EBC Energy in Buildings and Communities Programme

ANNEX 67

Towards Energy Flexibility: Canadian Context

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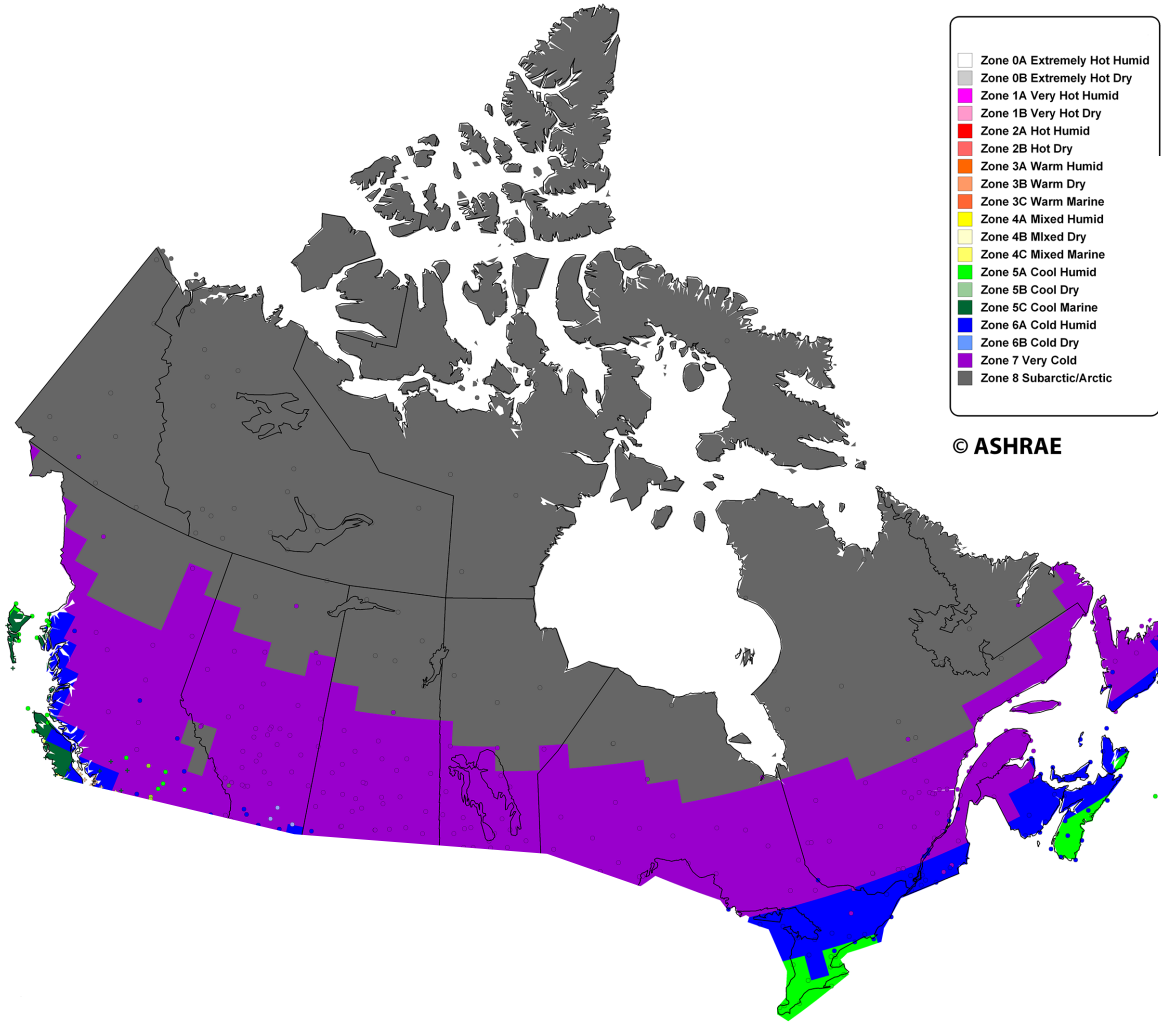
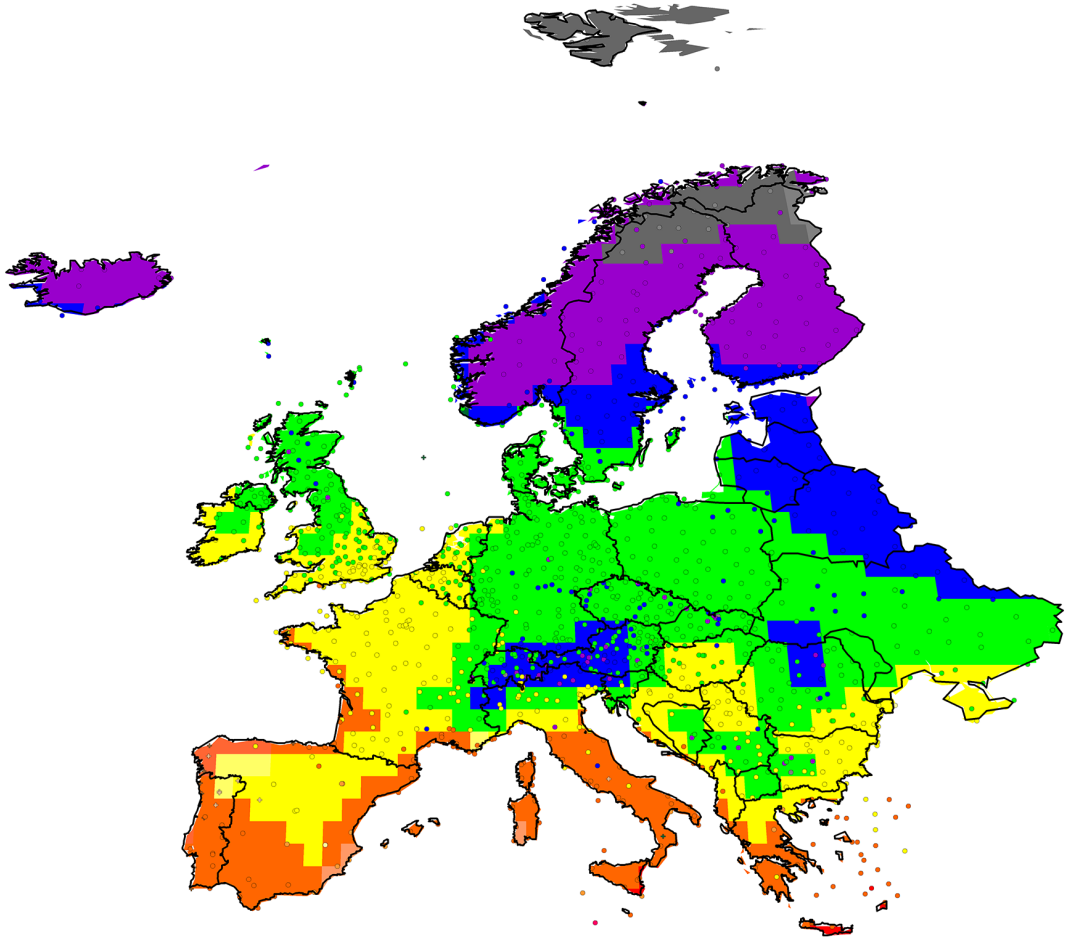
POLYTECHNIQUE MONTRÉAL

