# 2020 INTEGRATED RESOURCE PLAN (IRP): DRAFT ASSUMPTIONS ADDENDUM/UPDATE

FEBRUARY 3, 2020

Nova Scotia POWER
An Emera Company

# INTRODUCTION

- The following materials represent a preliminary working draft of the Input Assumptions to be used in the 2020 IRP Modeling.

- These Draft Input Assumptions are being brought forward for discussion with stakeholders.

- The details of these assumptions will continue to be further refined as the IRP team addresses stakeholder feedback and reviews emerging information.

The final view of the Input Assumptions to be used in the 2020 IRP model will be circulated to stakeholders on March 5, 2020, following discussion and refinement.

# SUPPLY SIDE OPTIONS OVERVIEW

- The original draft assumptions for the costs of new bulk grid scale resources (capital costs and fixed and variable operating costs) were based on the E3 Resource Options Study from the Pre-IRP Deliverables.
- Since the Pre-IRP Work was completed, several of the public sources for pricing assumptions have released late 2019 datasets. The following slides are reflect these updated data sources and subsequent pricing.
- The review of updated 2019 public sources for cost estimates lowered the "base case" resource costs for most new renewables and storage. However, the public source estimates for new wind remain higher than NS Power's original proposed assumption. Stakeholder comments to date have indicated that NSP's estimate may not be as low as expected; we remain open to receiving information from other sources that stakeholders may have.
- The following slides summarize the "base case" prices from the updated Pre-IRP work. The full report also includes "Low" price sensitivities to be tested.
- The assumptions for the cost of new distributed resources are in the following section.

Energy+Environmental Economics

# NSPI Resource Options Study
## 2020 Updates

Nova Scotia Power

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# Summary of Proposed Assumptions
## Capital Costs (1 of 2) – Renewables and Storage

| Technology | Subtechnology | Capital Cost (2019 CAD $/kW) | | |
|---|---|---|---|---|
| | | 2019 | 2030 | % Change |
| **Wind** | Onshore | $2,100 | $1,691 | -19% |
| | Offshore | $4,726 | $3,429 | -27% |
| **Solar PV**[a] | Tracking | $1,800 | $1,416 | -21% |
| **Biomass** | Grate | $5,300 | $5,146 | -3% |
| | Municipal Solid Waste | $8,470 | $8,470 | 0% |
| **Tidal** | n/a | $10,000 | $10,000 | 0% |
| **Storage** | Li-Ion Battery (1 hr) | $764 | $385 | -50% |
| | Li-Ion Battery (4 hr) | $2,125 | $1,071 | -50% |
| | Compressed air | $2,200 | $2,200 | 0% |
| | Pumped Storage | $2,700 | $2,700 | 0% |

[a] Solar PV costs reported in $/kW-ac, reflecting an inverter loading ratio of 1.3

# Summary of Proposed Assumptions
## Capital Costs (2 of 2) – Fossil and Nuclear

| Technology | Subtechnology | Capital Cost (2019 CAD $/kW) | | |
|---|---|---|---|---|
| | | 2019 | 2030 | % Change |
| **Coal** | Coal-to-gas conversion (102 – 320 MW) | $127 – 237 | $127 – 237 | 0% |
| **Natural Gas** | Combined Cycle (145 MW) | $1,688 | $1,574 | -7% |
| | Combined Cycle w/ carbon capture and storage (145 MW) | $3,376 | $2,987 | -12% |
| | Combustion Turbine – Frame (50 MW) | $1,080 | $1,004 | -7% |
| | Combustion Turbine – Aero (50 MW) | $1,755 | $1,632 | -7% |
| | Reciprocating Engine (50 MW) | $1,823 | $1,823 | 0% |
| **Nuclear** | Small modular reactor (100 MW) | $9,196 | $8,641 | -6% |

