

Pacific Institute for Climate Solutions



THE UNIVERSITY OF BRITISH COLUMBIA

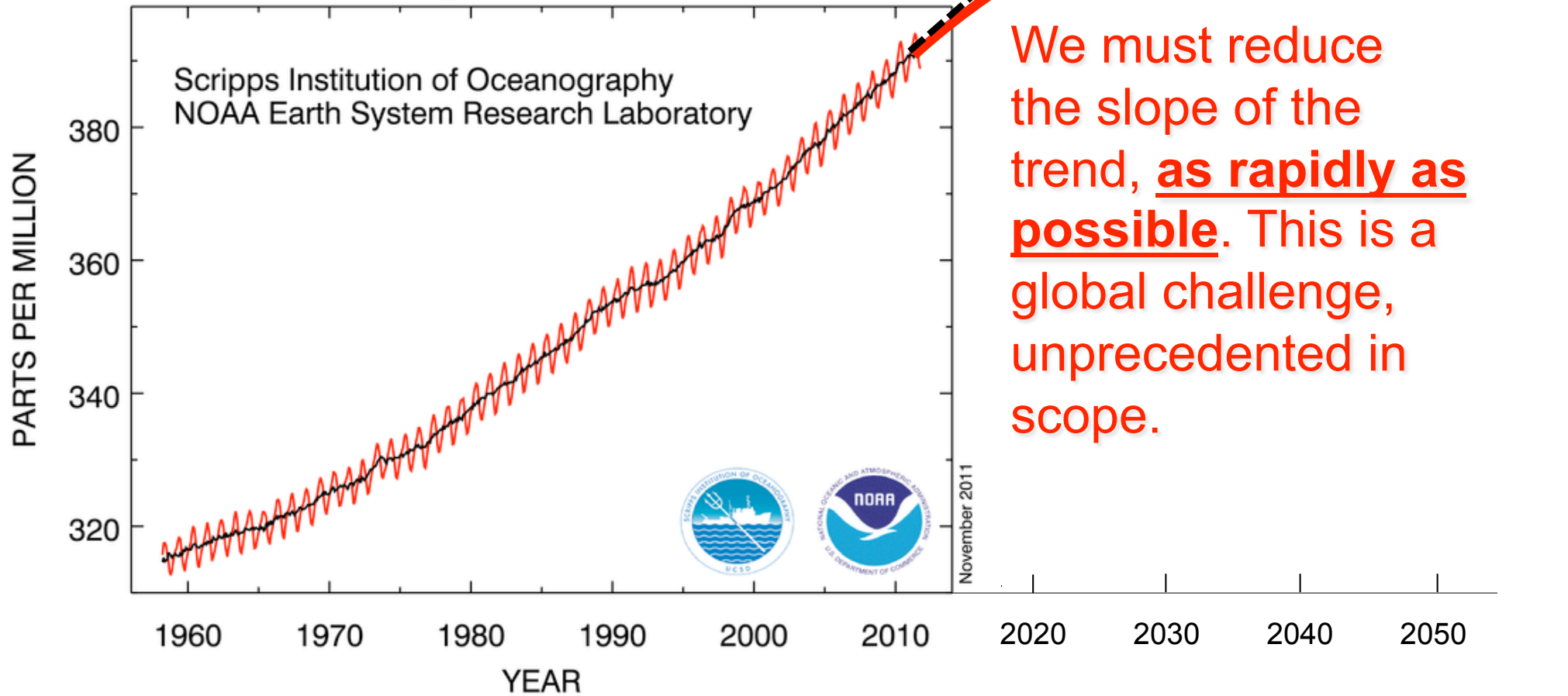


Responding to the CO₂ Challenge Via Grid Integration in Western Canada

Tom Pedersen, with Behdad Kiani, Andrew Rowe, Peter Wild, Lawrence Pitt, Jean Duquette, Amy Sopinka (all at UVic)

The “Keeling Curve”

Atmospheric CO₂ at Mauna Loa Observatory



We must reduce the slope of the trend, as rapidly as possible. This is a global challenge, unprecedented in scope.

The compelling need to reduce CO₂ emissions yields a key question:

Can we remove coal (and/or gas) from the Canadian electricity supply chain?

Possible strategy to address this:

Couple wind power with an integrated Canadian (or North American) electrical grid.

