

Surplus Baseload Generation: A Nuclear Operators Perspective

*Presentation to Market Pricing Working Group
December 2, 2008*



Agenda

- **How a Nuclear Unit Responds to Dispatch**
- **Surplus Baseload Generation Dispatches**
- **Future expectations of SBG**
- **Market based mechanisms to address SBG**



How a Nuclear Unit Responds to Dispatch

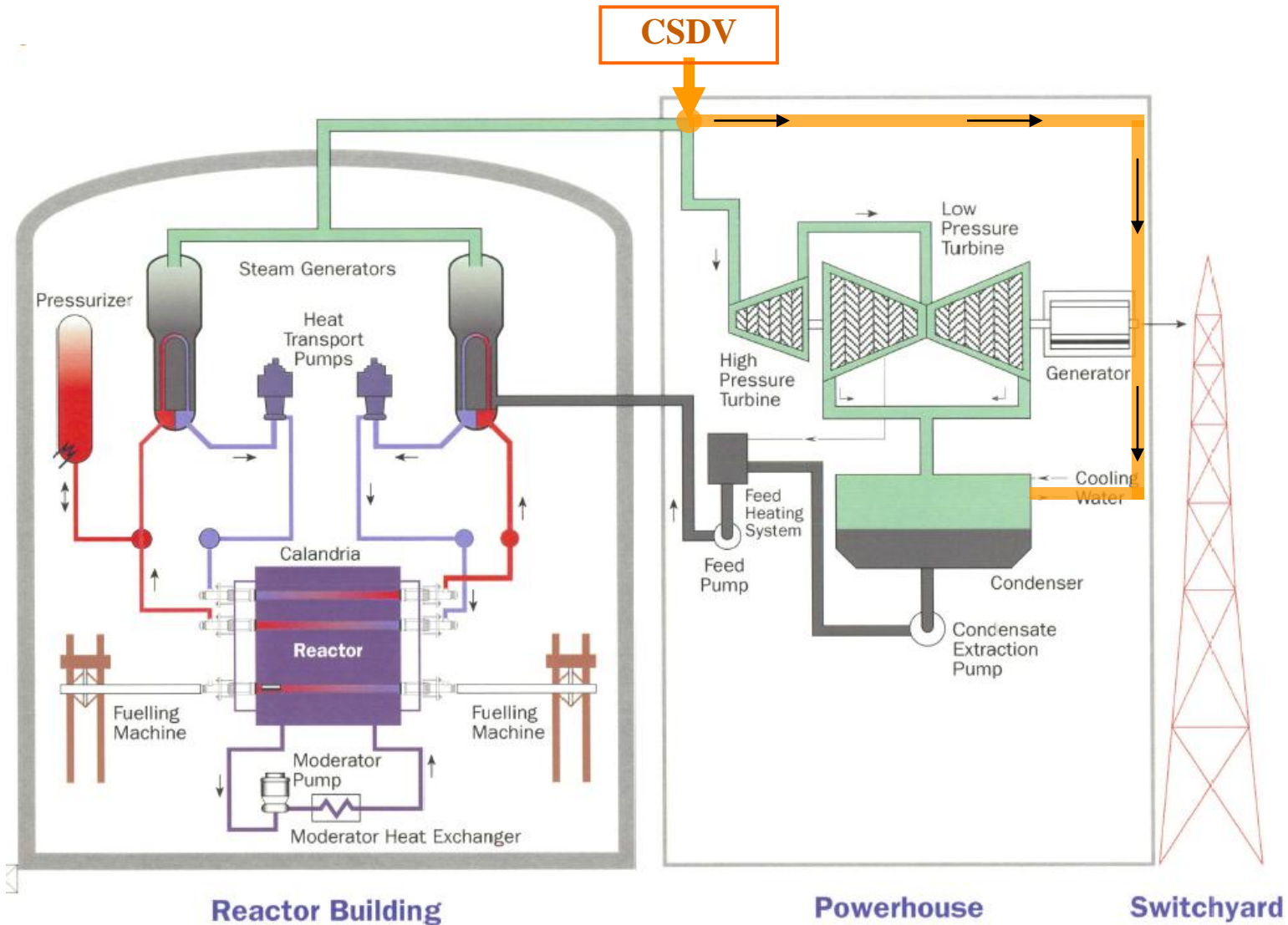
1. Utilize Condenser Steam Discharge Valves (CSDV)
 - Reactor power remains constant, steam is directed to condensers bypassing turbines/generators thus lowering output
 - High thermal stress on condenser equipment, increasing wear and tear
 - Environmental concerns with temperature of water returned to lake

2. Adjust reactor power
 - Very slow response time
 - Prone to 'poisoning out', concerns with maintaining reactivity and boiler chemistry

3. Utilize control absorber rods
 - According to Canadian Nuclear Safety Commission regulations Bruce Power is only permitted to use carbon absorber rods to respond to system emergencies. e.g. August 2003 blackout



Condenser Steam Discharge Valves



Surplus Baseload Generation Dispatches



What is Surplus Baseload Generation?

