Notes for Remarks

To the Ontario Waterpower Association's
Seventh Annual Conference

The Power of Water

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October 31, 2007
Huntsville, Ontario

Introduction

- Thanks for that kind introduction. I have been part of the OWA's executive dialogue in the past and I'm pleased to be at your annual conference today.

- I'm here today to stress the importance of waterpower to the provincial power system that my organization operates.

- I know I'm preaching to the converted but I want to reinforce the message that water power is critical to our ability to reliably operate the system. The flexibility it provides must not only be preserved, it must be increased in the future.

- Over the next few minutes, I want to talk about the characteristics of water power that make it such a valuable resource in meeting current and future needs.

- In doing so, also need to examine what the future requirements will be … or what my perspective is on the future needs.

- We have been and will continue to be vocal about the future needs. As the operator of the power system, you can appreciate that we have a key stake in ensuring that the future system we will operate, has the characteristics we need in order to ensure reliability.

Changing role of water power

- Water power has played a vital but changing role over the past 100 years.

- In the beginning it was essentially all about Niagara Falls.

- Yet as new forms of generation have been introduced into the Ontario system to meet the growing demand for electricity, it has been the unique characteristics of water power that has helped facilitate those new technologies.

- The dependability of water power, the ramping capability, the quick response, have helped facilitate the introduction of new technologies such as nuclear that have served also served as baseload generation without the flexibility of water. And it's a role that water power will continue to fill tomorrow as this province increases its reliance on other forms of generation …and, in particular, on wind.

- More than 400 MW of wind has been installed on the system with more than 4400 MW of wind in our future plans. While the environmental benefits of wind have been widely

touted, critics of wind power like to point to the challenges around its dependability … in particular its unpredictable, intermittent nature and its low outputs during peak demand periods in the summer.

- Hydroelectric, with its load-following capability, or in this case … wind-following capability … can help us to better utilize the potential that wind offers.

Changing Demand Profile in Ontario

- Another change has been the way electricity is used by Ontarians.

- In the past we used more electricity in the winter than in the summer. As the sun went down, as people got home from work, as they started cooking dinner, electricity requirements would peak for about two hours in the early evening. This suited hydroelectric production very well. Limited water could be called into use to maximize the output from hydro generators to meet the relatively short peak requirements. This is still typical of winter operation and water power is still valuable in meeting these requirements.

- Today the peak amount of electricity that Ontarians use is in the summer. This is driven almost entirely by residential and commercial cooling demands. The nature of the cooling demand is that it builds in the morning and lasts through to early evening. So the peaks are higher and last longer than in the winter. And they happen at a time of year when hydroelectric production is generally declining as the summer progresses.

- This is not to say that hydro isn't of value for these summer peaks. Quite the contrary, in fact. But it does highlight two important things: that water power alone is not enough to meet the changing demand patterns, and that the flexibility to use limited energy from water is even more important in summer than it has been in the past.

Flexibility

- Hydroelectric has significant environmental benefits over other generating sources … it is renewable and produces virtually no emissions.

- Yet when I think of water power as a system operator, flexibility is the word that comes to mind. And that flexibility is instrumental in our ability to reliably manage the power system. In fact it is absolutely essential.

- It is fast, moveable energy that can serve as baseload but also has tremendous load-following potential. It has extremely quick response capability, with many hydroelectric

resources able to ramp to their full capacity within minutes. It is geographically dispersed around the province so it can be called on not just when you need it but where you need it.

- Given the fluctuations we see in demand on a constant basis, the ability to respond within seconds … either through increased or decreased production … is a tremendous asset.

- I could probably look back at any particular week – actually, any particular day –and demonstrate the value of dependable and flexible hydroelectric production. But let me use some more extreme examples.

- In the summer of 2005 Ontario faced record heat, record demands and low precipitation. We didn't have the energy we needed in the province and imports from the US were often limited by the transmission into the central part of the province. Every day we relied on the operating reserve from hydro generators to meet the reliability standards that we must meet as part of the international interconnected network. Because even though the energy available from many hydro units was limited as it often is in the summer, there was usually an hour's worth of water that could be called on if needed. And every day we managed the limited energy of the hydro units carefully to maximize the imports of energy into the province. The flexibility of water helped us squeak through a very tough summer.