The Integrated North American Transmission Grid

~12 GW grid
~ 95% hydro

~12 GW grid
~ 90% coal/gas

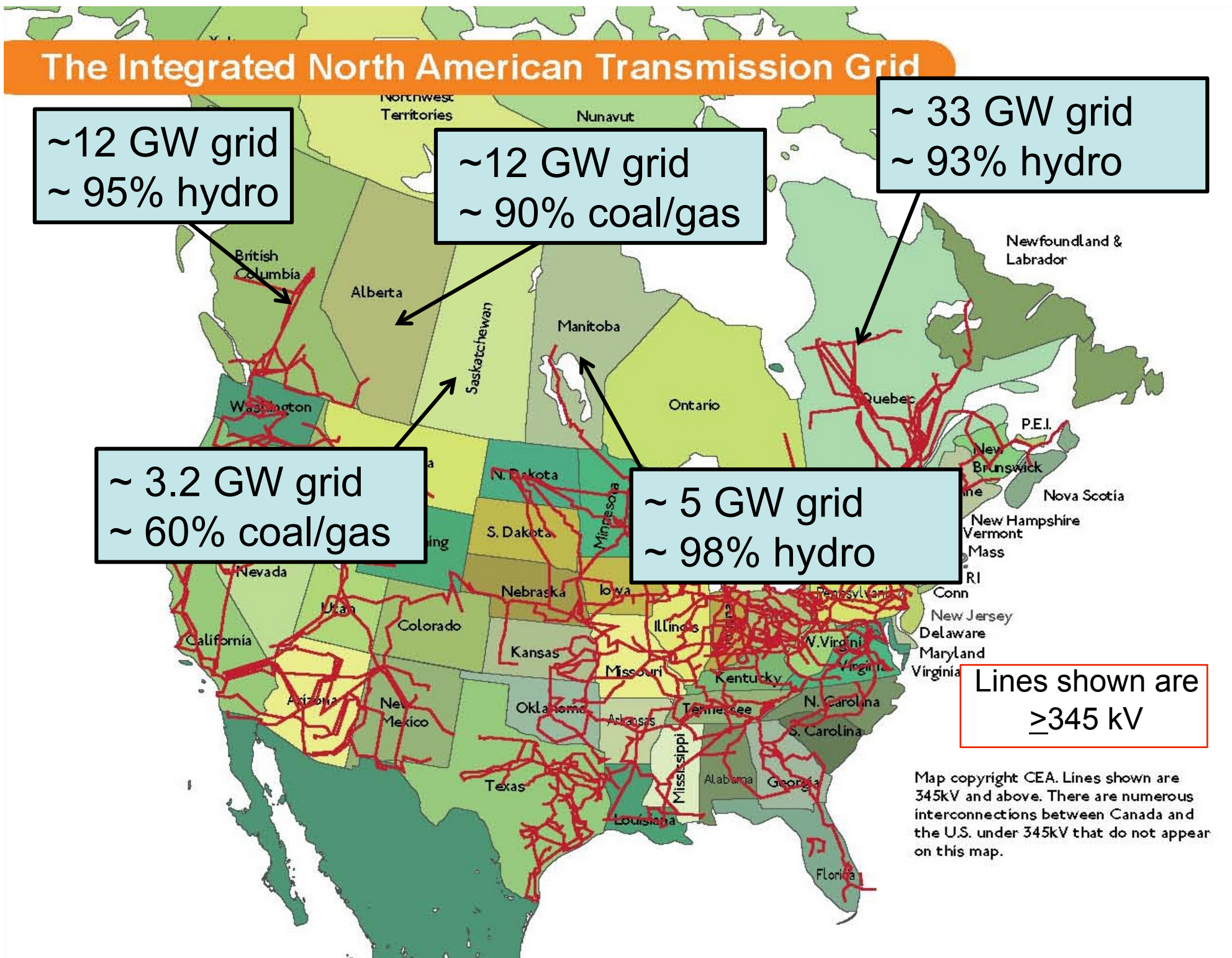
~ 33 GW grid
~ 93% hydro

~ 3.2 GW grid
~ 60% coal/gas

~ 5 GW grid
~ 98% hydro

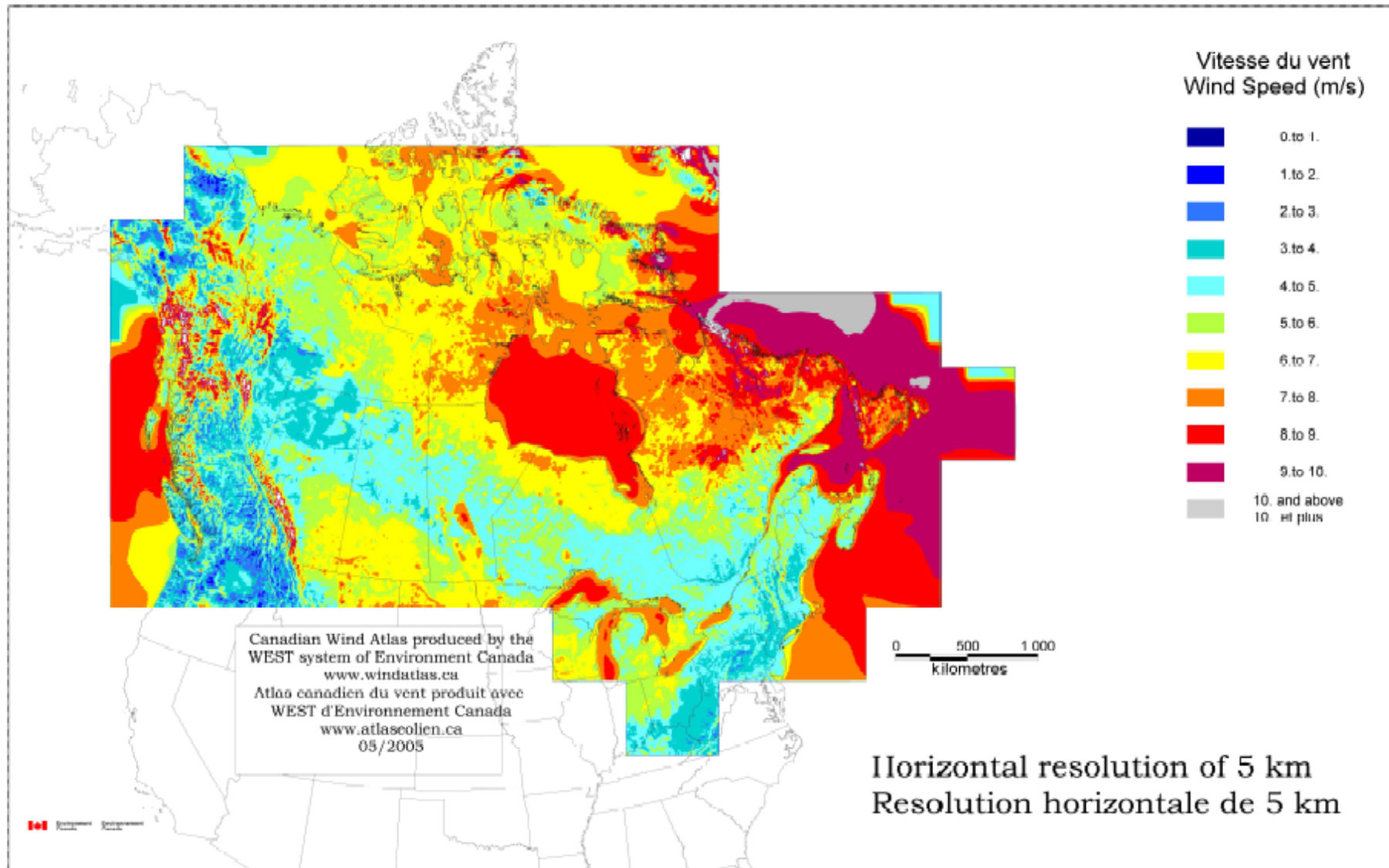
Lines shown are
 ≥ 345 kV