# Summary of Proposed Assumptions

## Operating Costs – All Technologies

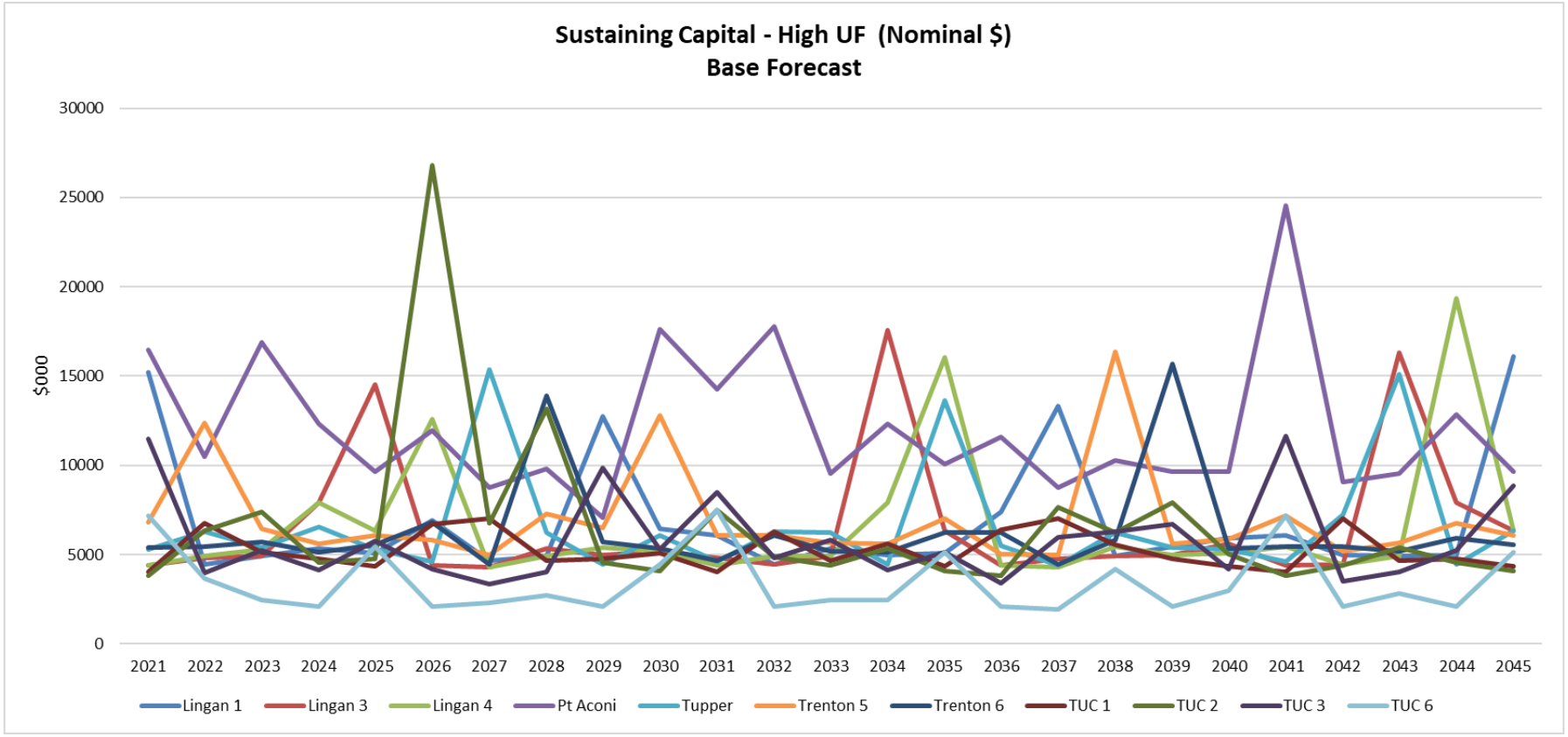
| Technology | Subtechnology | Operating Cost | |
|---|---|---|---|
| | | Fixed O&M ($/kW-yr) | Variable O&M ($/MWh) |
| **Wind** | Onshore | $59 | $0 |
| | Offshore | $165 | $0 |
| **Solar PV** | Tracking | $18 | $0 |
| **Biomass** | Grate | $155 | $7 |
| | Municipal Solid Waste | $162 | $0 |
| **Tidal** | n/a | $338 | $0 |
| **Storage** | Li-Ion Battery (1 hr) | $8 | $0 |
| | Li-Ion Battery (4 hr) | $27 | $0 |
| | Compressed air | $20 | $0 |
| | Pumped Storage | $32 | $0 |
| **Coal** | Coal-to-gas conversion | $37-$45 | $1 |
| | Coal-to-biomass conversion | $152 | $7 |
| **Natural Gas** | Combined Cycle | $15 | $3 |
| | Combustion Turbine - Frame | $17 | $7 |
| | Combustion Turbine - Aero | $17 | $7 |
| | Reciprocating Engine | $27 | $9 |
| **Nuclear** | Small modular reactor | $140 | $0 |

All O&M costs assumed to escalate at 2% per year.

