2017 Price Review Questionnaire

July 08, 2016

1. Introduction

The IESO is undertaking the annual review of FIT and microFIT prices. The IESO is required to regularly review the prices offered to generators under these programs to ensure both ratepayer value and a reasonable return on investment. As part of the current price review, the IESO will focus on ensuring ratepayer value, with consideration of global renewable generation cost trends, prior FIT application volumes, and associated FIT price reductions.

Feedback from program participants, industry associations, municipalities, Indigenous communities and other interested parties is being sought through this questionnaire to support the IESO's price review. The deadline for responses is **July 28, 2016.** Please email your completed questionnaire to FIT@ieso.ca, indicating **"2017 Price Review"** in the subject line. Should you desire that a particular answer, or the entire submission, remain confidential, please mark it "Confidential." Please note that all submissions not marked Confidential, as well as those from industry associations and public entities, will be posted to the FIT website.

2. Questions

In providing your responses, please specify the renewable fuel/technology/size to which the feedback relates. Except where specifically noted for comparison to other jurisdictions, please consider the questions in the context of project development and operation in Ontario.

Economic and financial considerations

1. How have the costs of capital (both debt and equity) that are required to develop a renewable energy generation project changed over the past year? Debt and equity costs have not changed in the past year.
    a. How do these costs vary with technology and project size? High quality projects – projects that use bankable equipment with a good quality track record and strong warranties, and that are built by reputable contractors – tend to get cheaper debt and equity. However, such equipment and contractors tend to be more expensive. In general, you CANNOT get the lowest price of debt and equity on a project that is built with the cheapest equipment and labour – there is

a balance required to get the most economically viable project that meets investor return requirements and is a quality project that will last for 20 years.

b. Describe and quantify any anticipated economic and financing trends that may substantially affect these costs. We anticipate that in the next three years that interest rates will be headed higher. We do not expect that the current low-interest rate environment is sustainable.

2. Do the current FIT prices allow a renewable energy developer to earn a reasonable rate of return? If no, please describe recommended adjustments and provide supporting evidence. The significant reduction in FIT prices for FIT 4 and LRP I have rendered a lot of potential projects un-economic. For instance, we do not believe that FIT 4 prices supported building any commercial-scale rooftop installations (all of our projects were ground projects). There is very little room for error in these projects under the FIT 4 pricing regimen as well – any site that requires anything more than a simple connection or that has suboptimal geotechnical characteristics will not be built.

   a. What is considered a range of "acceptable" rates of return on equity for a renewable generation contract in Ontario's current financial market? Please provide an explanation for your answer, including worked calculations where possible. 10% levered equity returns are required for projects/portfolios of sufficiently large size and quality. For smaller projects/portfolios, and for projects/portfolios built with the cheapest equipment and labour and with weak warranties, the expected equity returns will be higher (and debt will be correspondingly more expensive).

   b. The high application volumes and the fact that 52 percent of successful FIT 4 applicants applied for price reduction priority points could be interpreted as indicative of proponents having the ability to realize returns despite lower FIT prices. In what areas, if any, have proponents been able to cut costs in order to further reduce prices and realize acceptable returns? Our analysis is that those projects operating under a price reduction are going to be very difficult to finance and build at an acceptable level of quality. We believe that the developers applying for priority points are hoping for an as-yet unforeseen technological advance or are expecting the equipment price reductions of the past 5 years to continue unabated, and have not done the requisite analysis to understand the available economics for the next few years. We suspect that a lot of the FIT 4 and LRP I projects are going to be stranded.