Map copyright CEA. Lines shown are 345kV and above. There are numerous interconnections between Canada and the U.S. under 345kV that do not appear on this map.



Canadian Wind Resources: The World's Second Largest

Mean Wind Speed at 50 m above ground
Vitesse moyenne du vent à 50 m au dessus du sol



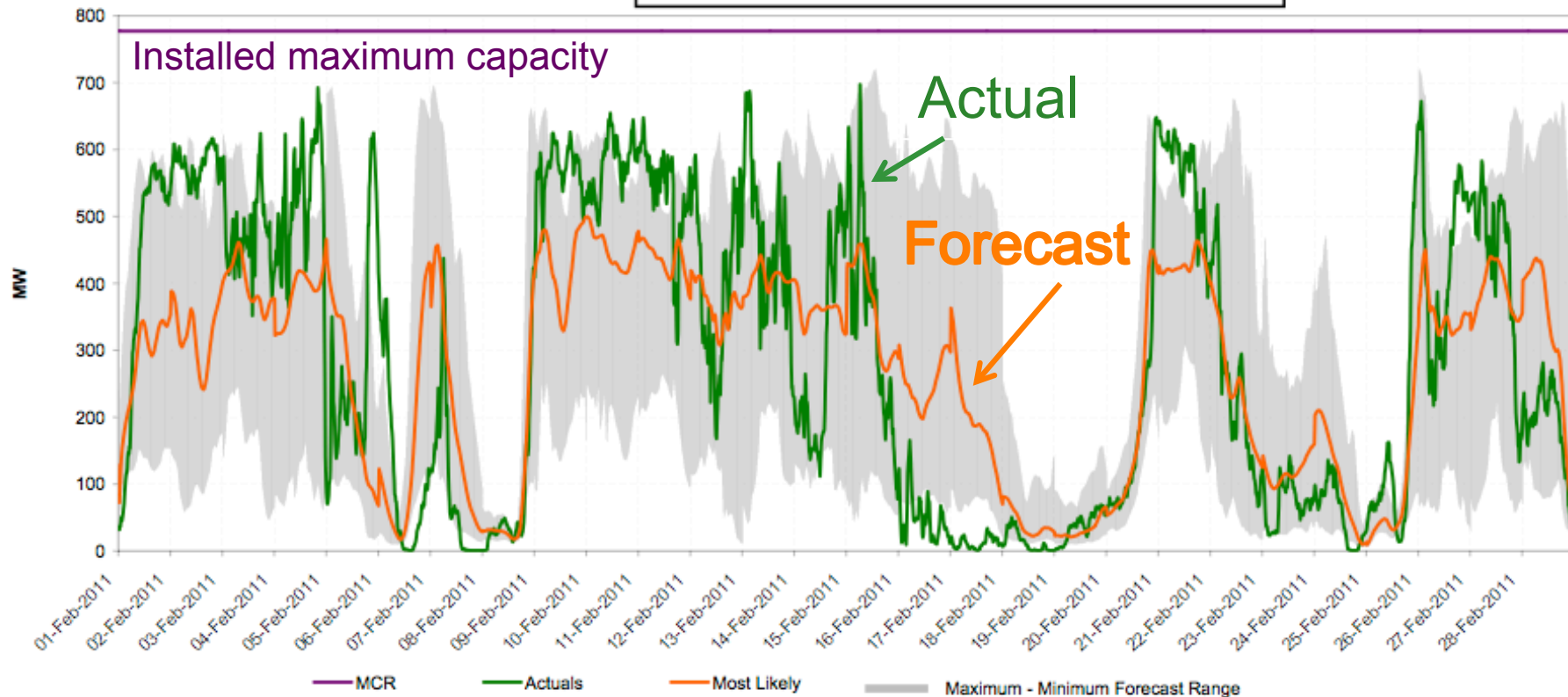
Wind power production, Alberta, February 2011

