	50
Bioenergy	0	60
<b>Total</b>	<b>90</b>	<b>410</b>

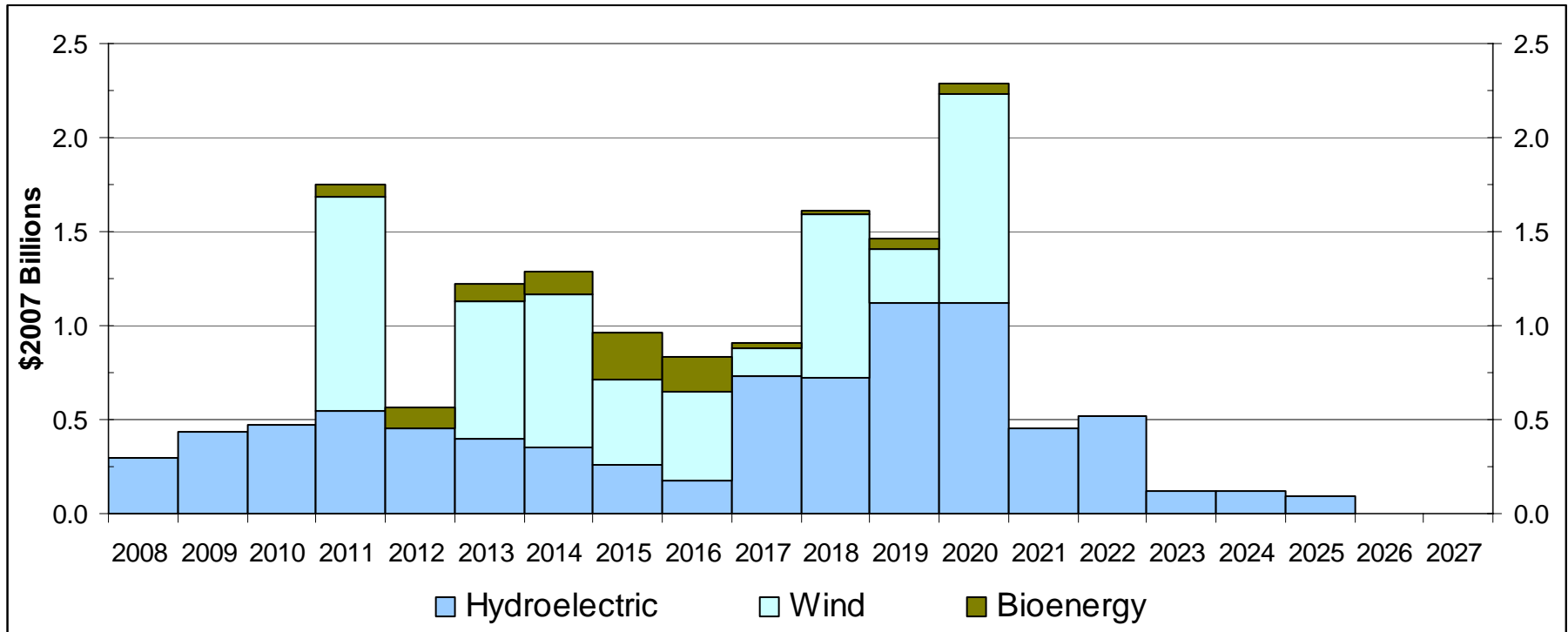
<b>TOTAL</b>	<b>2,280</b>	<b>6,500</b>
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# Cost of planned resources: \$60 Billion



2007 \$ Billions	
Conservation	10.2
Transmission	4.0
Nuclear	26.5
Gas	3.6
Wind	6.0
Hydro	8.4
Biomass	1.0
<b>Total</b>	<b>59.7</b>

# Cost of planned renewables: \$15.4 Billion



- Average of about \$0.5 Billion per year on wind power between 2008 and 2020

# RES 3: procurement in development

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- **Renewable Energy Supply (RES)**
  - Ministerial Directive received August 27, 2007 to procure up to 2000 MW
  - Projects greater than 10 MW
  - 2015 in-service date
  - Consultation with First Nations and Métis
  - RES III: first phase for up to 500 MW
- **Status and timeline:**
  - Request for Expressions of Interest issued in November 2007
  - Responses received in December 2007
  - Draft RFP expected to be issued in Q1 2008
  - Final RFP expected to be issued in Q2 2008
  - Proposal submission deadline Q3 2008
  - Targeting process completion by end of 2008

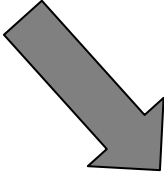

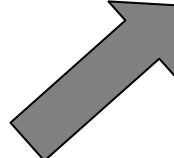
# RESOP: current procurement

## As of January 31, 2008:

- 262 executed contracts
- 1025 MW executed capacity
- 2010 anticipated in-service

<b>Fuel</b>	<b>MW</b>	<b>% of Total MW</b>	<b># of Contracts</b>	<b>% of Total Contracts</b>
Wind	599	59%	69	26%
Water	42	4%	15	6%
Bio-energy	67	7%	20	8%
Solar	316	31%	158	60%
<b>Total</b>	<b>1025</b>	<b>100%</b>	<b>262</b>	<b>100%</b>

# Environmental Indicators

<b>Follow coal phase-out (large decrease)</b> 	Greenhouse gases (CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O)
	Air contaminant emissions (NO <sub>x</sub> , SO <sub>2</sub> , particulates, mercury)
	Ash solid wastes
<b>Follow nuclear production (steady)</b> 	Flow-through water use
	Radioactivity
	Used nuclear fuel
<b>Affected by transmission and renewables (increase)</b> 	Land use

# Plan Highlights

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- 1. Conservation is a cornerstone of this Plan.**
  - Extensive programs in the short term
  - Standards (right now) are key for the longer term
  - Evaluation, Measurement and Verification (EM&V) will be critical to future programs and plans
- 2. Decisions around Pickering B in 2008 will impact scope for nuclear new build and transmission requirements.**
- 3. Natural gas will provide the flexibility and insurance in the mid- to longer term.**
- 4. Renewables, particularly hydro, will require extensive transmission.**
- 5. Restoring nuclear by refurbishment/new build is key to providing baseload energy.**

## Plan Highlights (cont'd)

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- 6. Transmission development work required now to enable future options.**
- 7. Environmental indicators will improve on most measures.**
- 8. Cost to customers will be affected by :**
  - Gas prices
  - Nuclear costs
  - Success of conservation
  - Regulatory decisions
- 9. Efficient review and approvals processes around infrastructure implementation are necessary for this plan to work.**
- 10. Policy development will support plan implementation.**

# Questions ?

