

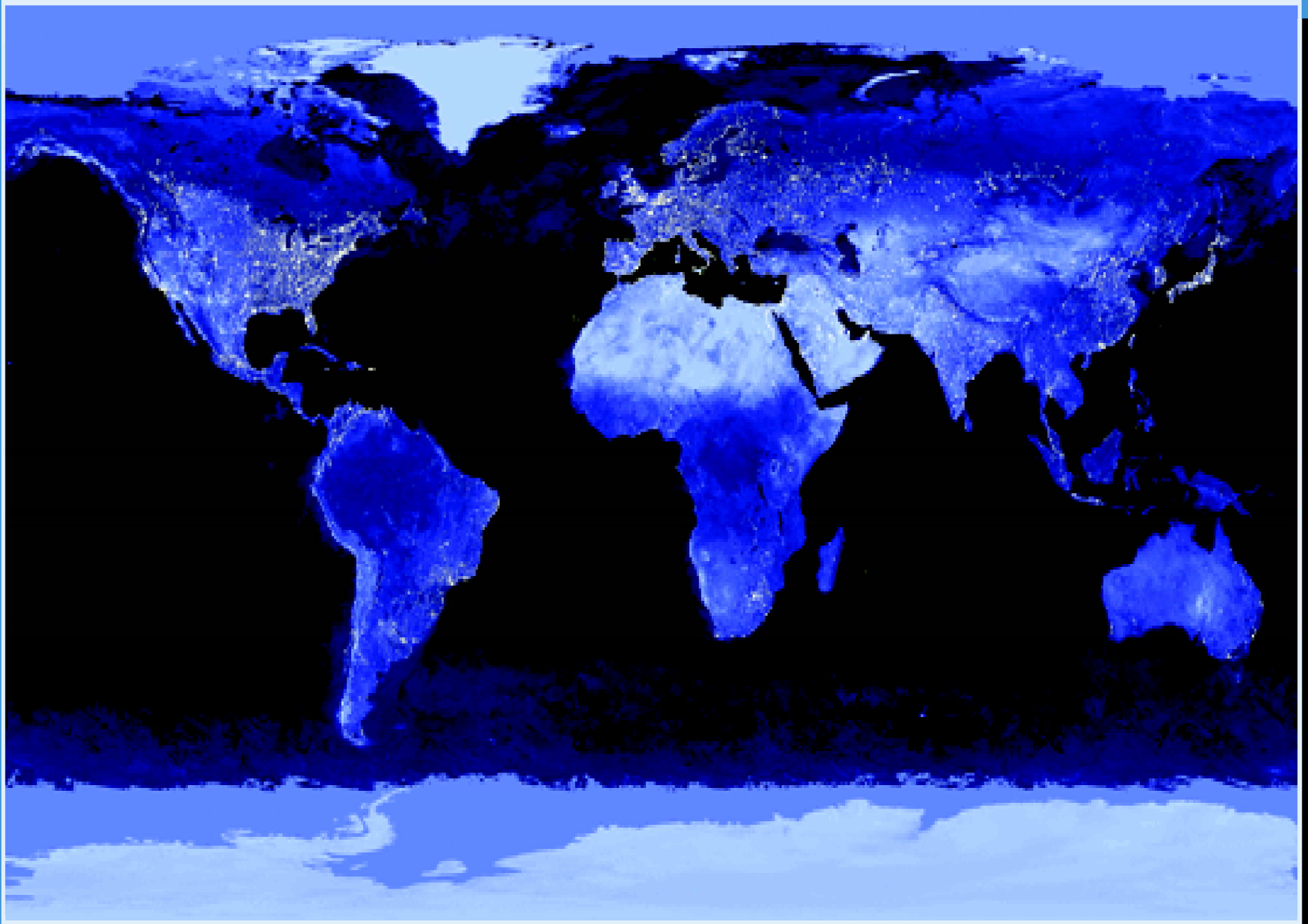
Hydroelectricity a Renewable Option and Part of the Solution to Climate Change

Claude Demers
Science Communicator
Hydro-Québec

Climate 2050, Montréal

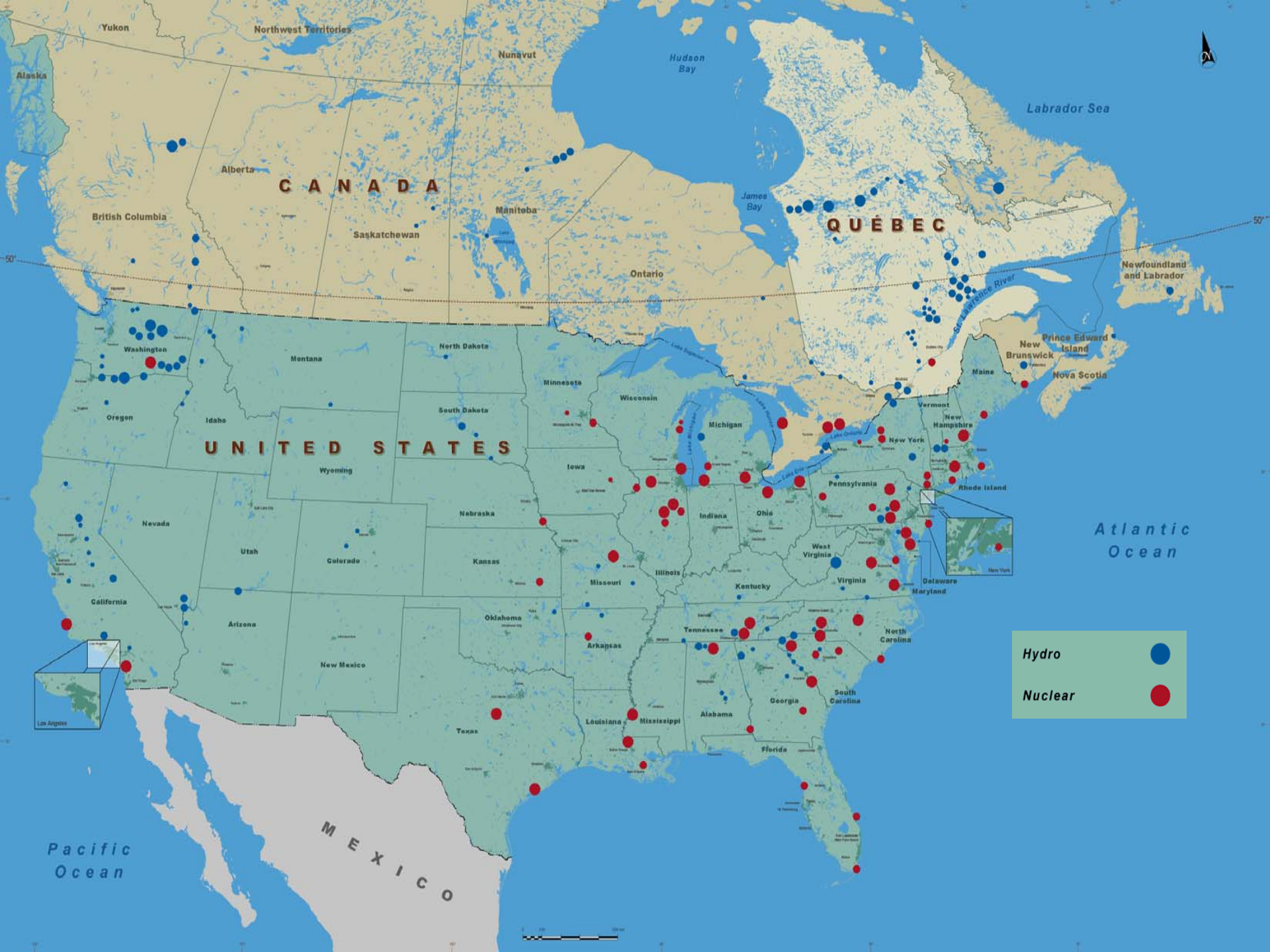
Why are you attending this conference ?