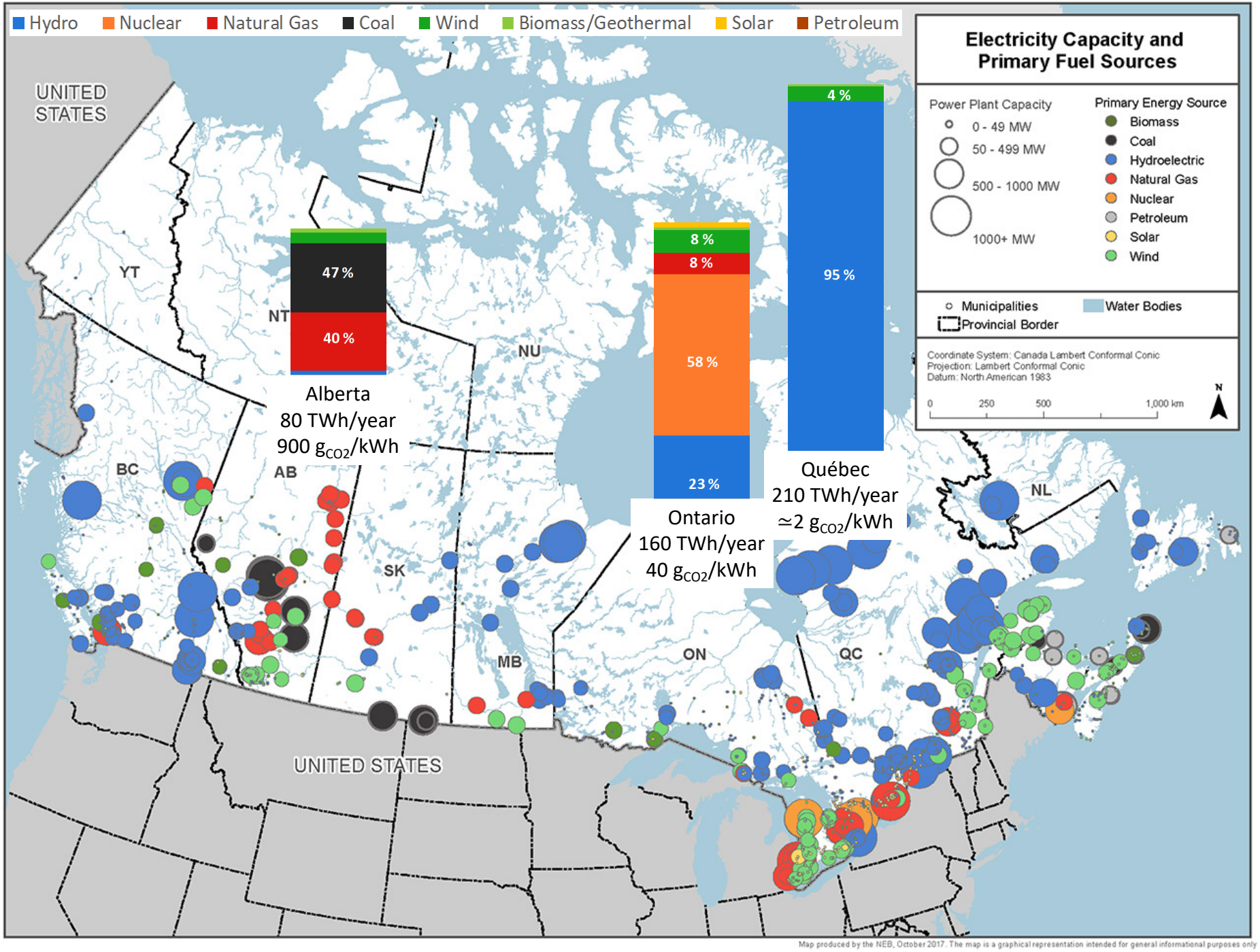
Canada


Iceland
Sweden
Finland
Norway
Denmark
United Kingdom
Belarus
Poland
Germany
Ukraine
France
Romania
Italy
Spain
Greece
Turkey
Portugal
Uzbekistan
Turkmenistan
Syria
Tunisia
Iraq
Iran
Afghanistan
Morocco
Pakistan
Algeria
Libya
Egypt

