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GROUP

ENBRIDGE'S NAVIGATOR END-USE MODEL

Presentation for Technical Working Group
July 19, 2022

AGENDA

- How our Navigator model works and what information flows into it

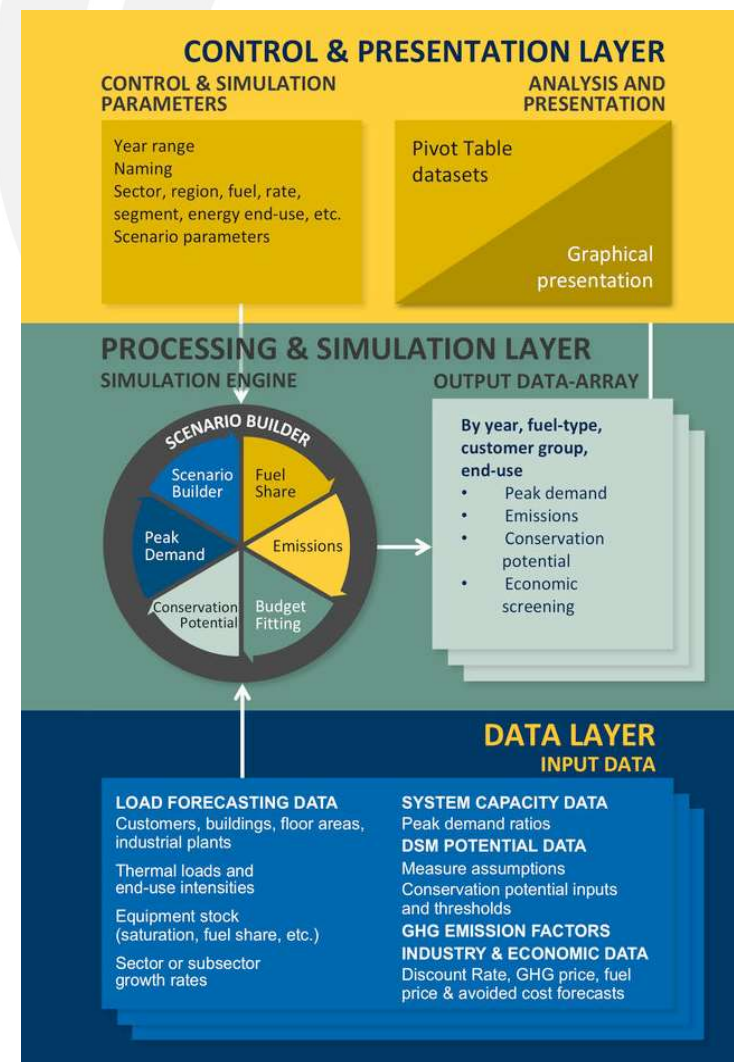


BRIEF OVERVIEW OF NAVIGATOR

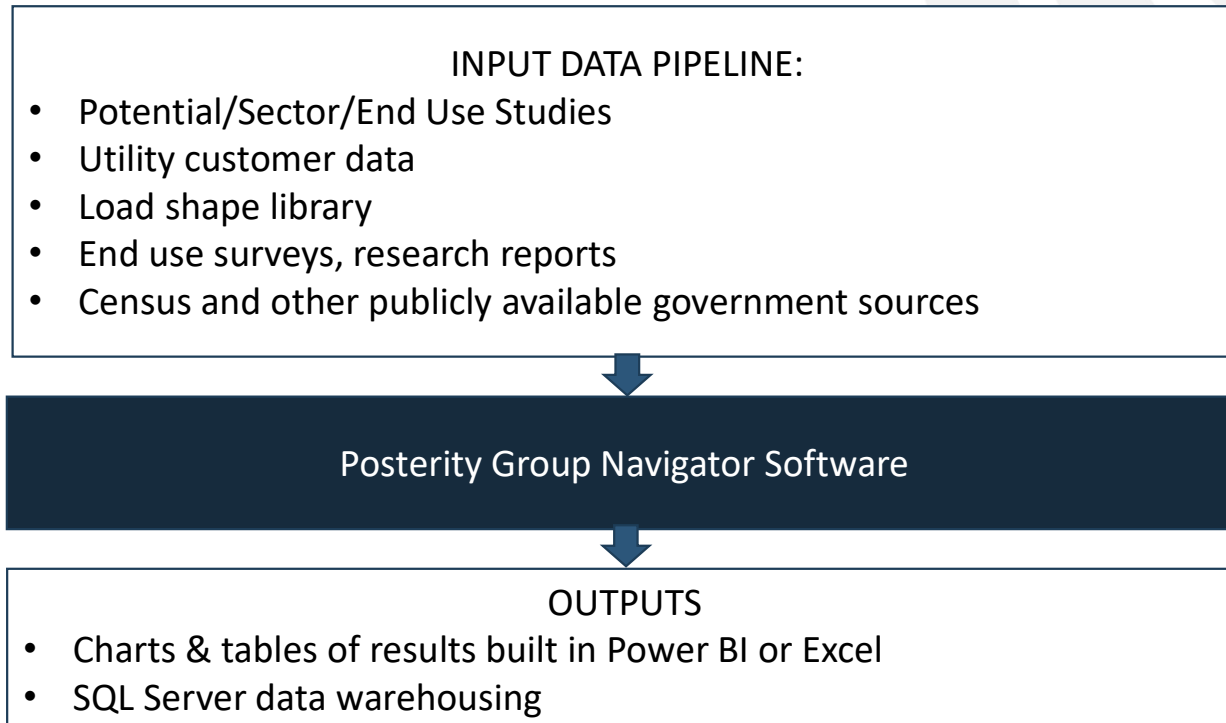
Navigator is a tool built to explore energy and emissions scenarios at an end-use level