- "The objective of the conference is to help identify essential technology and policy pathways leading to steep reductions in GHG emissions between now and 2050."
- Why hydro is not mentioned in sessions descriptions ?



Where are we coming from ?





CANADA

QUÉBEC

UNITED STATES

MEXICO

Hydro ●
Nuclear ●





CANADA

QUÉBEC

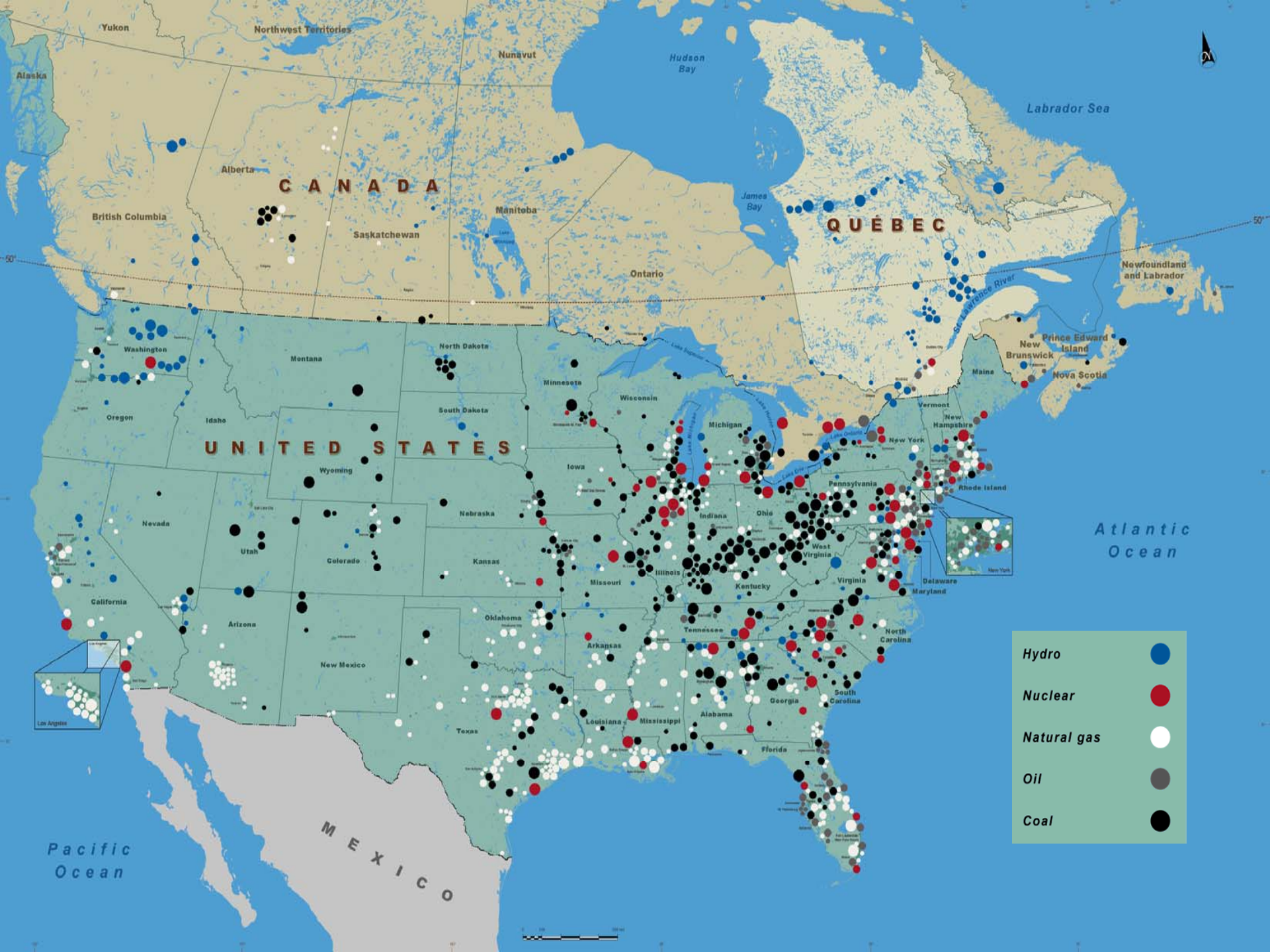
UNITED STATES

MEXICO