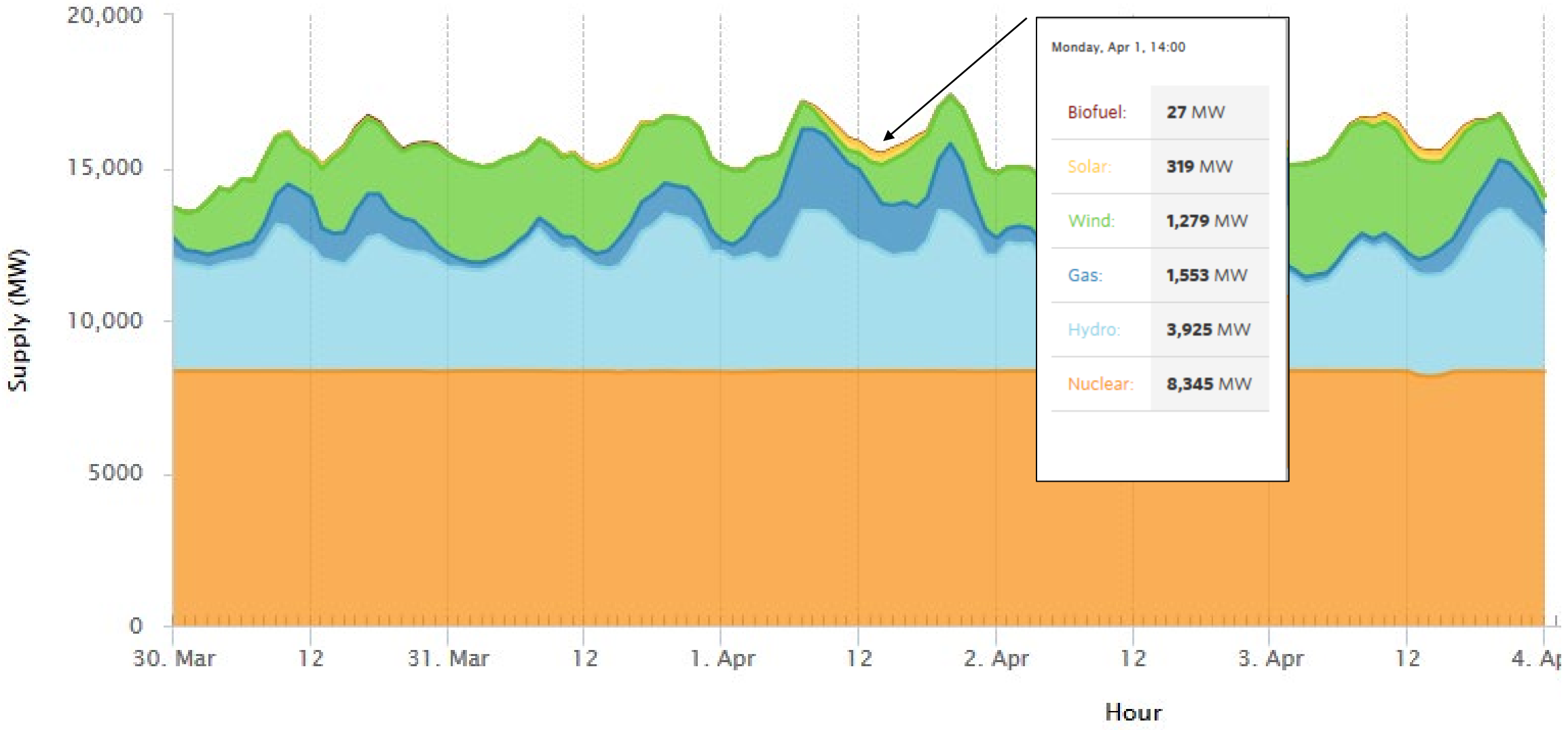
Climate zones (ASHRAE Std 169)



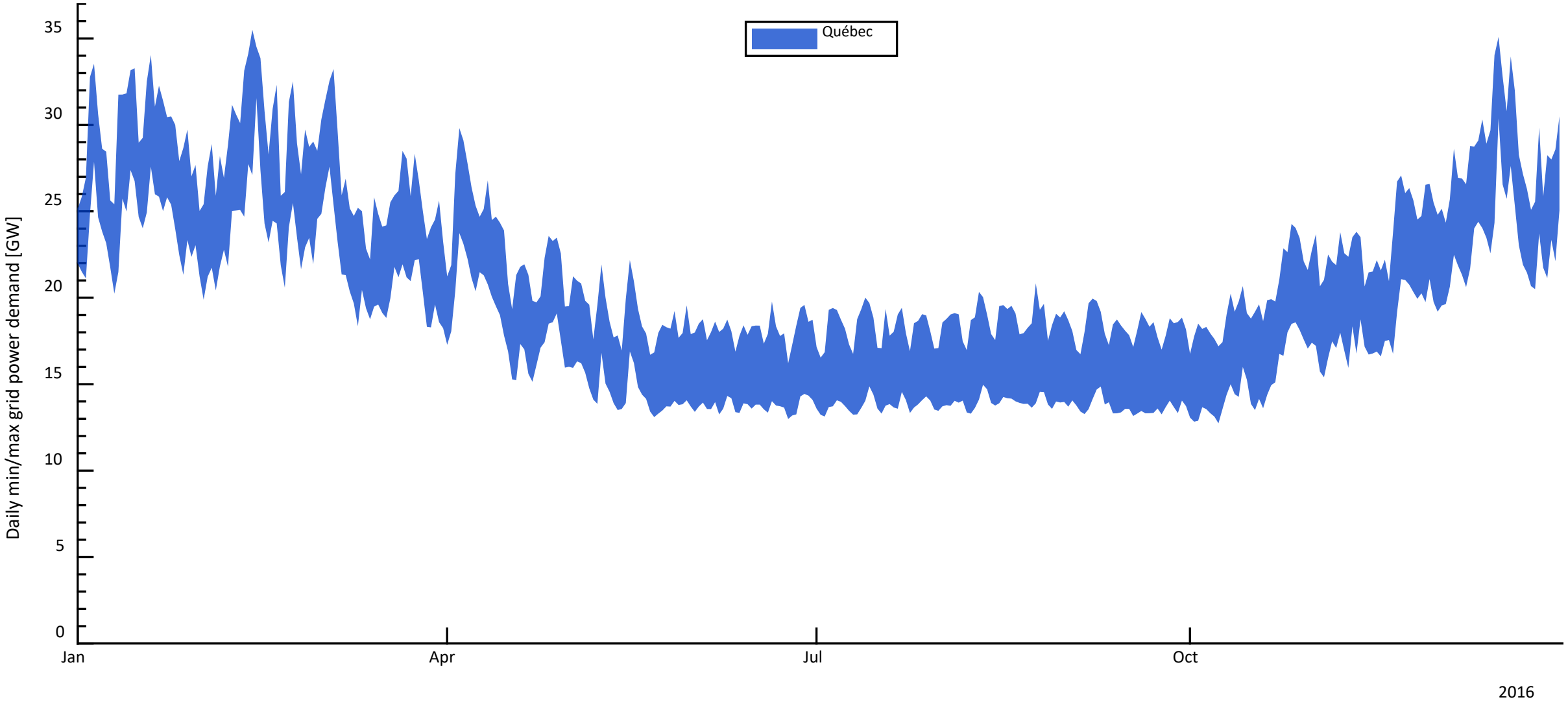



Hydro
Nuclear
Natural Gas
Coal
Wind
Biomass/Geothermal
Solar
Petroleum
UNITED STATES
YT
NT
NU
BC
AB
SK
MB
ON
QC
NL
47 %
40 %
Alberta
80 TWh/year
900 gCO2/kWh
8 %
8 %
58 %
23 %
Ontario
160 TWh/year
40 gCO2/kWh
4 %
95 %
Québec
210 TWh/year
≃2 gCO2/kWh
Electricity Capacity and Primary Fuel Sources
Power Plant Capacity
0 - 49 MW
50 - 499 MW
500 - 1000 MW
1000+ MW
Primary Energy Source
Biomass
Coal
Hydroelectric
Natural Gas
Nuclear
Petroleum
Solar
Wind
Municipalities
Provincial Border
Water Bodies
Coordinate System: Canada Lambert Conformal Conic
Projection: Lambert Conformal Conic
Datum: North American 1983
0
250
500
1,000 km
N
Map produced by the NEB, October 2017. The map is a graphical representation intended for general informational purposes only