Navigator allows our utility clients to:

- Build a bottom-up, end-use level, model
- Address several regulatory requirements (long-term resource plans, potential studies, rate applications, etc.)
- Report estimated potential down to the rate-class level.



HOW DOES NAVIGATOR WORK?





HOW DOES THE SOFTWARE WORK?

- Navigator models current and future energy consumption, energy peak demand, and emissions by year
- Inputs and estimated potential results are subdivided by region, building type, building size, fuel, rate-class, accounts, and energy end-use
- At its core, the model performs a lot of addition and multiplication
- Every calculated value is stored and can be filtered and rolled-up for maximum flexibility of analysis and presentation
- The Navigator software code facilitates faster processing, using consistent formulas, and outputs detailed, high-resolution datasets



CONSUMPTION AND HOURLY PEAK

- Consumption = Units x Saturation x Fuel Share x Unit Energy Consumption
- Hourly Peak = Consumption x Hours-use peak factor
- Hours-use peak factors are applied for each region, sector, and segment, at the end use and measure level
- Measures are applied to both consumption and hourly peak



ECONOMIC TESTS

- The following economic tests are available in Navigator:
 - TRC test
 - PAC (or UCT) test
 - RIM test
 - PCT test
- Other tests can be added in, as required

TRC TEST

$$TRC_{Ratio} = \frac{\sum_{t=1}^N \frac{PAC_t + \sum_{f=1}^{Nf} UAC_{f,t} + \sum_{r=1}^{Nr} RAC_{r,t}}{(1+d)^{t-1}}}{\sum_{t=1}^N \frac{PCN_t + PRC_t + \sum_{f=1}^{Nf} UIC_{f,t} + \sum_{r=1}^{Nr} RIC_{r,t}}{(1+d)^{t-1}}}$$

Where:

TRC_{Ratio} is the Total Resource Cost test expressed as a benefit/cost ratio

N is the expected lifetime of the measure

PAC_t is the participant avoided costs in year t (such as reduced annual maintenance costs)

Nf is the number of fuels for which the measure changes consumption

$UAC_{f,t}$ is the savings in utility avoided costs for fuel f in year t

d is the discount rate

Nr is the number of other resources (such as water) for which the measure changes consumption

$RAC_{r,t}$ is the savings in resource avoided costs for resource r in year t

PCN_t is the net participant costs in year t (such as the upfront measure implementation cost)

PRC_t is the program administrator program costs in year t

$UIC_{f,t}$ is the increase in utility avoided costs for fuel f in year t

$RIC_{r,t}$ is the increase in resource avoided costs for resource r in year t



POTENTIAL SAVINGS SCENARIOS

- Technical potential: Maximum potential savings, considering only technical feasibility.
- Economic potential: The subset of technical potential that is financially cost-effective. Cost-effectiveness is determined by screening each measure with a defined benefit/cost ratio test.
- Achievable potential: The subset of economic potential that could be achieved under various scenario constraints. Referred to as “derating factors” in this context. The achievable potential scenario used in this model is Scenario B from the APS.

POTENTIAL HOURLY PEAK SAVINGS CALCULATION

$$PeakSavings_{ES} = (BaseConsump - UpConsump) \times PeakFactor$$

Where:

PeakSavings_{EC} is the peak savings for the energy savings measure for this fuel, region, segment, existence category, and end use.

BaseConsump is the base energy consumption for the energy consumption measure for this fuel, region, segment, existence category, and end use.

UpConsump is the upgrade energy consumption for the energy consumption measure for this fuel, region, segment, existence category and end use, as specified in the Measure input file.

PeakFactor is the ratio of peak reduction to annual savings appropriate to this measure. In many cases it will be the hours-use peak factor for the end use affected, but some measures have savings with a different load shape than the underlying end use and therefore have their own factor.

POTENTIAL HOURLY PEAK SAVINGS CALCULATION

$$PeakSavings_{PR} = BasePeak - UpPeak$$

Where:

PeakSavings_{PR} is the hourly peak savings for the peak reduction measure for this fuel, region, segment, existence category, and end use

BasePeak is the base hourly peak for the peak reduction measure for this fuel, region, segment, existence category and end use

UpPeak is the upgrade hourly peak for the peak reduction measure for this fuel, region, segment, existence category and end use



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QUESTIONS & DISCUSSION