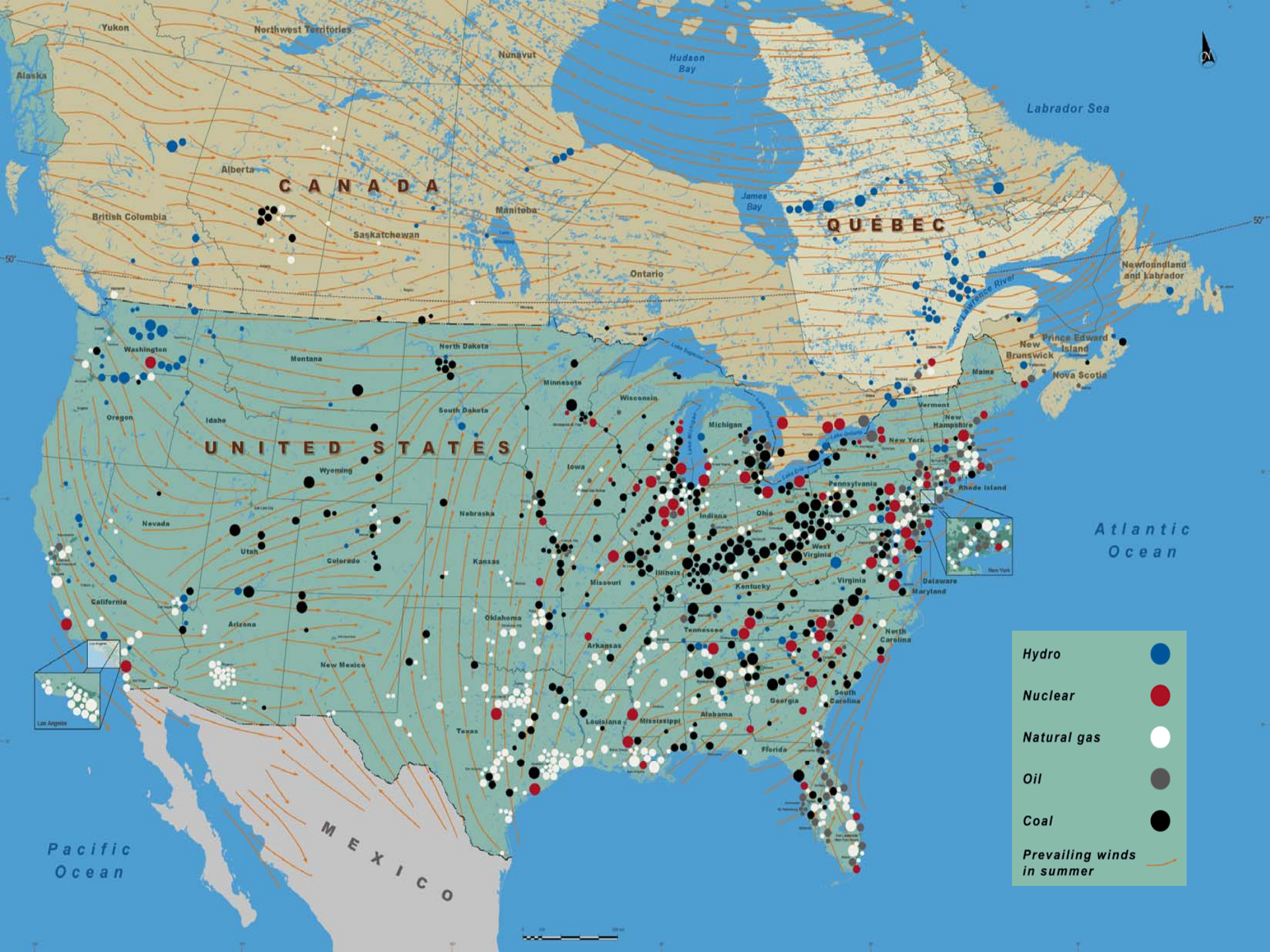
- Hydro ●
- Nuclear ●
- Natural gas ●



- Hydro ●
- Nuclear ●
- Natural gas ●
- Oil ●



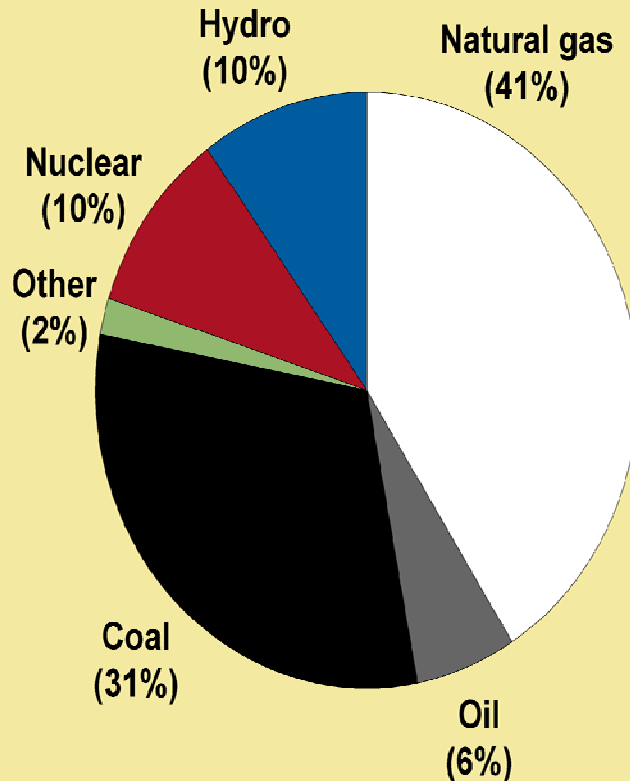
- Hydro ●
- Nuclear ●
- Natural gas ●
- Oil ●
- Coal ●



Generating Options, 2005

UNITED STATES

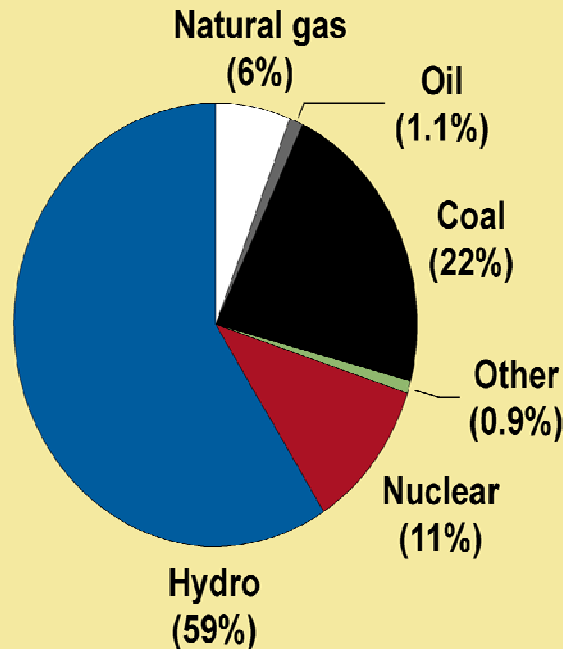
Installed capacity: 1,067,000 MW



Source: U.S. Energy Information Administration, 2007 (Name Plate Capacity)