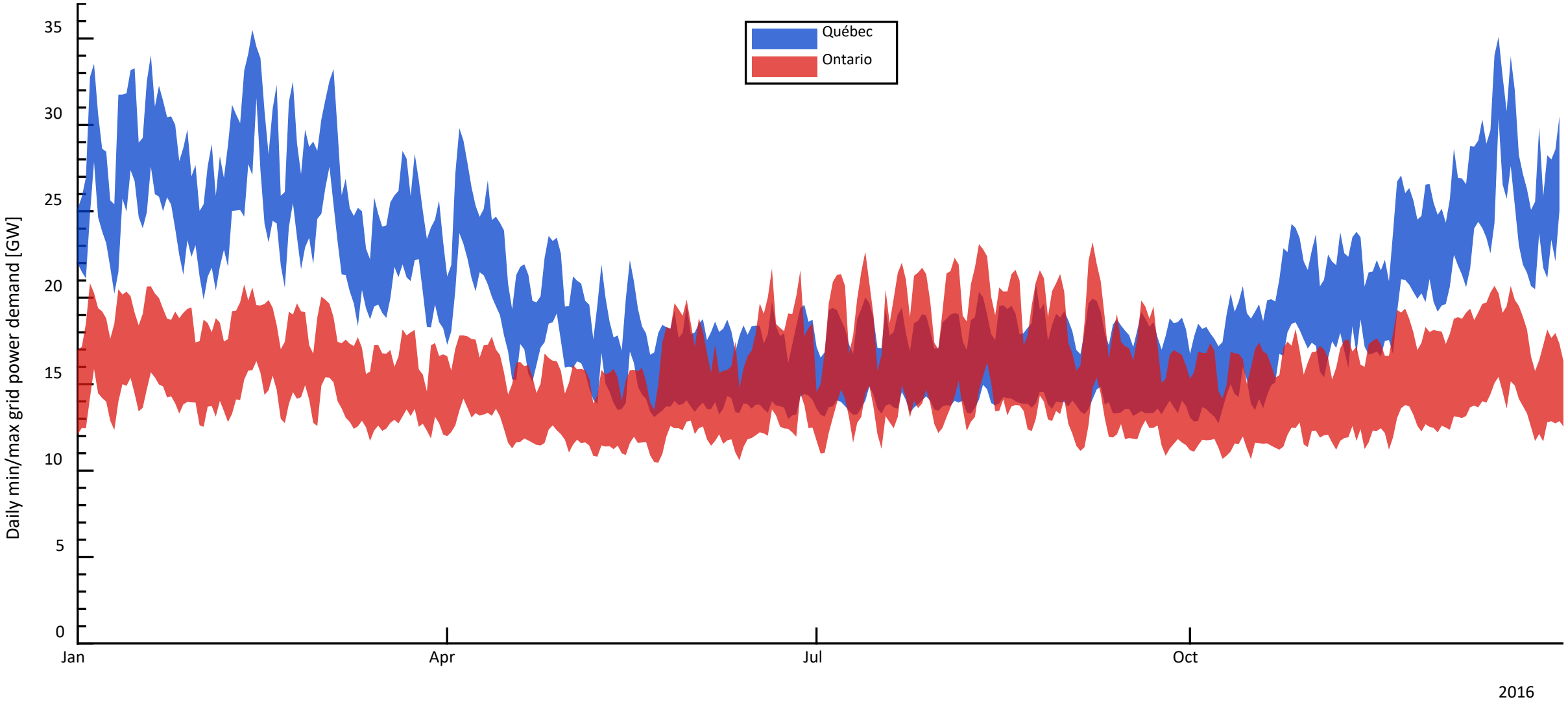
Solar and wind penetration - Ontario



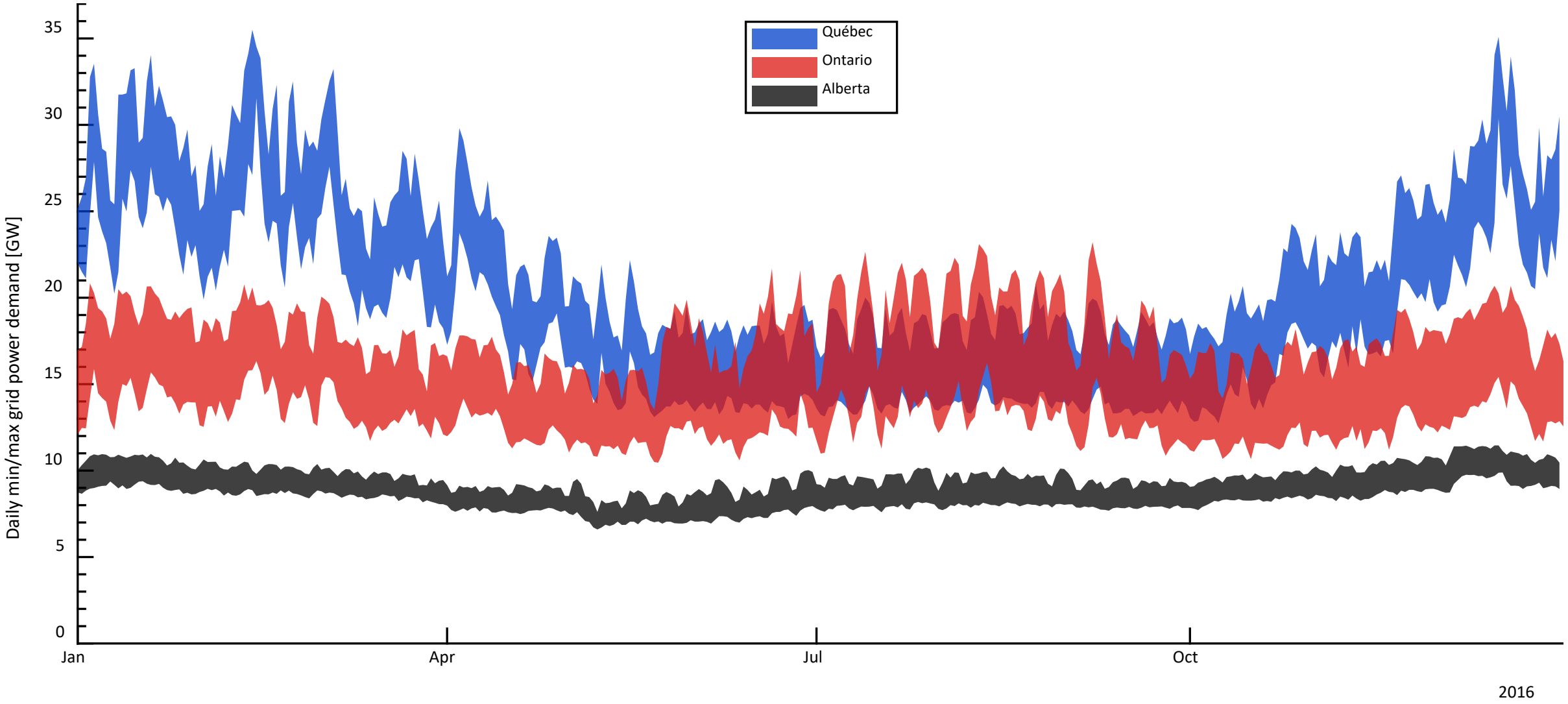
Daily power demand (min – max)