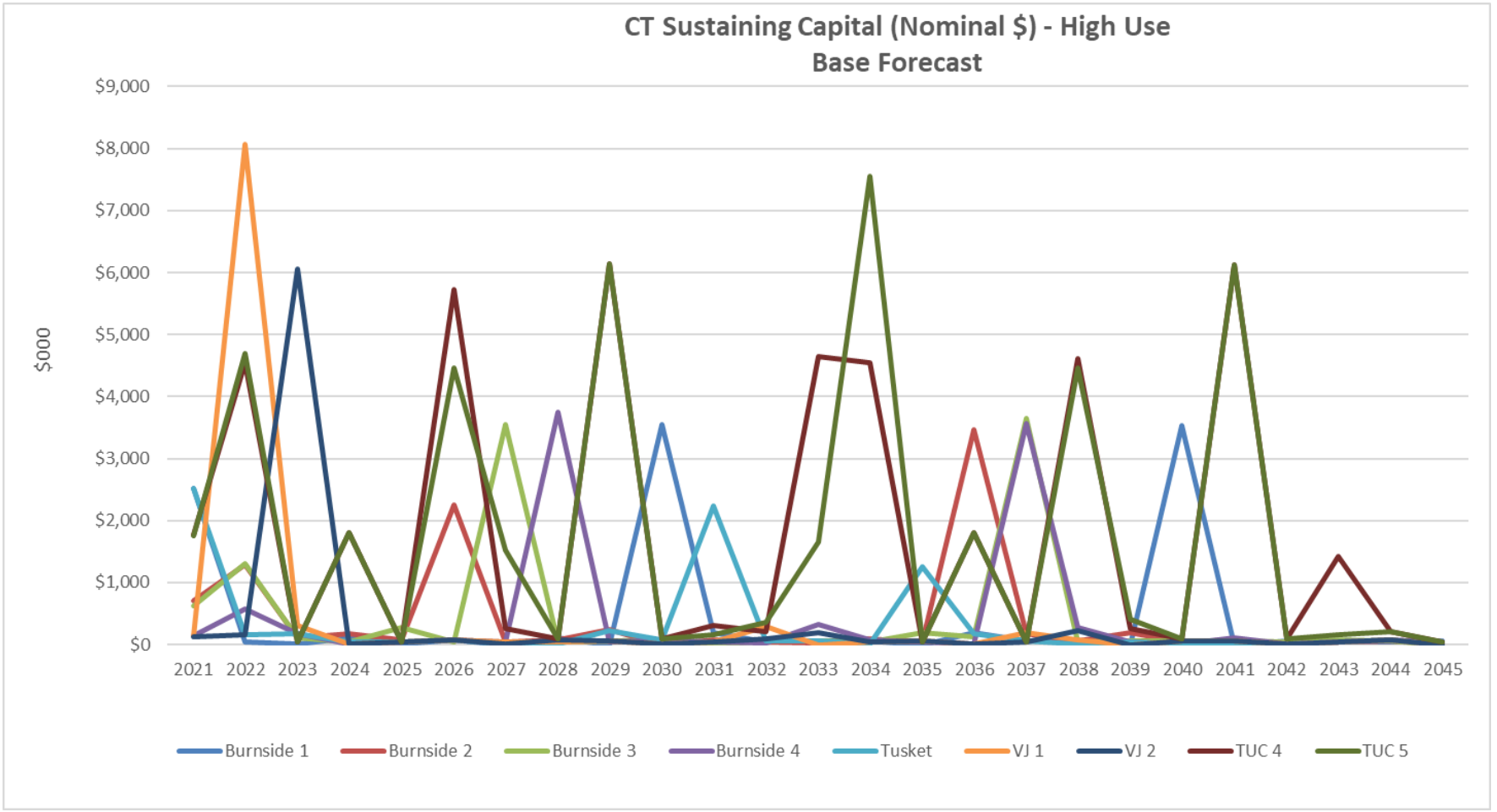
# FUNDAMENTAL PRICE FORECASTS

| Commodity | Pricing Point | Provider | Updated |
|---|---|---|---|
| Solid Fuel | API 2 | Allegro | Q4 2019 |
| | API 4 | | |
| | Northern Appalachian (NAPP) | | |
| | Domestic Coal | NSP Contract Pricing, escalated for period beyond contract term. | Q4 2019 |