CANADA

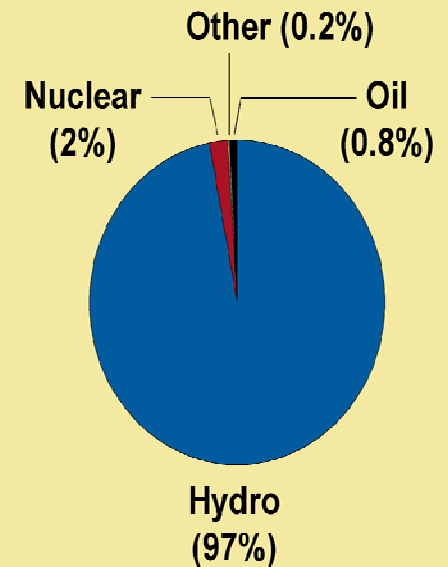
Installed capacity: 121,000 MW



Source: Natural Resources Canada

QUÉBEC

Installed capacity: 38,000 MW



Source: Natural Resources Canada

Electricity Generation: 4,055 TWh

Source: U.S. Energy Information Administration, 2007 (Name Plate Capacity)

Electricity Generation: 597 TWh

Source: National Energy Board

Electricity Generation: 175 TWh

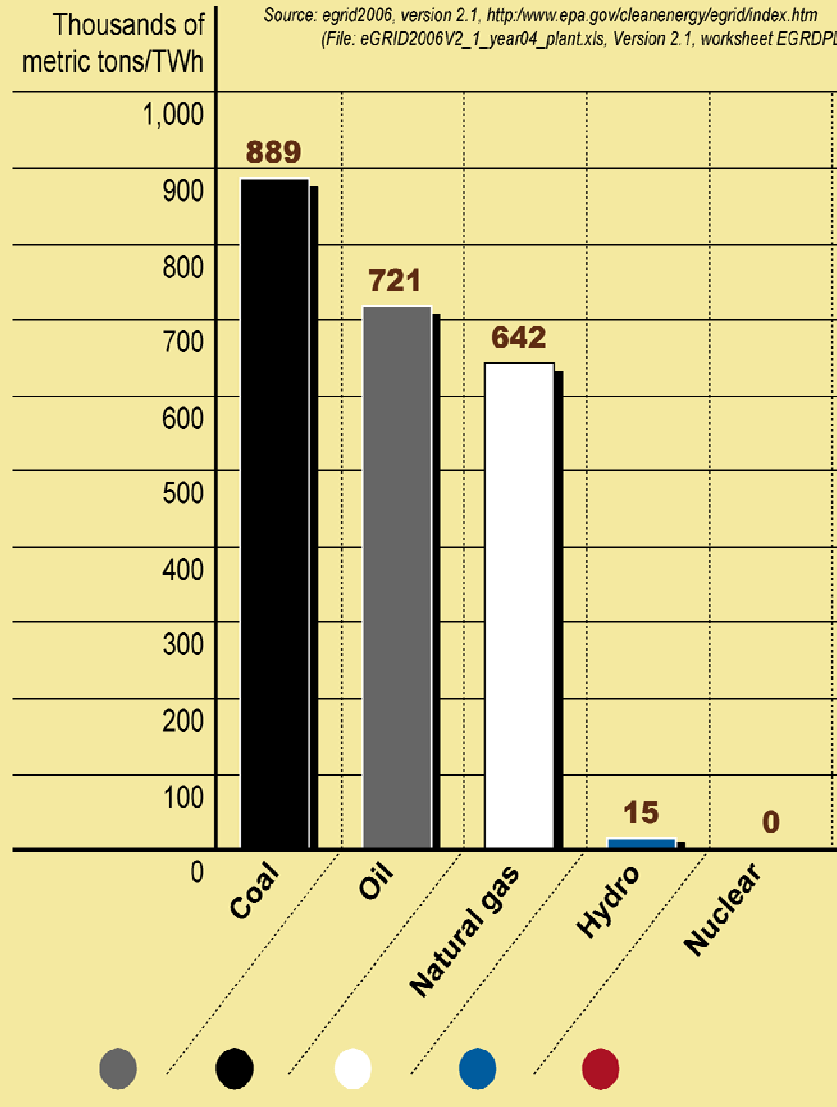
Source: National Energy Board

GHG and Electricity Generation

- Canada = 17 %
- Québec = 2 %

Average Emission Factors in Operational Phase, 2004

Carbon Dioxide (CO₂)



Note: Emissions from the exploration, extraction, refining, transportation and storage of fuel are not taken into account here. The data is average data from generating plants in New York State and New England. Oil data is for heavy fuel oil.