- In 2003, when 50 million people were suddenly blacked out, we ended up with our two largest hydro facilities at each end of Lake Ontario tenuously connected through New York State. The capability of these plants was used in the early minutes of the blackout to carefully establish a stable base to begin restoration. And from there they were used to balance supply and demand as well as the loading of our ties to New York as we rebuilt the Ontario grid. Up in my hometown of Timmins, my mother couldn't understand what all the fuss was about because she was only without power for a few hours. The reason was the capability of the northern hydro plants that allowed restoration to proceed independently of what was going on in the south.

- You may be aware that earlier this year standards for reliability became mandatory and enforceable in the US, something that has been the case in Ontario since the market opened. The US legislation requires that the standards ensure an "adequate level of reliability." No one has ever defined what an adequate level of reliability is. The first attempt by the North American Electric Reliability Corporation to do so has, as one of the five requirements, the ability to restore the power system following a blackout. In Ontario the capability of specific hydro generators to start without any outside source of power is key to us being able to meet this requirement. This "blackstart" capability is just one of the ways water power demonstrates its flexibility.

- When I first joined this industry too many years ago, Ontario was developing a leading edge approach to increase the capability of its transmission lines. The more electricity that transmission lines carry the hotter they get. As they get hot they stretch and get closer to the ground. There is a safe limit to how hot they can get. What we recognized was that you could get to the same temperature by loading a transmission line moderately for a long time or by loading it very high but only for a short time. If we could be sure that we could reduce a high loading quickly we could effectively increase the capability of the line substantially without having to build a new line. This is the way we have planned and operated our transmission system for the last thirty years. And a key reason that we can do this is because of the flexibility to quickly load or unload hydroelectric facilities. Ontario has saved hundreds of millions of dollars because of this flexibility. And we use this flexibility every day to avoid what would otherwise be a very congested transmission system.

- Transmission is a key component in achieving future benefits of hydroelectric. We need transmission to get generation to where it is needed. This will be particularly relevant as we develop new hydroelectric sites in the northern parts of the province.

- Just as water power is key to maximizing transmission capability, transmission is key to maximizing the flexibility of water power. It helps to manage the variability of water power … moving power out of an area at times of high generation and bringing power into an area during low production.

- While new transmission is being planned, we continue to point to the need to having those facilities in place when they are needed. That's why we have continued to push for improvements to the current approvals process.

- And we still have concerns over the siting and development of certain new hydroelectric projects.

Variability

- Despite the many great attributes of water power, like any fuel source, it has its limitations. Not all of it is as flexible as I've described. Some of it is energy limited. Some is subject to a lot of seasonal variability. And much of it is quite variable depending on the weather. The variability of hydroelectric can be a concern. That was certainly evident in the summer of 2005, as I discussed. This was compounded by the record peak demand conditions that we experienced over an extended period during the summer because of the hot, humid weather conditions.

- Since that time, we have introduced a number of changes in our planning assumptions to address both the impacts of weather and the variability of water resources.

- To better reflect the impact of weather on the power system, particularly during the summer, the IESO has started using "seasonal normalized weather" in our long-term demand forecasts.

- This has resulted in significantly improved demand estimates that better capture the higher loads being experienced over the summer period, while also reducing the forecast uncertainty.

- We have also changed our hydroelectric forecasting process to better reflect the supply capability we could depend on from water.

- This change led to more effective warning signs of supply shortfalls in our 18-month outlooks and in our Ontario Reliability Outlook.

- In 2007, we married this forecasting approach to a specific hydroelectric monitoring program. Each month's hydro is compared with the longer-term forecast from our Ontario Reliability Outlooks, giving us a clear and timely indicator of better or poorer than expected water conditions for generating electricity.

- This helps us fine-tune our forecasts to reflect current conditions and to investigate other short-term supply options when necessary.

Water Management Plans

- Weather patterns are certainly not the only things that cause water flow variations.

- As most of you are aware, water management plans have been developed by the Ministry of Natural Resources for hydroelectric generation in Ontario.

- Water management plans are intended to strike a balance among various environmental, social and economic objectives, taking into account the uses and users that are affected by changes in water levels and flows.