# SUSTAINING CAPITAL FORECAST – THERMAL (BASE)

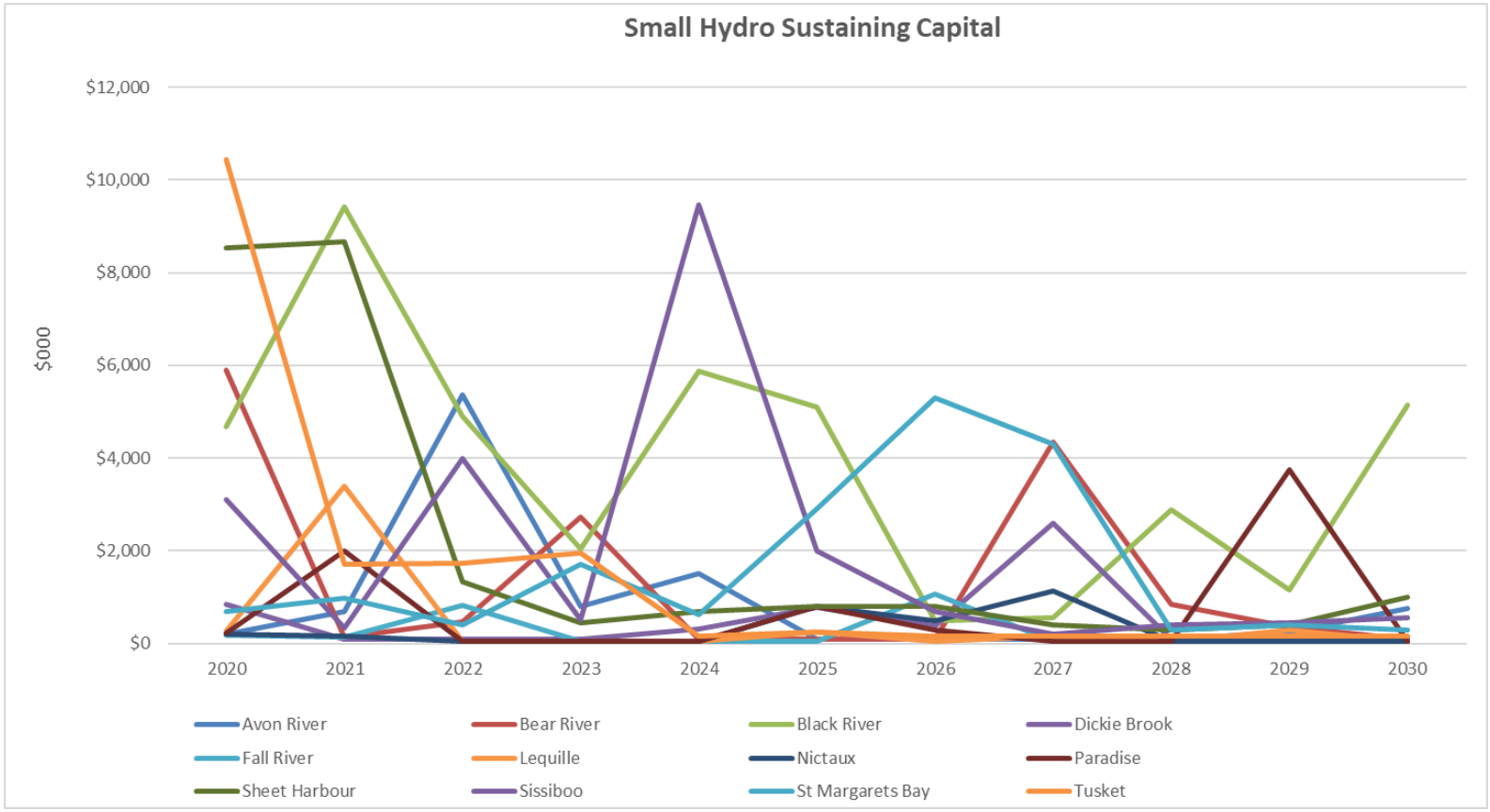


# SUSTAINING CAPITAL FORECAST – CTs



# SUSTAINING CAPITAL FORECAST – SMALL HYDRO

- The sustaining capital forecast for hydro assets are based on Q1 2020 Forecast (an update of the Hydro Asset Study).



# INTERCONNECTION COSTS

- Integration costs, such as the construction of synchronous condensers or other transmission system stability requirements, will be modeled at a high level based on the minimum services constraints discussed in the previous slides (e.g. a resource plan with X MW of wind will require X MW of grid technology investments to provide grid services, if the combination of other resources in the plan cannot provide sufficient levels).
- Transmission interconnection costs, which are the cost to connect a resource to the grid to deliver energy/capacity, can vary significantly depending on the location of new generation and/or storage resources.
- Estimating interconnection costs based on presumed locations may not accurately reflect the cost of potential projects. As the IRP provides directional insight on the long-term resource strategy, and not decisions on specific projects, presuming a location does not provide particular value to informing the long-term strategy (and it could over or underestimate the project specific interconnection costs required).
- NSP is proposing that should resources be identified as preferable through the analysis, further detailed work can be conducted to estimate the value of various location options.