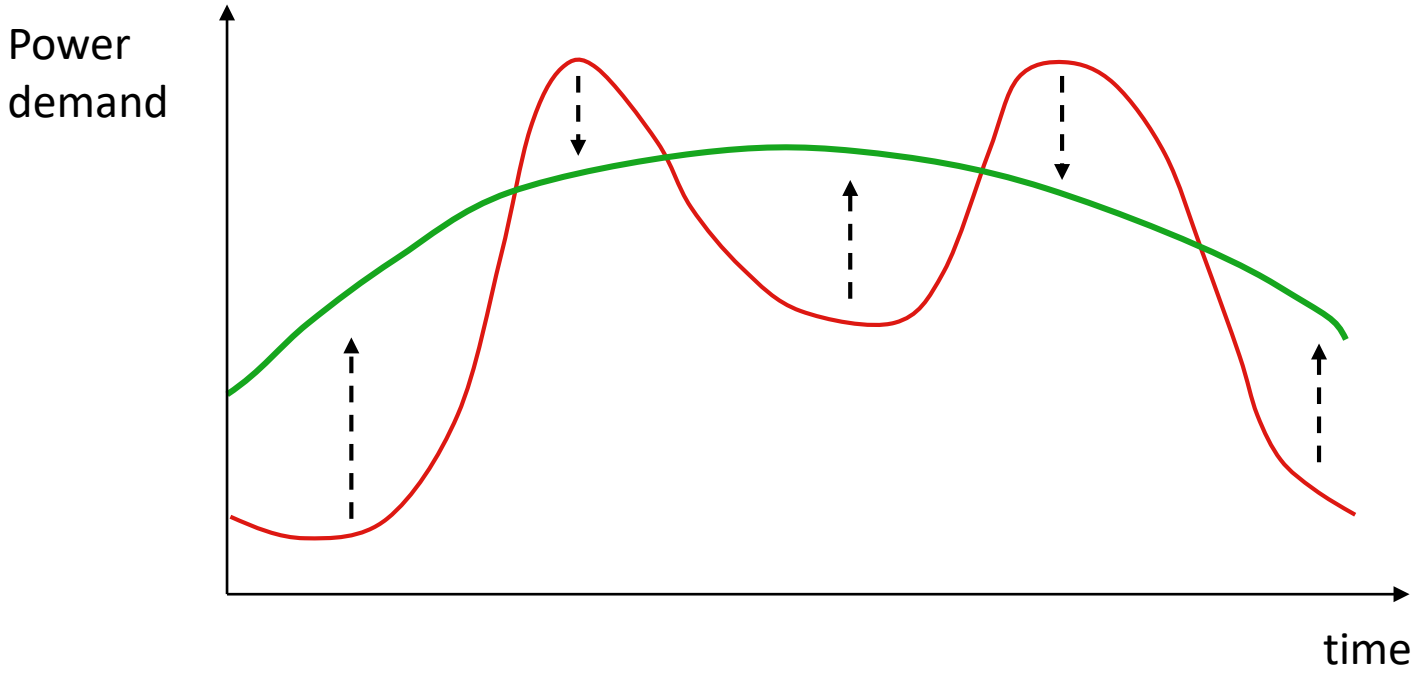
Daily power demand (min – max)



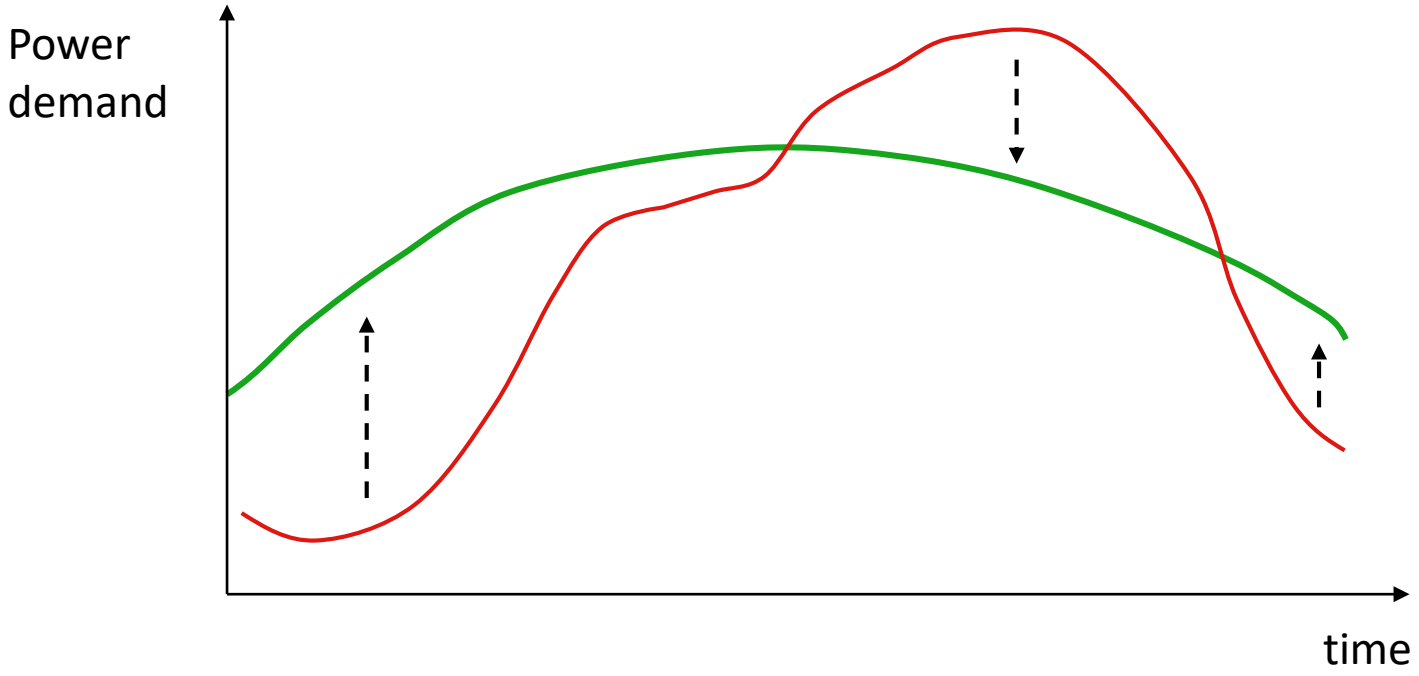
Daily power demand (min – max)



Daily profile – typical winter peak



Daily profile – typical summer peak



Flexibility programs in Canada ?