3. In consideration of the current FIT prices, the significant interest in FIT 4 price reduction priority points and the contract price ranges of the recently executed Large Renewable Procurement contracts[1], what prices would you recommend for 2017 (in $/kWh) for each technology and size tranche and why? Provide/attach justifications for differences between your recommended prices and global pricing levels. We would not recommend any price reduction below the current FIT 4 price levels.

    a. For solar PV: The cost of solar continues to decline dramatically. Recent procurements in other jurisdictions have seen prices for solar PV as low as US$0.0299/kWh.[2] Solar LRP I Contracts averaged $0.1567/kWh. Costs are expected to continue to decline in the near future, with declines from 2005–2020 expected to exceed 35%.[3] Assuming Ontario follows this trend, FIT solar prices should continue to be reduced. Is this a reasonable conclusion? If not, please provide an explanation for your answer, including worked calculations where possible. There are a lot of differences when comparing project costs in Ontario vs project costs in other jurisdictions such as the Arabian desert (and therefore the contract pricing required to achieve required economic returns). The following makes it more expensive to build projects in Ontario. (1) Cost of labour is much higher here and the labour is less productive compared to jurisdictions such as USA and Germany. (2) Permitting is more extensive and required on much smaller projects, resulting in both more permitting costs and longer timelines to construct the projects. Major permitting costs include ESA, building permits and environmental assessments. (3) Connection costs are high and increasing. In particular, HONI's connection costs for smaller projects are unreasonable. (4) Many LDCs have onerous SCADA requirements and in some instances they don't even use the SCADA systems that they require we install (e.g., Toronto Hydro). (5) The Canadian dollar has dropped dramatically in the past year, which drives up the cost of equipment, which are priced internationally. There has been no reduction in equipment costs in Canadian dollars in the past year. (6) It is difficult to build during the winter, which causes longer construction timelines and increased cost of labour and cost of capital. (7) Solar resource (insolation) is not as plentiful as in many jurisdictions closer to the equator.

[1] www.ieso.ca/lrp
[2] http://cleantechnica.com/2016/05/02/lowest-solar-price-dubai-800-mw-solar-project/
[3] On the Path to Sunshot, The Role of Advancements in Solar Photovoltaic Efficiency, Reliability, and Costs, May 2016, NREL/TP-6A20-65872

Project development costs

4. The IESO is seeking submissions that include specific cost data with respect to capital costs, operational costs, capacity factors, project financing information (e.g., cost of project and construction financing, debt terms, debt service coverage ratio requirements) and other costs and factors that influence the levelized cost of electricity for the various technologies and size tranches in the FIT and microFIT programs. Please include any data tables or Excel spreadsheets, as necessary.

    a. Please identify any cost categories that differ significantly between Ontario and other jurisdictions, and explain such differences. What are the main reasons, if any, for these differences? Will these differentials remain constant or are changes/reductions foreseen? Please comment, if possible, on each of project development, permitting, equipment, construction, operation and maintenance. See answer to question 3a above.

5. Are there any recent technologies or process improvements that have affected costs or may affect costs in the future? If so, please describe.

    a. For solar PV: What are the highest wattage panels available in Ontario at this time? What are the highest wattage panels expected to be installed in 2017, 2018 and 2019, respectively? 345W for 72 cell panels in 2017. Beyond this it is difficult to forecast, however we anticipate that the power density will not increase at the same rate as in previous years because the technology is maturing.

    b. For solar PV: How prevalent is the use of microinverters, string inverters or power adaptors on commercial-scale rooftop systems? Are there any software solutions that further reduce system losses? Are there other innovations that are being used/considered to further optimize solar PV installations? We do not make use of power adaptors or microinverters for rooftops. We see these as niche technologies that are expensive and useful primarily in situations where there is plenty of shading and other constraints on the site (i.e., sites that are difficult to build on in the first place). We do make use of string inverters, but there is a tradeoff between flexibility that these configurations provide and the increased number of parts that can fail (inverters, breakers, fans, etc.). We believe that a reasonable size for string inverters (for systems less than 1MW) is approximately 20kW – 50kW.

    c. For solar PV: Local distribution companies have identified voltage control as one of the bigger issues limiting the increased deployment of distributed solar

generation.[4] The use of so-called "advanced" inverters may mitigate some of these issues. Are "advanced" inverters being used in Ontario? What are the costs relative to traditional inverters?

d. For solar PV: Has the trend to racking standardization accelerated or remained stagnant over the past two to three years? What is now the dominant racking type?

e. For solar PV: Please comment on the additional upfront and ongoing costs of integrating storage into a system and the corresponding benefits of doing so. How are the costs expected to decline by 2019?