Réservoir Eastmain-1

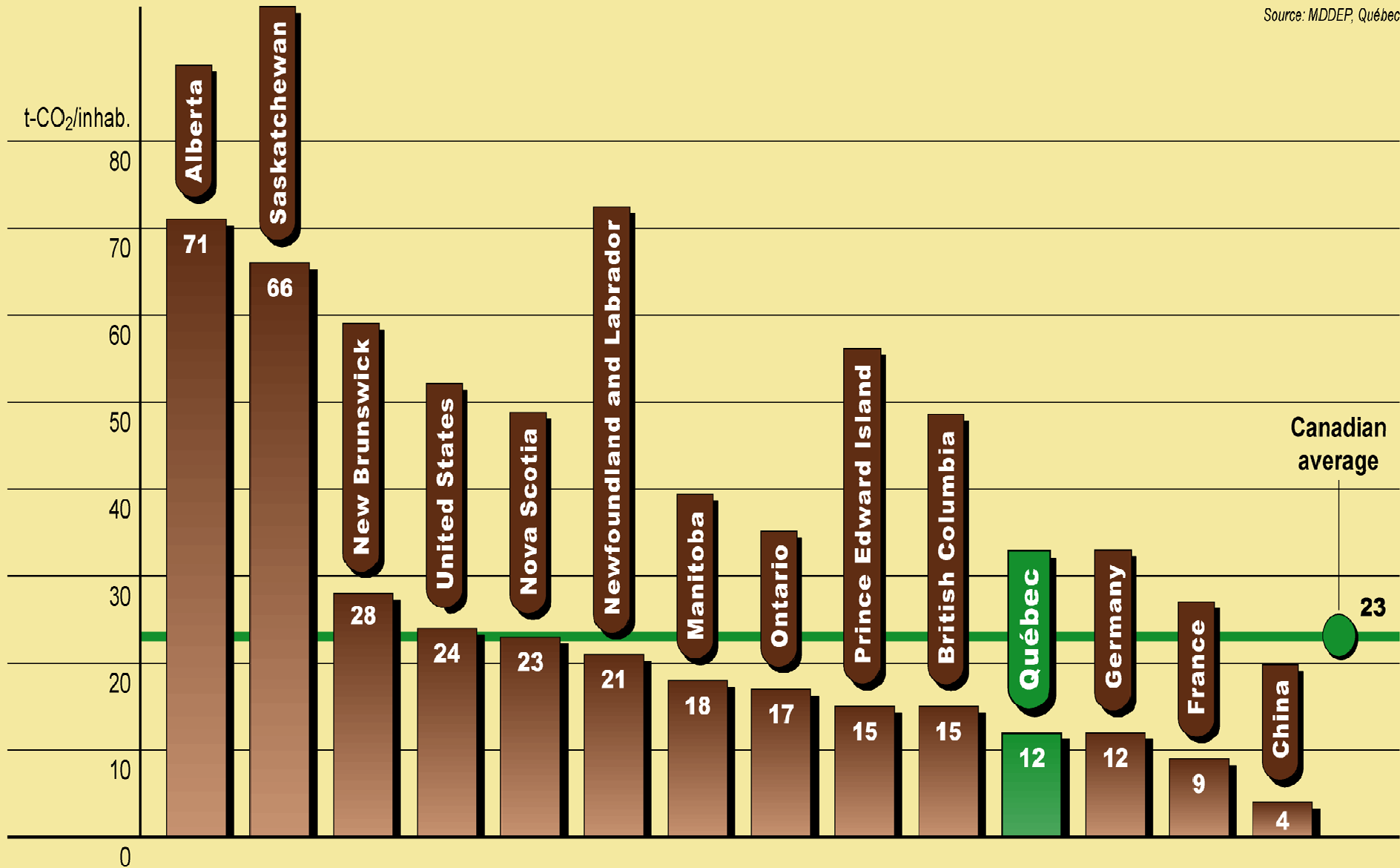
A world premiere..
Scientific results

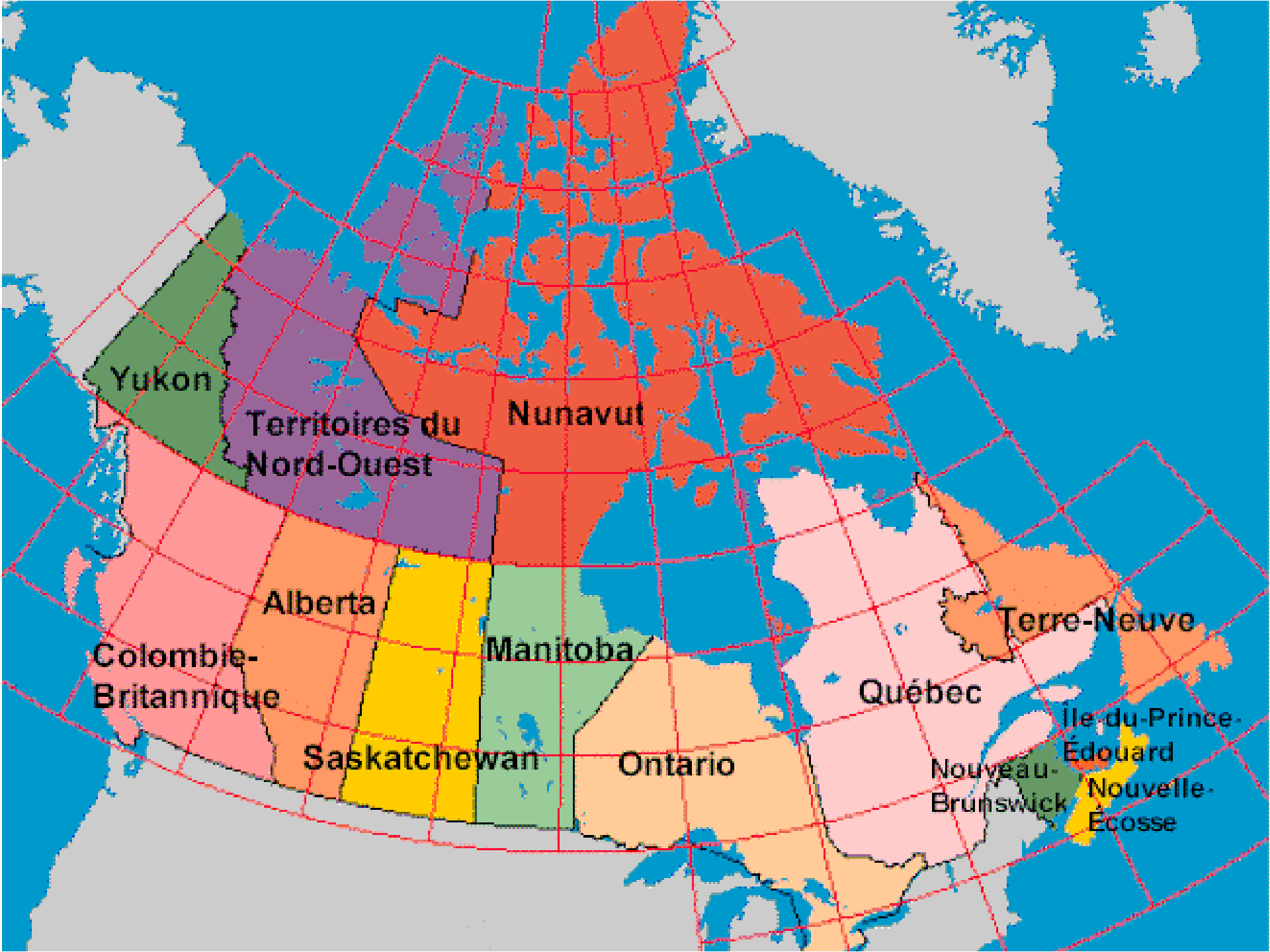


± 10 years

Greenhouse Gas (CO₂) Emissions Per Inhabitant, 2003

Source: MDDEP, Québec





Yukon

Territoires du
Nord-Ouest

Nunavut

Alberta

Colombie-
Britannique

Manitoba

Saskatchewan

Ontario

Québec

Terre-Neuve

Ile-du-Prince-
Édouard

Nouveau-
Brunswick

Nouvelle-
Écosse

Hydro relies on Climate

- The fuel: where, how, how much, when
- The demand: temperature
- A better knowledge of the regional climate