- They are meant to provide certainty and clarity with respect to the operation of hydroelectric facilities and control structures, their impact on water flows, and their contribution to long-term ecological and economic sustainability.

- However, since their introduction five years ago, the IESO has expressed concerns about the potential for water management plans to limit the energy and the flexibility of hydroelectric generators.

- The flexibility available in the operation of hydroelectric facilities is absolutely essential to robust power system operations.

- Given the expected future mix of resources in Ontario, the value of hydroelectric flexibility will increase.

- For these reasons, we feel this important contribution to province-wide system reliability needs to be balanced with other uses that may influence local requirements with respect to water management.

- Simply put, preserving or increasing the operating flexibility of hydroelectric generating facilities (existing or planned) must be a critical consideration in the development of future water management plans.

- We look forward to the release of the results of the review of water management planning that the Ontario Waterpower Association and the Ministry of Natural Resources are currently undertaking, whether to confirm that energy production and flexibility have been adequately considered or to suggest that changes are needed.

Future needs

- Now I'd like to touch on my own perspective on the future system we will be expected to operate.

- The OPA has contracted for 10,000 MW of new or refurbished supply. So, at least in the medium term, our concerns are less about having enough supply but rather the type of supply we will have. The future is taking us to increasing baseload generation … new and refurbished nuclear, wind, cogeneration, combined cycle gas generators that have very high minimum loads … all of that is in the works and yet all of that has very limited flexibility.

- That again points to the value of a flexible hydroelectric source.

- But the current and projected capacity may not be enough given the increase in baseload and particularly the increase in wind generation. That's why I am so intrigued with the potential of pumped storage and its wind-following capability. Pumped storage is an operator's dream, even more dependable and flexible than normal hydro power. Ontario doesn't have much pumped storage at present, just a couple of hundred MW at Niagara Falls. Nor does the IPSP contain any specific plan for pumped storage. But this doesn't mean we should lose sight of it as an option as we look further to the future and as our needs become better known.

- More than 4,000 MW of new wind is expected to be installed in Ontario over the next 15 years. Ontario is not alone in its increasing reliance on wind as a source in meeting future demand. Within the ISO areas, which cover about two thirds of North American demand, there is more than 124,000 MW of wind generation in the ISO connection queues. Of course not all of these proposals will be built but it gives an idea of the magnitude of the potential for new wind generation. Twenty-five states in the US have renewable portfolio standards and there is federal legislation proposed for a National RPS.

- In contrast, these same areas have only about 4,000 MW of hydro power in their connection queues. So while there is potential to add huge amounts of intermittent supply, there is a much more limited amount of flexible hydro proposed.

- There is currently a lot of discussion in North America about how best to address the intermittent nature of wind. Pumped storage represents one opportunity, enabling the energy production of wind to be stored and then dispatched when demand is high or when wind power output is low.

- But the future power system also includes an increased reliance on demand response. Clearly the notion of building a generating plant to meet demands for the few hours of the year when it is at its peak is a notion that needs to be questioned. Effective demand response, particularly at the residential level, or more appropriately, automated at the appliance level may be the right answer.

- It is why smart meters make sense. Smart meters represent one tool that will enable residential customers to shift their use of electricity to off-peak hours, reducing the strain on the power system, reducing environmental impacts and saving customers money. But increasingly attention is being focussed on even more direct control of end-use appliances and devices, control that would enable increases or decreases in demand to be used to match the changes in system demand and supply on a minute-to-minute basis. The information and control technology and the market mechanisms to pay for this kind of service are almost within our grasp.

- Another way of dealing with the change to a cleaner but less predictable supply mix across the continent is to coordinate operation across larger areas. This would take advantage of the natural benefits that arise from weather diversity as well as the more effective use of flexible resources in the wider region. Some advantage of this occurs now through trading between markets but not nearly as much as could occur within a much broader market.

- So my expectation is that 20 years from now we will have a very different mix of resources, a very different demand makeup, a very different mix of control technologies

to deal with these and better coordination across broader regions. But whatever the changes to the future power system, it is absolutely clear to me that one thing won't change: water power's critical role in maintaining reliability, which is based on its flexible operating characteristics. These will continue to be needed and will be increasingly valuable. And I will continue to advocate for it to anyone who will listen.

- Thanks very much. I look forward to your questions.