IESO OPO and External Cost Estimates for Wind, Solar PV, Natural Gas and Nuclear

IESO OPO and Modules		
Technology	**New Build Cost**	**Repowering Cost**
Wind	**IESO OPO:** Current cost of new build wind is $65-210/MWh.	**IESO OPO Module 7:** Indicates that re-contracted generators are expected to operate at lower cost than the current contracted rates, as a result of lower capital cost requirements. **IESO OPO Module 7:** Indicates the cost of repowering solar is consistent with the LRP I low weighted price inflated to the year of contract expiry (ie. LRP I low weighted price: $64.5/MWh).
Solar	**IESO OPO Module 4:** Cost of new build utility-scale solar PV projected is $90-130/MWh by 2035. **IESO OPO:** Current cost of new build utility-scale solar PV is $140-290/MWh.	**IESO OPO Module 7:** Indicates that re-contracted generators are expected to operate at lower cost than the current contracted rates, as a result of lower capital cost requirements. **IESO OPO Module 7:** Indicates the cost of repowering solar is consistent with the LRP I low weighted price inflated to the year of contract expiry (ie. LRP I low weighted price: $141.5/MWh).
Natural Gas	**IESO OPO:** Current cost of new build Natural Gas is $80-310/MWh.	**IESO OPO Module 7:** Indicates Combined and Single Cycle Gas Turbine (CCGT/SCGT) repowering costs reflect all original contract price components with only 20% of the capital cost portion.
Nuclear	**IESO OPO:** Current cost of traditional new build nuclear is $120-290/MWh.	**IESO OPO Module 4:** Current cost of refurbishing nuclear reactors is $80/MWh.

General Comments	• As the above technologies, excepting solar PV, are relatively mature costs can be expected to decrease moderately (ie. in the case of wind) or to increase due to inflation (ie. nuclear and natural gas). • IESO projects a cost of solar for 2035 that reflects continued assumed cost decreases into the future (ie. $90/MWh by 2035).

External Sources – Bloomberg New Energy Finance and National Renewable Energy Laboratory		
Technology	**New Build Cost**	**Repowering Cost**
Wind	**Bloomberg New Energy Finance – 2030 Market Outlook (Wind):** Onshore wind USD$53-74/MWh by 2030 (CAD$70-98/MWh)	**National Renewable Energy Laboratory – Wind Power Project Repowering**: The NREL assumes that capital costs to repower a wind project will be 95% of new build capital costs on a $/kW basis for 2020-2030. The net capacity factor is assumed to be the same for a full repowering project vs. greenfield. Accordingly, a range of CAD$66-93/MWh is assumed based on NREL assumptions and the BNEF wind price forecast.
Solar	**Bloomberg New Energy Finance – 2030 Market Outlook (Solar):** Utility-scale Solar PV USD$63-84/MWh by 2030 (CAD$83-111/MWh)	It is anticipated that utility scale solar will require maintenance and equipment replacement, including modules, and inverter replacement between years 10-15 of operation. As such, repowering capital costs are expected to be considerably less than new build capital costs at contract expiry. Efficiency is expected to be ~80% of that of a new build project at contract expiry (20 years).