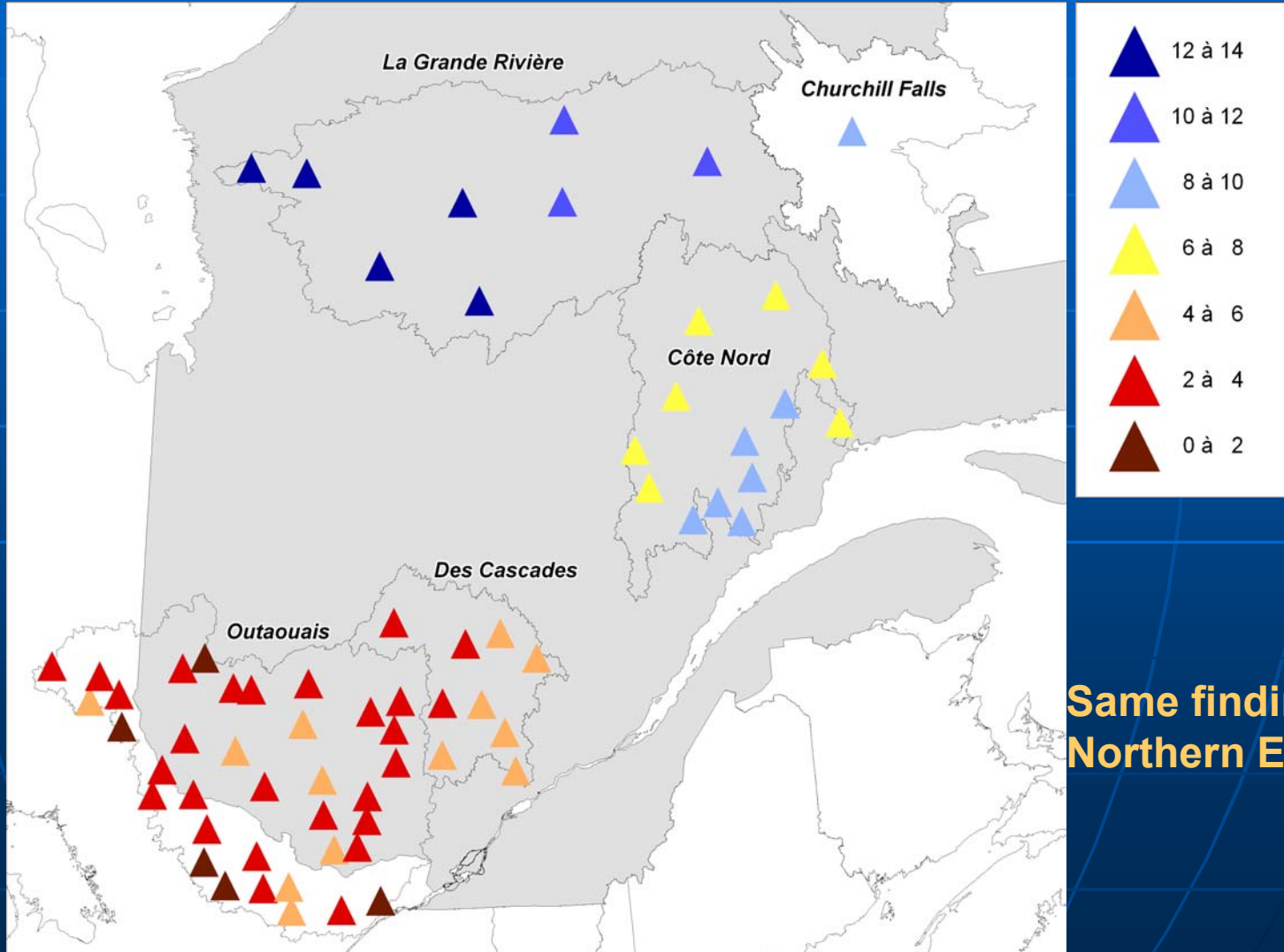
Consortium on Regional Climatology and adaptation to Climate Change

- ✓ *The Ouranos Consortium, whose creation was announced on May 16, 2002, pools the expertise and disciplines of more than 250 researchers in order to advance the understanding of the issues and the associated requirements for adaptation resulting from climate change on the scale of the North American continent.*

1 000 km

Variations of Natural Inflows

2050 (2041-2070) vs now (1960-2002) (%)

