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Request IR-1:

Reference: NS Power 2023 Load Forecast, Page 33, Lines 6-7

"The estimated number customers who installed heat pumps in 2022 was almost 20,800, or 30 percent more than forecast."

How was the estimate of 20,800 customers calculated? Please provide any references, source materials, and/or calculations supporting this calculation.

Response IR-1:

The number is based on responses to monthly contractor surveys and reporting. Please refer to Attachment 1 for details.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Heat Pumps	1088	952	1318	1399	1828	2057	2070	2082	1945	2057	2240	1747	20783
New Homes:	185	189	252	356	278	306	327	313	254	296	273	222	3251
Ducted	64	59	80	63	61	62	56	57	64	57	79	43	745
Ductess	121	130	172	293	217	244	271	256	190	239	194	179	2506
Existing Homes:	903	763	1066	1043	1550	1751	1743	1769	1691	1761	1967	1525	17532
Ducted	70	80	106	95	108	139	220	134	182	204	174	127	1639
Ductless	833	683	960	948	1442	1612	1523	1635	1509	1557	1793	1398	15893

Request IR-2:

Reference: NS Power 2023 Load Forecast, Page 36, Lines 8-14

"On average, the coefficient of performance (COP) of heat pumps modeled in the RESHAPE scenario supporting the Load Forecast declines from 400 percent at 8°C to 233 percent at -15°C. Poorer performance at cold temperatures leads to significant peak impacts relative to the annual load impacts. The capacity of heat pumps in the model is also assumed to decline as a function of COP which causes greater reliance upon backup electric resistance heating with lower efficiency during coldest hours increasing peak impacts."

(a) Please provide the COP performance curves modelled as a function of outdoor temperature. If multiple curves are considered, please include all.

(b) Please provide the heat pump capacity curves modelled as a function of outdoor temperature. If multiple curves are considered, please include all.

(c) Does the Load Forecast use heat pump performance characteristics of multiple heat pump types (i.e., ductless versus ducted)? If yes, please provide details with regard to each type of heat pump included in the Load Forecast. Please provide all assumptions for each type of heat pump included in the models. Please provide the supporting rationale for the assumptions made.

(d) Have any of the following heat pump performance characteristics changed in the 2023 Load Forecast compared to the 2022 Load Forecast? If yes, please describe the change and the rationale for the change.

- **(i) COP curves**
- **(ii) Capacity curves**
- **(iii) Outdoor air temperature cut-off point**

(e) Are all types of heat pumps used within the model/Load Forecast assumed to have the same low-temperature behaviour? If not, please describe all differences.

(f) Is any contribution from heat pumps expected below -15 °C?

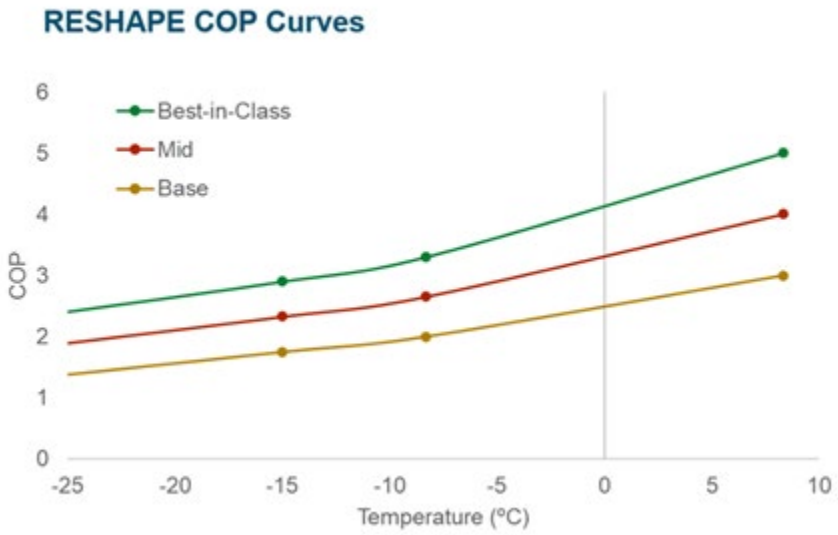
(g) Is a heat pump outdoor air temperature cut-off used in the Load Forecast? If yes, what is the cut-off temperature and how was the cut-off temperature determined for each heat pump type modelled?

(h) For each type of heat pump modelled, at what outdoor air temperature is the back-up electric resistance heating assumed to become operational?

(i) As outdoor air temperature drops and heat pump capacity drops, does the Load Forecast assume the heat pump continues to provide heat at its maximum capacity? Does the modelling assume that back-up heating provides only the incremental heat required to meet the building's heat load requirement? If not, please fully describe all differences from this description, and provide the rationale for these assumptions.