Day Ahead Wind Power Forecast vs. Actual Wind Production for the Month of February 2011



This figure is intended to illustrate the correlation between the wind power forecast received from WEPROG and actual wind production.

Accuracy Statistics: Mean absolute percent error (MAPE) = 14.4%
Average range between the maximum and minimum forecast = 361 MW



Prepared on 01-Mar-2011



Lake Williston

Lake Williston and the W.A.C. Bennett Dam, one of the world's largest batteries



The Integrated North American Transmission Grid

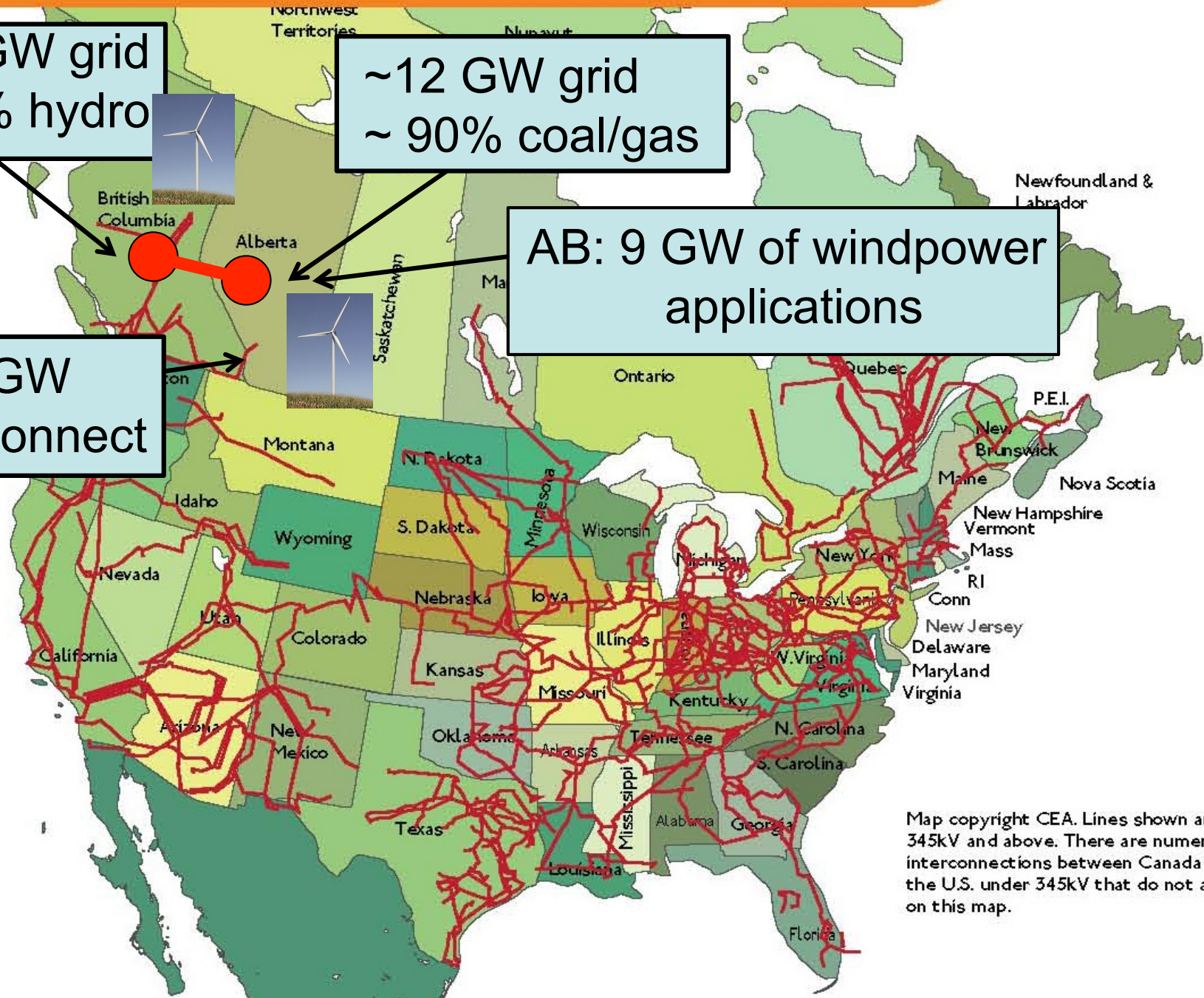
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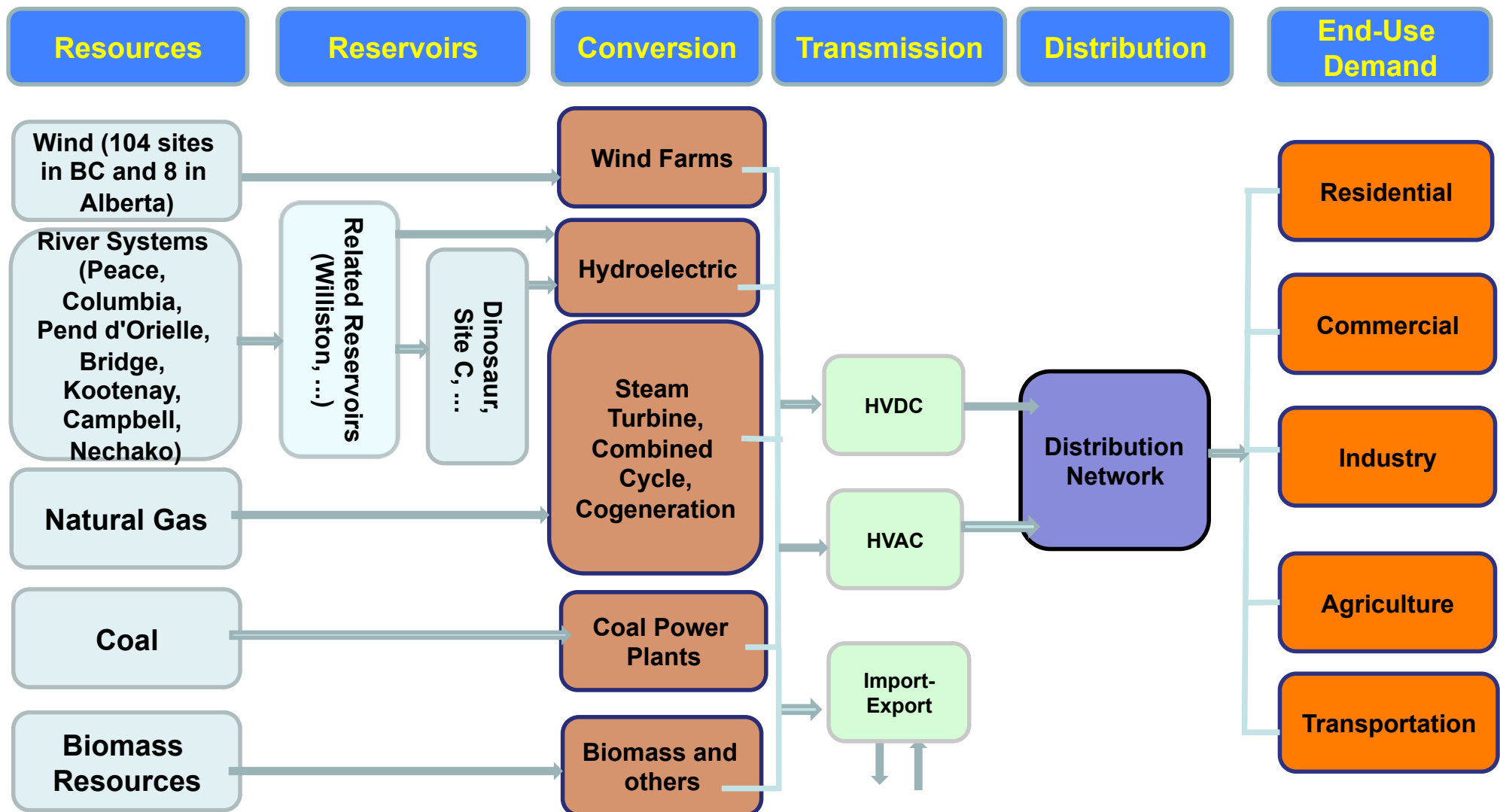
AB: 9 GW of windpower applications