6. What is the range of typical connection costs for LDCs across Ontario for each of FIT and microFIT (excluding equipment or system upgrades that are unique to a specific project)? For sites that are between 100kW and 500kW, we see a wide range of connection costs. CIA costs run between $3,000 and $10,000 depending on the LDC. Connection costs run between $3,000 and $30,000 if no line extension or LDC equipment upgrades are needed. Finally, SCADA is often required by the LDCs, which adds an extra $10,000 to $20,000 to project costs. Note that these costs are fixed and do not scale up or down with project size. HONI's costs are very high – there is no CCA for HONI that costs less than $15,000 (and it is often twice that), which is unreasonable, and they typically always require SCADA, which is overkill for smaller systems.

   a. In terms of project interconnection costs, what variance, if any, has been observed for actual costs incurred versus estimates (both initial developer design estimates and those provided by the LDC during early project development)? Have there been any noticeable changes in LDC estimate/actual variances since the inception of the FIT and microFIT programs? Connection cost estimates provided by the LDCs as part of the CIA process are usually never underestimated. In some situations, we have seen the estimates be approximately 50% higher than actual. This is usually on projects with very high connection cost estimates. Note that this is better than an underestimated connection cost with a surprise upside.

   b. What are the expected cost savings associated with the re-acceptance of in-series metering in both FIT and microFIT?

[4] On the Path to Sunshot, Emerging Issues and Challenges in Integrating Solar with the Distribution System, May 2016, NREL/TP-5D00-65331 SAND2016-2524 R

7. Identify the project development/construction costs anticipated to have the greatest potential for reductions/improvements in the near-term (e.g., 6–12 months) and long-term (e.g., 1–5 years)? Are there specific cost groups that are expected to increase? If yes, what are the drivers of these increases?

8. For solar PV: During last year's price review survey, there was no conclusive support for changing the maximum FIT DC/AC overbuild ratio. Is this still the case? If a change is desired, please provide information about the additional generation that can be achieved by building projects that exceed the 120% limit. How should an increased overbuild limit impact the price? If there were no overbuild limit, what would be the ideal overbuild ratio? What would be the percentage increase in generation for this ratio instead of 120%? There is no ideal overbuild ratio since the amount of overbuild that is optimal for a site depends on a lot of factors that are site-specific and technology-specific. We believe that 20% is limiting to the economics that can be achieved on these projects, and that a maximum in the range of 30% - 50% will make more projects economic to build.

Ongoing project costs and performance

9. How have ongoing operation and maintenance costs for existing facilities been tracking over the past year? Have costs been higher/lower than expected? O&M costs have been generally in line with budget, although warranty claims have been higher (along with system downtime). We believe that this is because there was a time crunch in 2014 and 2015 (many FIT 1 and FIT 2 projects needing to be built before contracts expired), which led to higher-than-expected manufacturing defects and workmanship problems (too much work being done by too few people in too short a time).

10. Have any recent technology or process improvements had an impact on generally accepted performance assumptions (e.g., average capacity factors, equipment replacement, maintenance outages) for renewable energy projects? How has ongoing performance of renewable generation projects tracked relative to estimates? Some of the newer ESA requirements have introduced problems that cause downtime. Arc fault detection has been a flaky situation (numerous false alarms) which equipment manufacturers and contractors continue to work through. Rapid shutdown requirements are also going to cause a lot of problems in upcoming projects as there is little consensus or idea in the industry as to how to implement this.

Prioritization costs and other considerations

11. In relation to the items below, please identify and describe any:

    a. Administrative (e.g., legal, financial, etc.) costs associated with arranging partnership structures necessary to qualify for a Contract Capacity Set-Aside (as defined in the FIT Rules);

    b. Unique implications or advantages (e.g., taxation) of operating a project in a partnership structure; and

    c. Costs associated with obtaining FIT priority points.