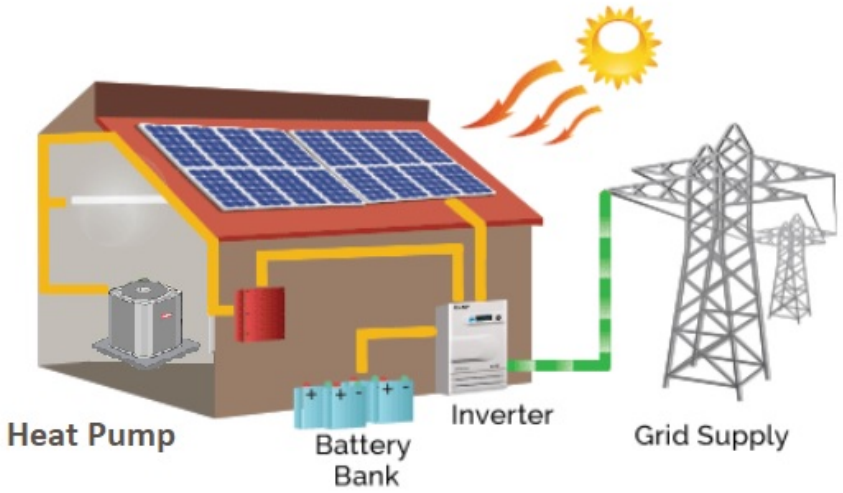
7 CAD = 4.7 EUR = 35 DKK

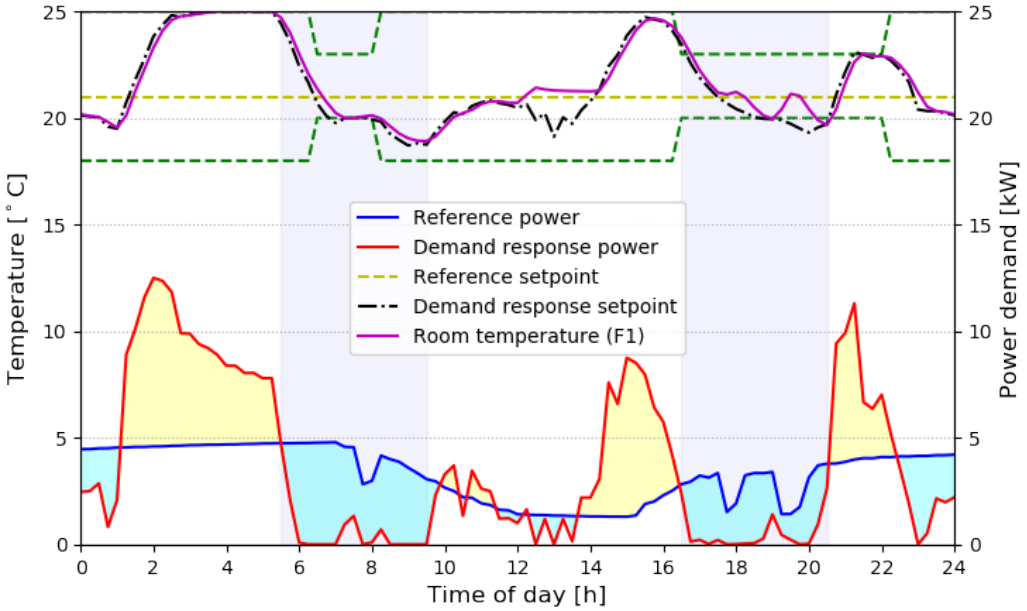
- The need is there and will be stronger with more heat pumps
- No general framework
- Some examples
  - Ontario has time of use rates for residential market (6.5 ¢/kWh to 13.2 ¢/kWh)
  - Québec residential market: flat rate, 7 ¢/kWh (but “smart” meters)
    - Voluntary “flexible” rates being planned
      - Time of day rates, or difference with a baseline
  - Québec commercial / institutional
    - Cost for energy and power
    - Incentive program uses the flexibility definition (actual – reference)
      - Value = 70 $/kW for “flexibility events”