0.78 GW
Interconnect

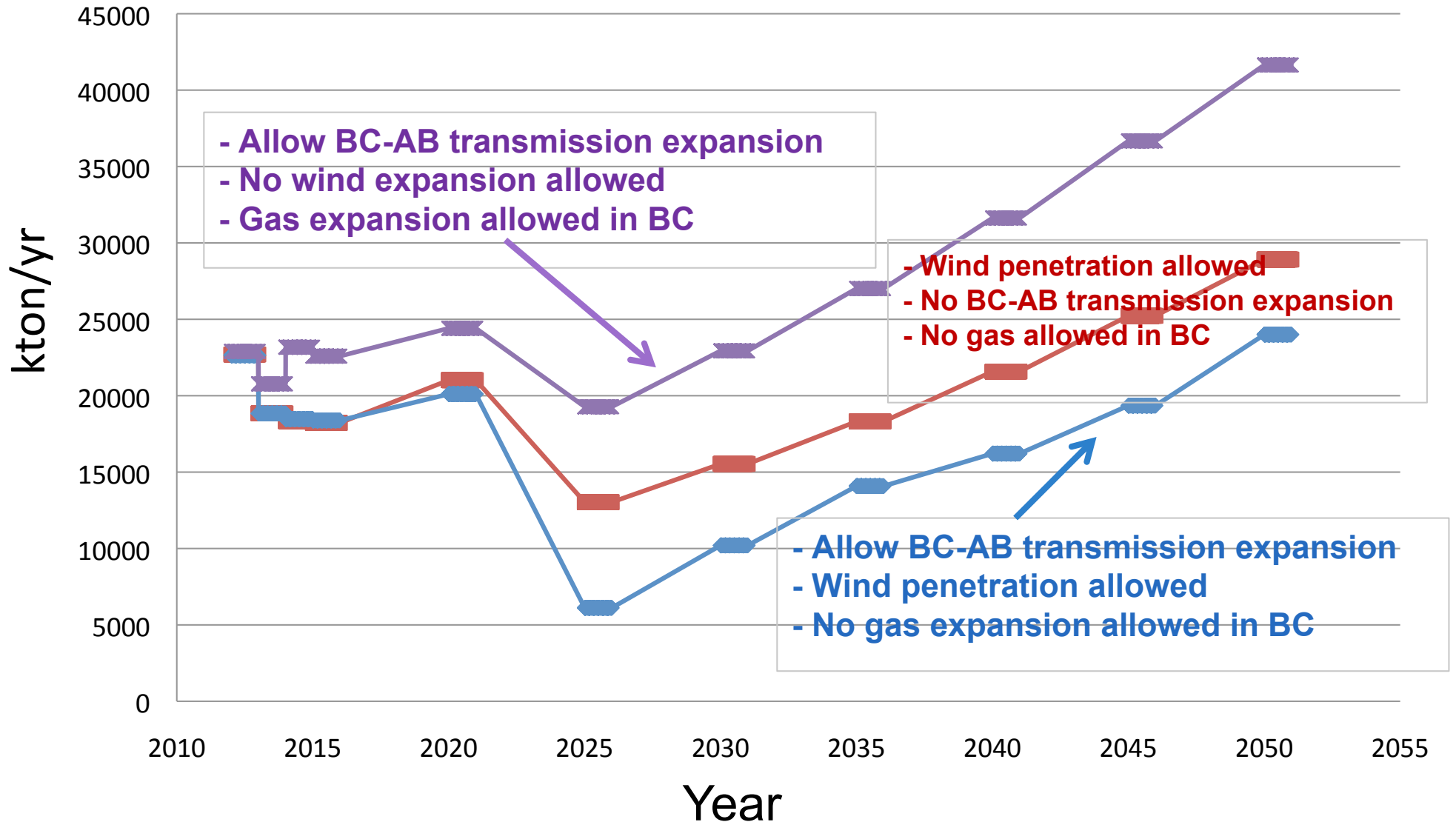


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BC and Alberta Reference Energy System



Modeled Collective CO₂ Emissions from BC-AB Electricity Generation to 2050, kton/yr