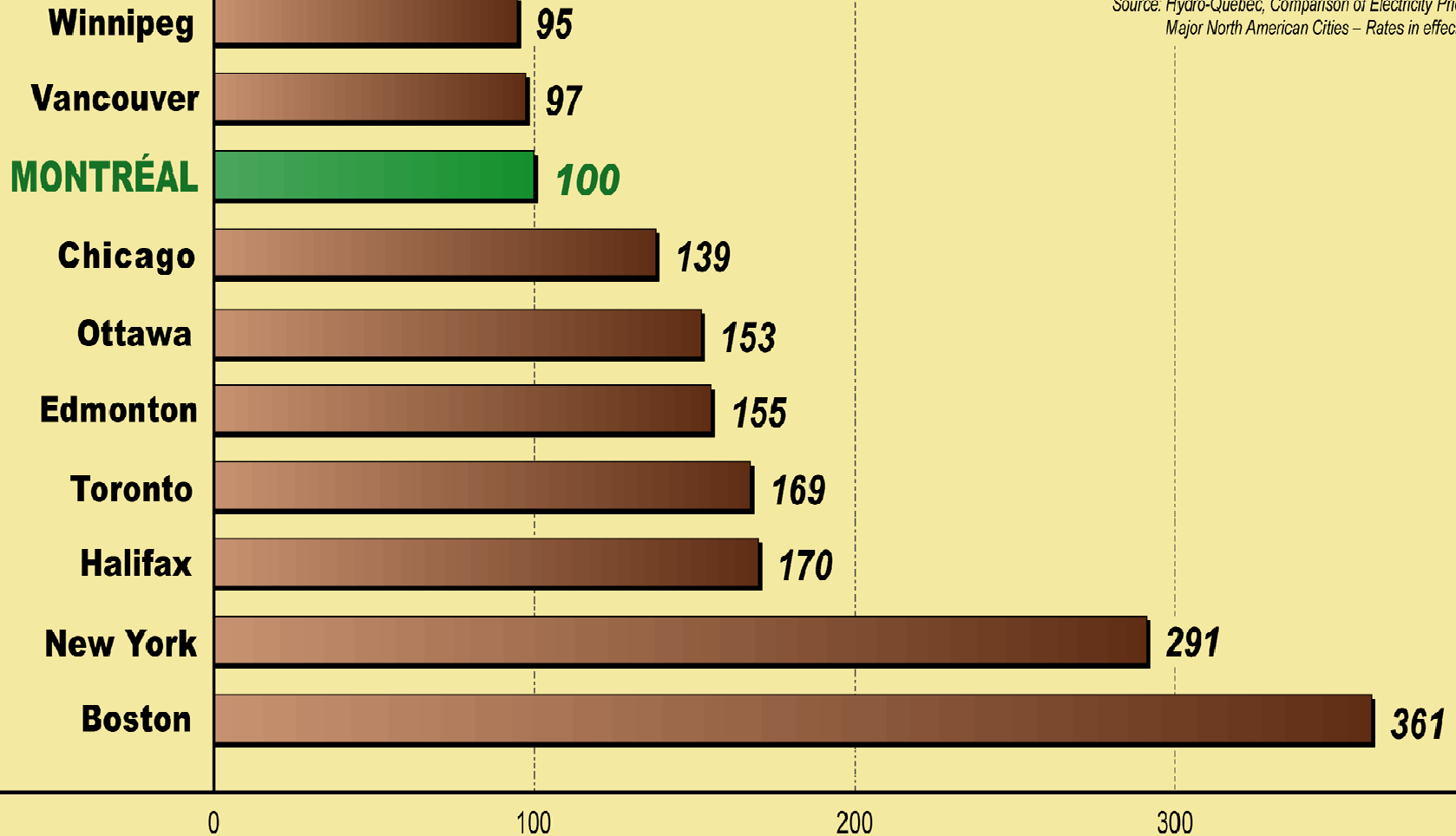


Same findings in Northern Europe!

Better Knowledge of the Electricity Needs

- Responsibility to deliver reliable power
- Large scale vs small scale
- Variability of the demand: day / year
- More interconnections: demand, time zone
- Storage capacity and flexibility
- Hydro a renewable = low rates