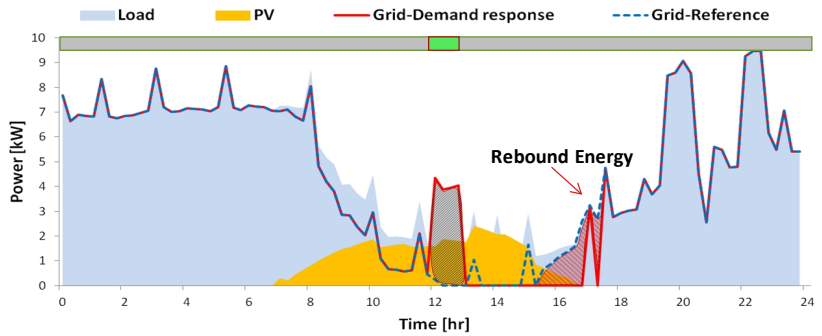
Energy flexibility examples

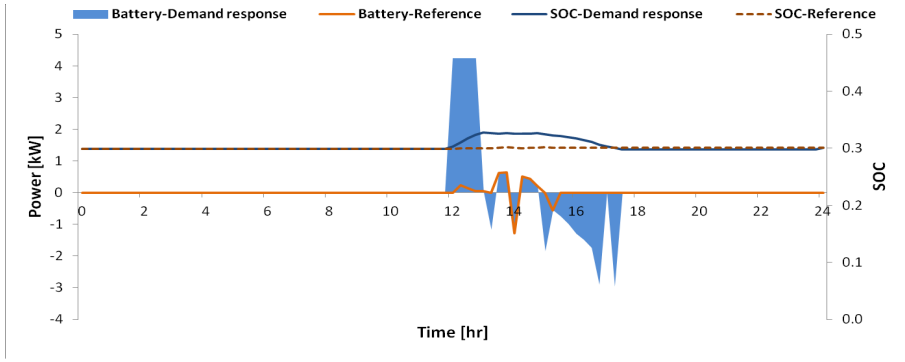
Modeling

Energy flexibility in a typical single-family house – with/without PV+battery

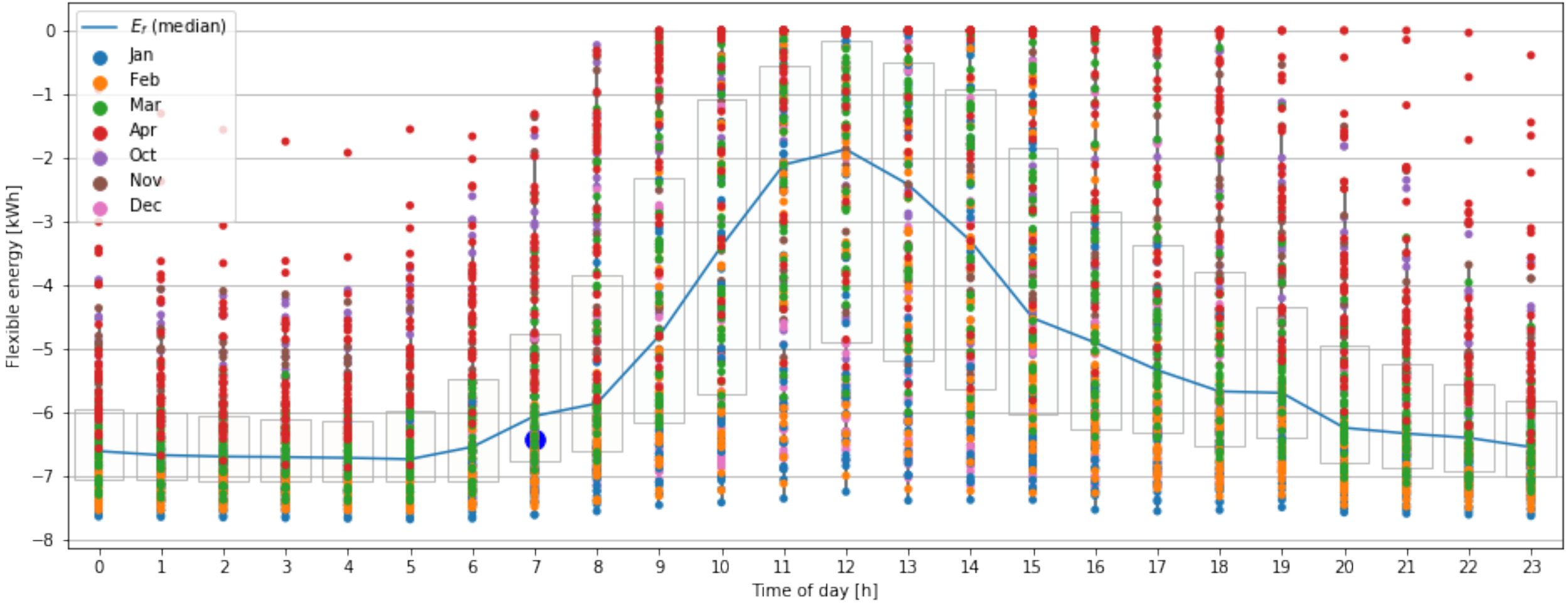








Energy flexibility is not one number

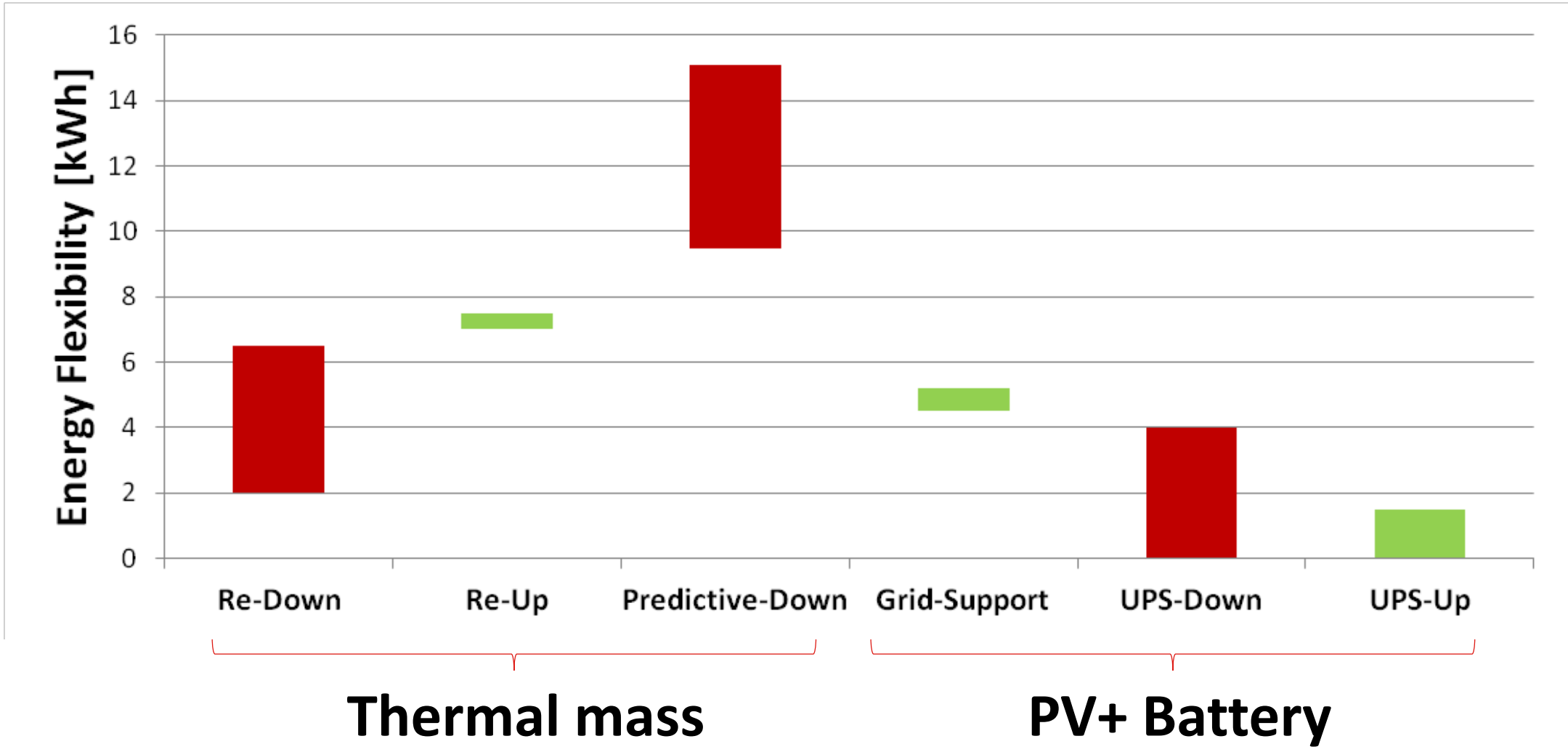


Downward flexibility – thermal mass, reactive control

Energy flexibility examples

Actual implementations

Flexible energy



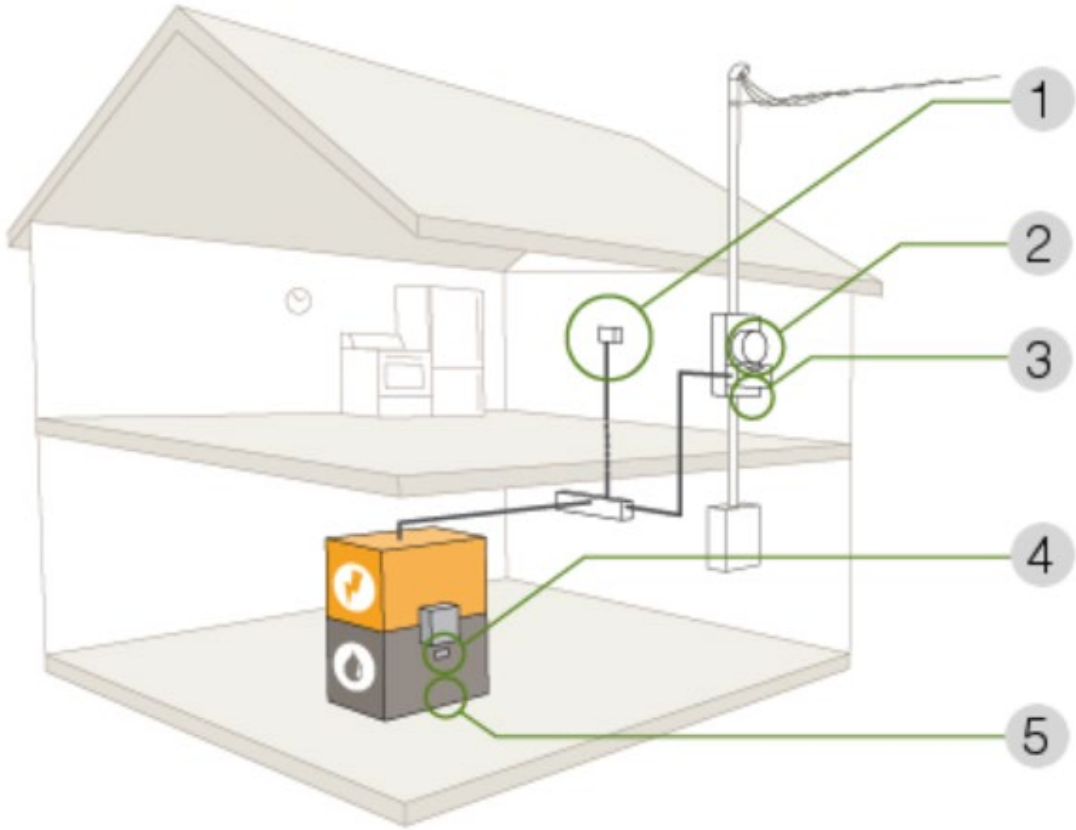
Implemented flexibility measure (QC): fuel switching (dual rate for residential)