The Integrated North American Transmission Grid

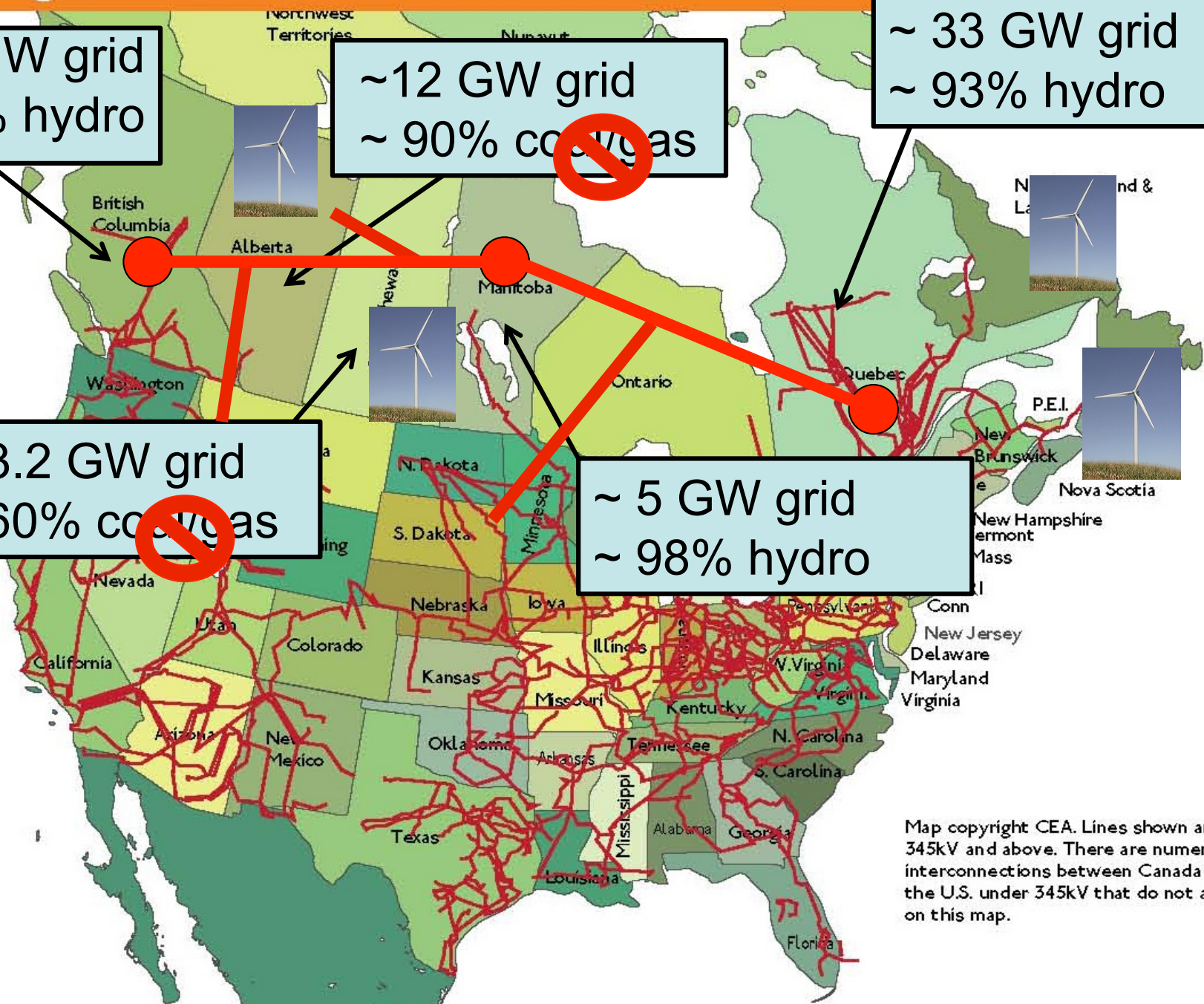
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But...

- Electricity supply is a provincial responsibility (thus, constitutional and legal issues).
- Electricity exports to the US from BC can be lucrative (thus, an economic issue).
- Future hydro supply in the face of a changing climate? (thus, a climatology/hydrology issue).
- Transmission corridors have impacts, and distances are immense (thus, social, ecological and engineering issues).