Monthly billings (taxes not included) for a typical consumption of 1,000 kWh

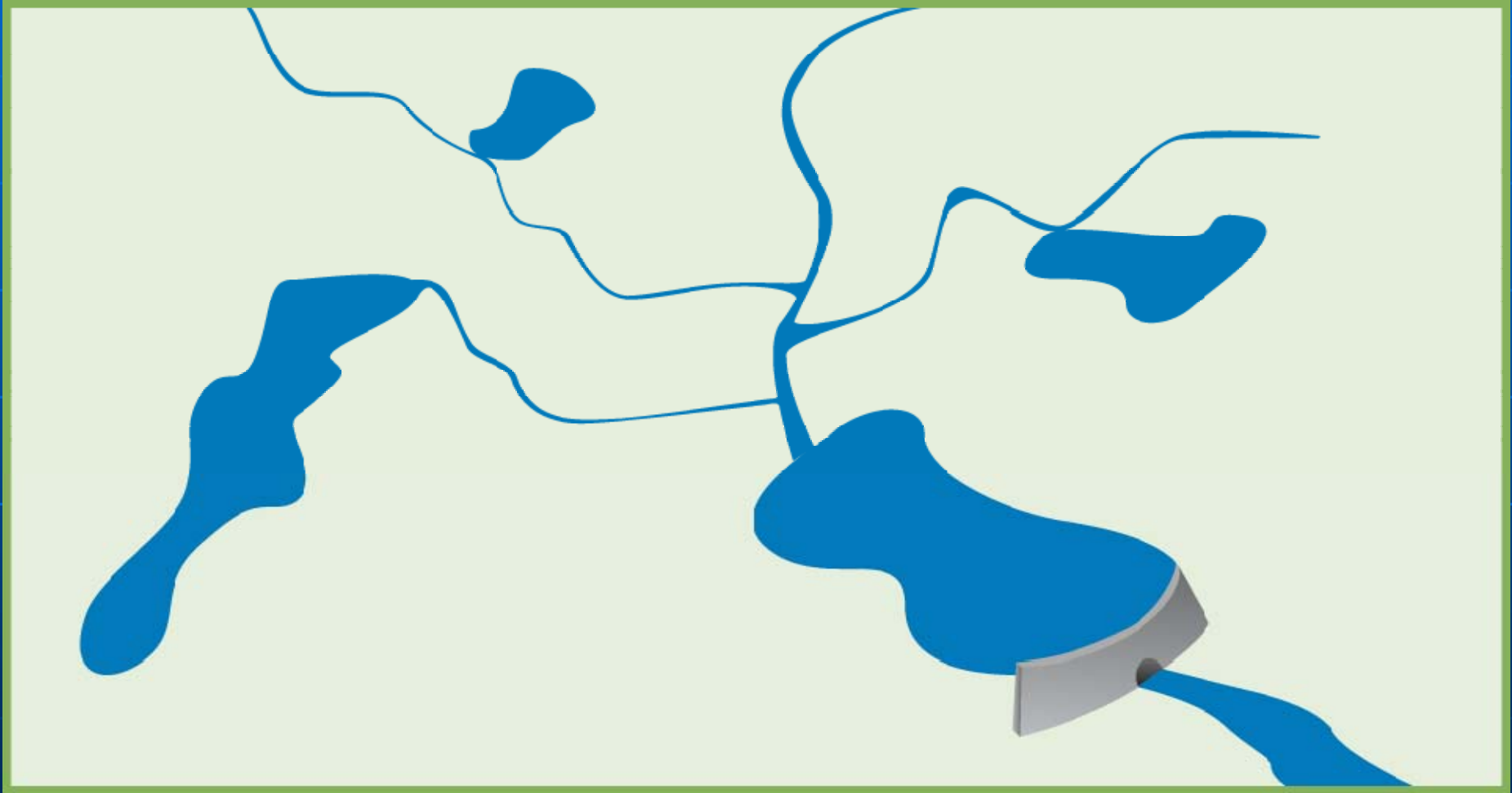


Comparative Index of Electricity Prices Residential Customers, 2006

Some issues

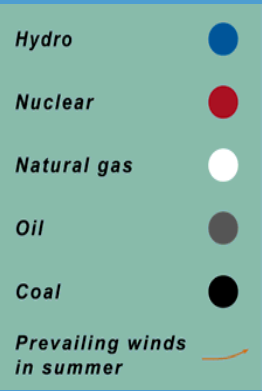
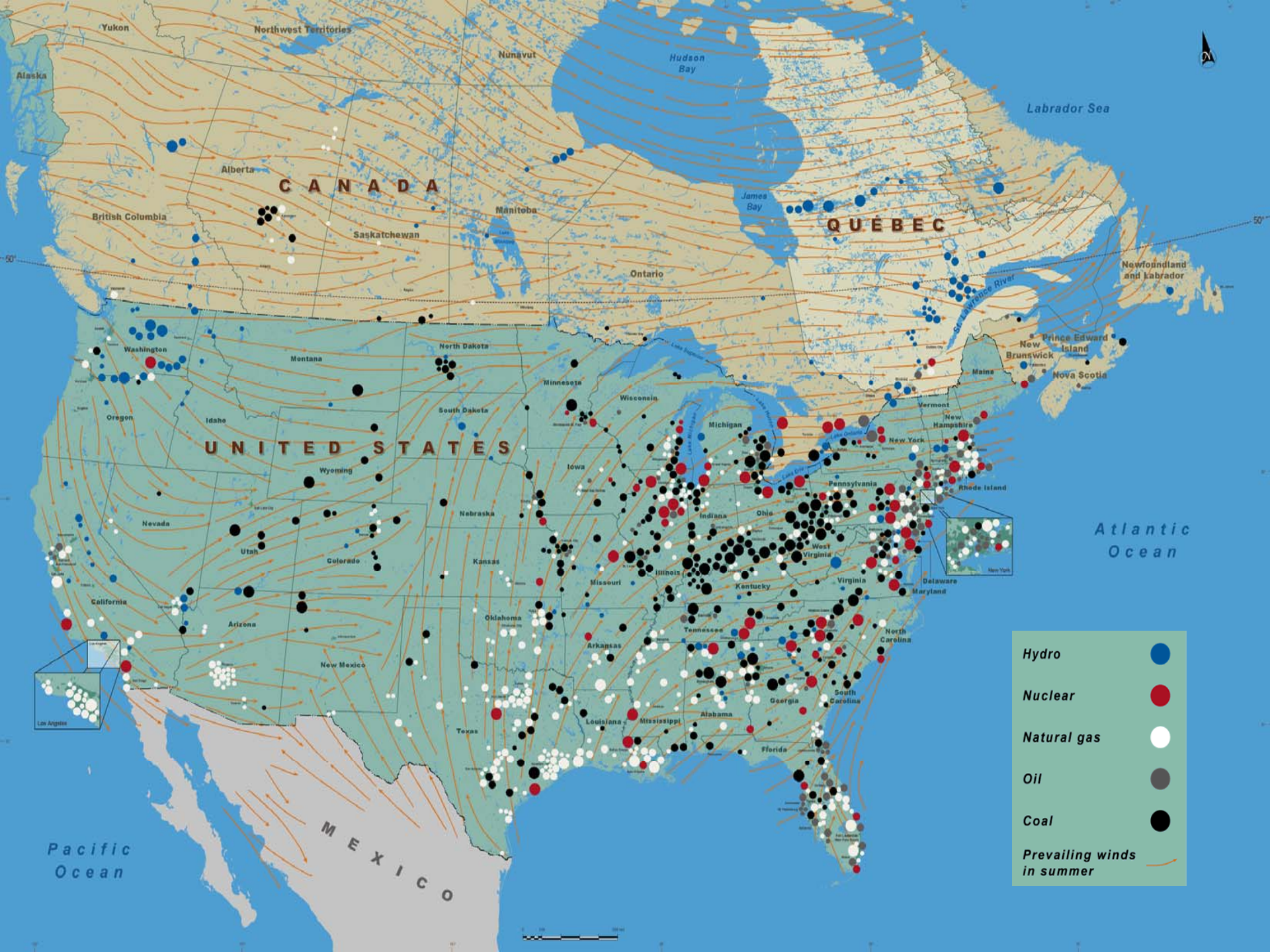
- No recognition of very low emissions from hydro reservoirs
- Ensure an equitable treatment of generating options (level playing field)
- Implementation of emitter pays principle

Vast Study Area and Complex Studies



30 Km





CANADA

QUÉBEC

UNITED STATES

MEXICO

Atlantic Ocean

Pacific Ocean



Yukon

Northwest Territories

Nunavut

Hudson Bay

Labrador Sea

Alberta

Manitoba

James Bay

British Columbia

Saskatchewan

Ontario

Newfoundland and Labrador

50°

50°

Washington

Montana

North Dakota

Minnesota

Wisconsin

Maine

New Brunswick

Nova Scotia

Oregon

Idaho

South Dakota

Iowa

Michigan

Pennsylvania

New York

Rhode Island

Nevada

Utah

Colorado

Kansas

Missouri

Illinois

Kentucky

Virginia

Delaware

Maryland

California

Arizona

New Mexico

Oklahoma

Arkansas

Tennessee

Georgia

South Carolina

Texas

Louisiana

Mississippi

Alabama

Florida

North Carolina

South Carolina

MEXICO

Atlantic Ocean

Pacific Ocean



Yukon

Northwest Territories

Nunavut

Hudson Bay

Labrador Sea

Alberta

Manitoba

James Bay

British Columbia

Saskatchewan

Ontario

Newfoundland and Labrador

50°

50°

Washington

Montana

North Dakota

Minnesota

Wisconsin

Maine

New Brunswick

Nova Scotia

Oregon

Idaho

South Dakota

Iowa

Michigan

Pennsylvania

New York

Rhode Island

Nevada

Utah

Colorado

Kansas

Missouri

Illinois

Kentucky

Virginia

Delaware

Maryland

California

Arizona

New Mexico

Oklahoma

Arkansas

Tennessee

Georgia

South Carolina

Texas

Louisiana

Mississippi

Alabama

Florida

North Carolina

South Carolina

Conclusion

- There is no global solution but regional needs and regional solutions
- There are some hydro sites available outside Europe and USA
- Hydro is part of the solution