Response IR-2:

(a) For the "Current Policies and Trends" scenario used in the 2023 Load Forecast, E3 modeled a mix of 30 percent Base efficiency, 40 percent Mid efficiency and 30 percent Best in Class heat pumps. The corresponding COPs are shown in the following graph:



(b) NS Power does not have that data; it is part of E3's proprietary RESHAPE model.

(c) The E3 forecast assumes that heat pumps are ducted with electric resistance backup. An additional scenario was also modeled where existing non-electric heating systems are retained and used to reduce peak demand requirements at colder temperatures; this scenario was designated the "Hybrid Peak" and was tested as a sensitivity in NS Power's evergreen IRP process.

(d) No changes have been made compared to the 2022 forecast. The "Hybrid Peak" scenario discussed in part (c) includes changes to the assumptions regarding the heat pump type (ductless) and lockout (no temperature lockout).

(e-i) All heat pumps are assumed to be sized to meet 93-95 percent hourly demand, and E3 assumed these heat pumps "lock out" below -7° C and only the auxiliary heating source (electric resistance) serves the load below these temperatures.

Request IR-3:

Reference: NS Power 2023 Load Forecast, Page 36, Figure 23

Please provide a version of Figure 23 that includes every year of the load forecast (2023-2033).

Response IR-3:

Please refer to Synapse IR-7 Attachment 1 for the annual data from the NS Power models. Residential energy data is included on the "Residential" tab in column D, commercial energy data is included on the "General Demand" tab in column D, and the combined peak data is included on the "Combined Peak" tab in column E. E3 data is only provided in 5 year increments.

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Request IR-4:

Reference: NS Power 2023 Load Forecast, Page 40, Lines 7-8

"The peak impact assumes that 70 percent of charging is managed by NS Power (including smoothing through vehicle-to-grid integration) and 30 percent of charging is unmanaged."

(a) Please provide the rationale for these levels of managed electric vehicle (EV) charging assumptions. What jurisdictions, research, or surveys were considered that suggest this may be an achievable level of managed charging? Please provide complete references and citations.

(b) Does NS Power anticipate the growth and development of ratepayer funded EV adoption programs in the future? Please provide details of all such assumptions related to both growth and development.

Response IR-4:

(a) Please refer to Synapse IR-9 part (f).

(b) The load forecast does not anticipate ratepayer-funded EV adoption programs.

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Request IR-5:

Reference: NS Power 2023 Load Forecast, Page 40, Lines 13-17

"The management of charging in this scenario was based on minimizing the cost of electricity to charge with the electric rates referenced being the existing time of use tariffs that are currently in the pilot stage, coupled with vehicle-to-grid integration to smooth large spikes in charging that would occur during switches from peak to off-peak period."

Do the EV managed charging assumptions used in the Load Forecast assume that all managed EVs will utilize both a time-varying pricing rate structure and utility direct load control of the EV? If no, please provide detail as to the assumptions included.

Response IR-5:

Yes, the assumptions assume that the managed EVs use both.

Request IR-6:

Reference: NS Power 2023 Load Forecast, Page 45, Figure 31

Please provide a version of Figure 31 that breaks out total new installs, load (GWh) and peak (MW) by residential and non-residential projects.

Response IR-6:

Please refer to Synapse IR-10 Attachment 1.

Request IR-7:

Reference: M10872. Commercial Net Metering. NS Power Closing Submission. Page 10, Lines 16-18.

"Following legislative amendments in April 2022, the consideration of net metering applications for installations over 27 kW was paused until the approval and subsequent implementation of this Commercial Net Metering Program."

EfficiencyOne is interested in how these recent changes to commercial net metering are impacting the solar photovoltaic (PV) included in NS Power's 2023 Load Forecast.

(a) In the 2023 Load Forecast, describe in detail how NS Power has accounted for the bottleneck of commercial solar net metering projects that have been on hold pending the new Commercial Net Metering Program?

(b) Please provide the estimated number of commercial net metering projects, together with the total capacity, that have been paused pending implementation of the Commercial Net Metering Program.

(c) Describe how NS Power has incorporated the new Commercial Net Metering Program, which is required to include projects up to 1 MW in capacity, into the 2023 Load Forecast.

Response IR-7:

(a) Historically, interest in projects greater than 27 kW represented less than 2 percent of total net metering participation with a program capacity limit of 100 kW. Understanding the expanded capacity limit of up to 1 MW under the Commercial Net Metering (CNM) program will increase interest, NS Power anticipates projects greater than 27 kW will grow

to approximately 10 percent of participation. The absence of an available program since April 2022 for projects greater than 27 kW will have a short-term impact on the volume of applications in 2023 with project timelines likely spread across 2023/2024 and beyond.

(b) NS Power does not have visibility into projects that may be awaiting the implementation of the CNM program.

(c) Please refer to part (a). NS Power anticipates projects greater than 27 kW up to 1 MW participating under the proposed Commercial Net Metering program will represent approximately 10 percent of new Net Metering installations with the availability of the program. This is an estimated increase of 8 percent from historical participation.