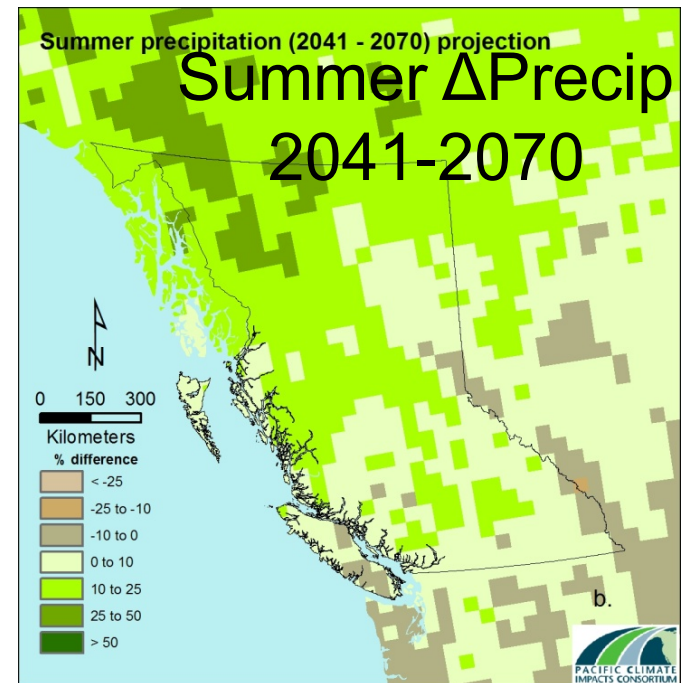
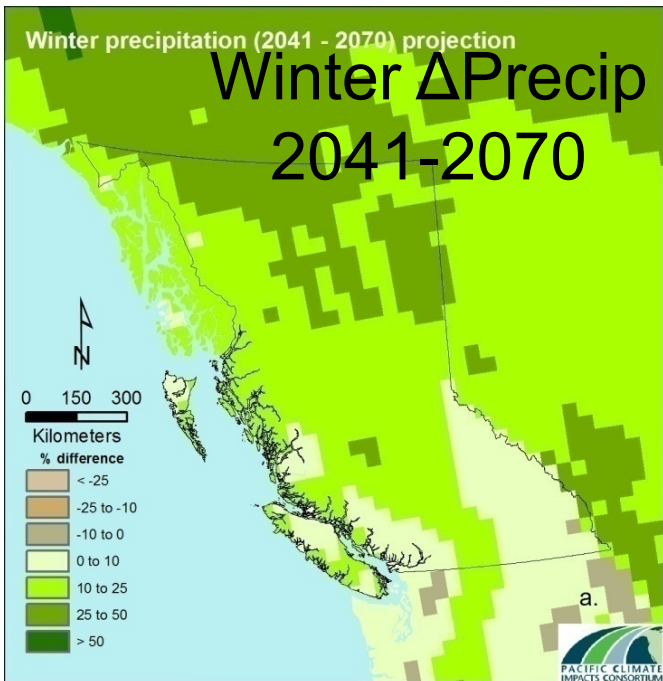
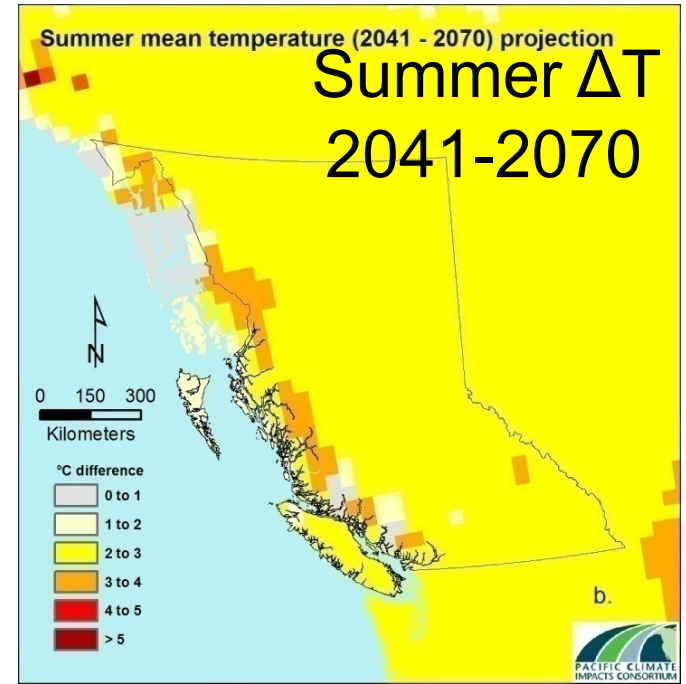
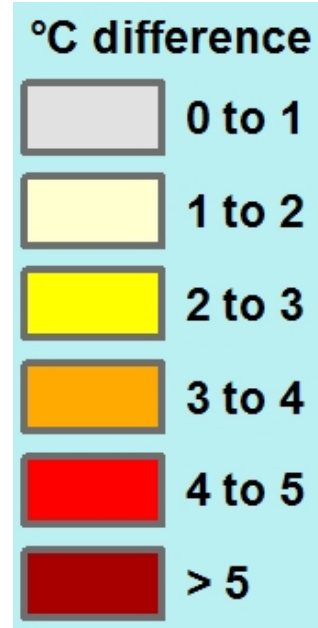
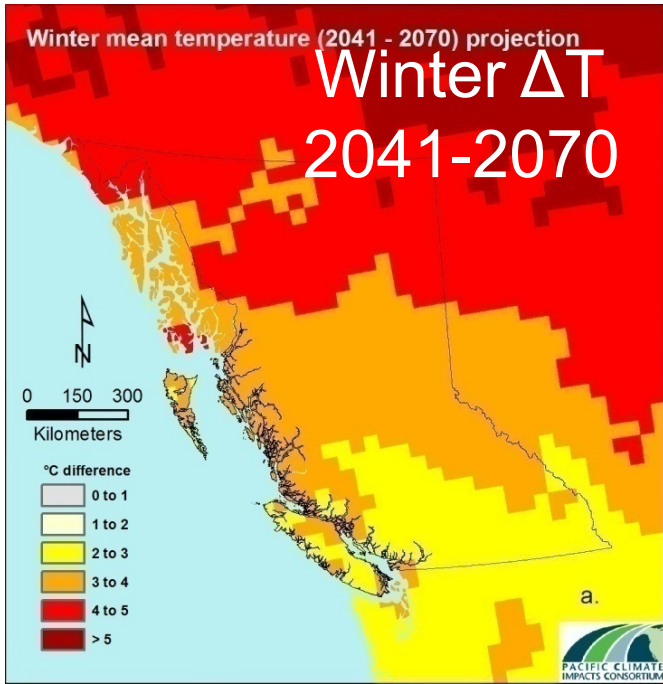
Parallels?

- “Supergrid” – northern Europe, HVDC.
- Western US states.
- A major rationale for both is enhanced accommodation of renewables.

The Role of Climate Services: PCIC (and Ouranos):

- Future hydrology?
- Future wind regimes, seasonally and geographically?
- Future temperatures seasonally (impact on air conditioning (summer) and space heating (winter) electricity demand)?

PCIC Results





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for Climate Solutions
Knowledge. Insight. Action.

www.pics.uvic.ca

Thank you.

Merci beaucoup.

Danke schön.