Automatic fuel switching based on outdoor temperature

Indicator light inside the home

	> -12°C	< -12°C
Rate (¢/kWh)	4.4	25.6
Heating source	Electricity	Oil

≃ 450 CAD/year savings (2200 DKK, 300 EUR)



Pilot programs for peak shaving (QC) – “smart” thermostats

Deployed connected line-voltage thermostats in detached houses

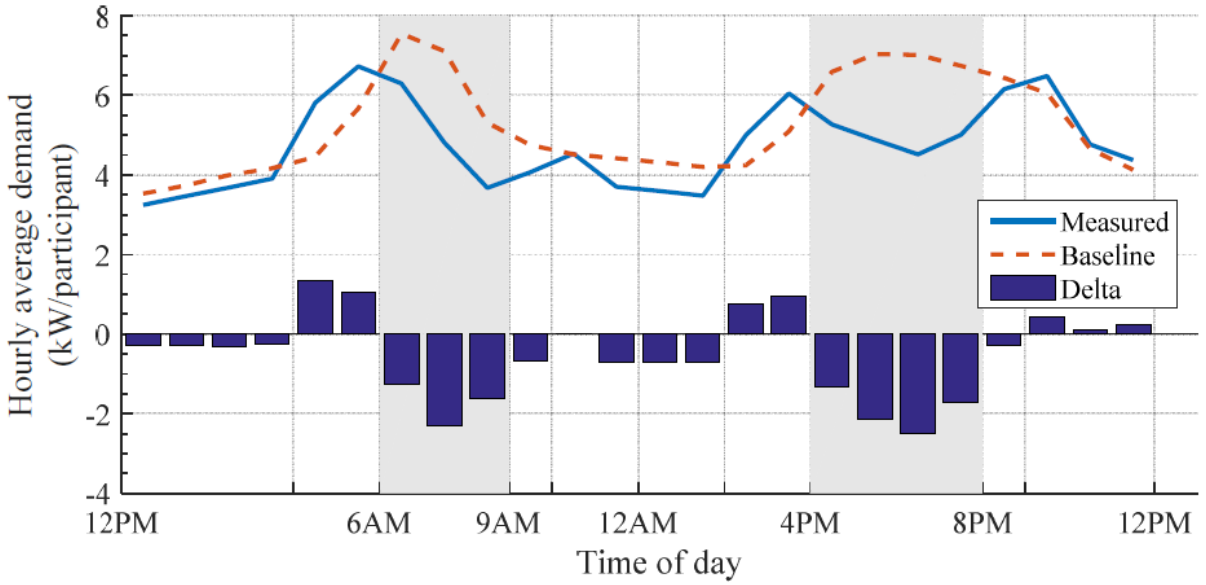
2 pilot studies (30 houses, 11 houses)

Assess:

Energy savings

Peak shaving based on Demand Respond events (downward flexibility)

Customer comfort and satisfaction



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