From IESO Operability review of IPSP:

Surplus baseload generation (SBG) is an over generation condition that occurs when Ontario's electricity production from baseload facilities such as nuclear and must run hydroelectric units is greater than market demand.

http://www.ieso.ca/imoweb/pubs/ircp/IESO-Operability_Review_of_IPSP.pdf



2008 SBG Dispatches

2008 SBG Dispatches		
Date	Magnitude (MW)	Duration (hours)
25-Apr-08	300	3
05-May-08	300	3
03-Jul-08	300	6.5
03-Jul-08	300	4
03-Jul-08	300	0*
05-Jul-08	300	2
06-Jul-08	300	5
06-Jul-08	285	4.5
13-Jul-08	300	1.5
14-Jul-08	150	3.5
01-Sep-08	60	1
23-Sep-08	300	1.5
29-Sep-08	150	1
08-Oct-08	300	3
08-Oct-08	300	1.5
12-Oct-08	300	4
12-Oct-08	300	2.5

*unable to respond due to environmental concerns



How Bruce Power Responds to SBG Dispatches



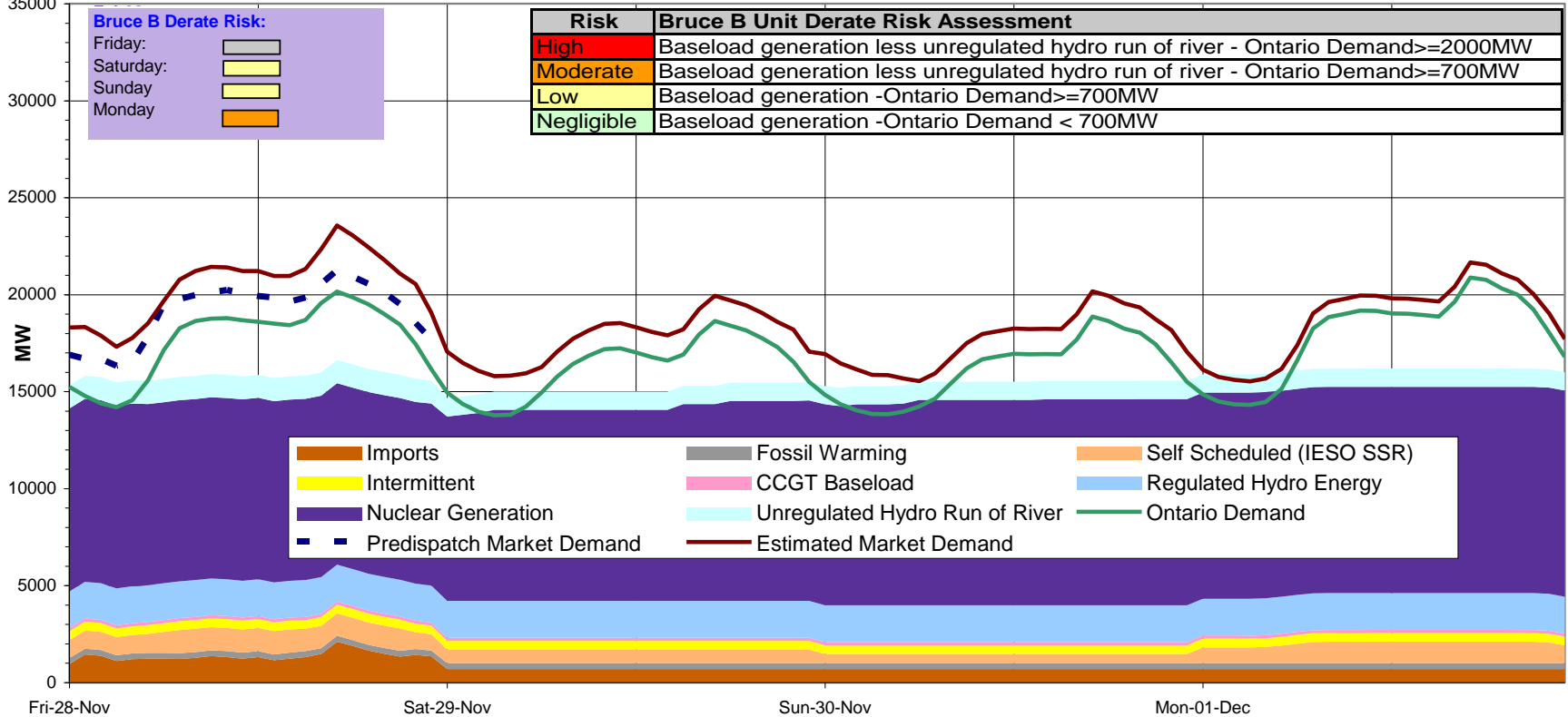
Brief Overview of SBG Procedures

1. Daily analysis of potential risk of SBG
2. Duty Shift Traders communicate continuously with the IESO operators and Bruce Power Control Room Shift Supervisor (CRSS)
3. Bruce Power's preferred manoeuvring order communicated to IESO and offers submitted to reflect manoeuvring order and ramp rate
4. CRSS perform pre-job brief of SBG procedure
5. Field Operators perform detailed inspection of condenser equipment
6. Authorized Nuclear Operator (ANO) prepares desktop procedures for SBG
7. When SBG dispatch received Duty Shift Trader confirms dispatch with IESO
8. Bruce Power takes a proactive derate to avoid being the marginal unit in the province
9. Duty Shift Trader communicates magnitude of derate to CRSS and ANO
10. ANO and CRSS work together to perform manoeuvre following extremely detailed procedures
11. Plant output reduced through the use of CSDV's
12. CRSS reports back to Duty Shift Trader that manoeuvre is complete
13. ANO and CRSS continuously monitor plant conditions
14. Procedures used to return plant to full output



Bruce Power's Daily SBG Analysis

Last Update: 8:30 EST Nov 28, 2008



Risks to Manoeuvring Nuclear Units

- **Environmental Concerns**
 - Concerns with violating thermal emission constraints

- **Equipment reliability**
 - CSDV increases load on condenser, increasing risk of condenser leaks
 - Condenser leaks could lead to a forced outage
 - Condenser leaks alter boiler chemistry resulting in more strain on boilers and chemistry equipment
 - Vibration concerns with continued use of CSDV
 - Increased risk of valve failure and condenser tube leaks

- **Increased probability of turbine trips**
 - Turbine trips dramatically increase the possibility of a forced outage
 - 48 hours to return from a forced outage

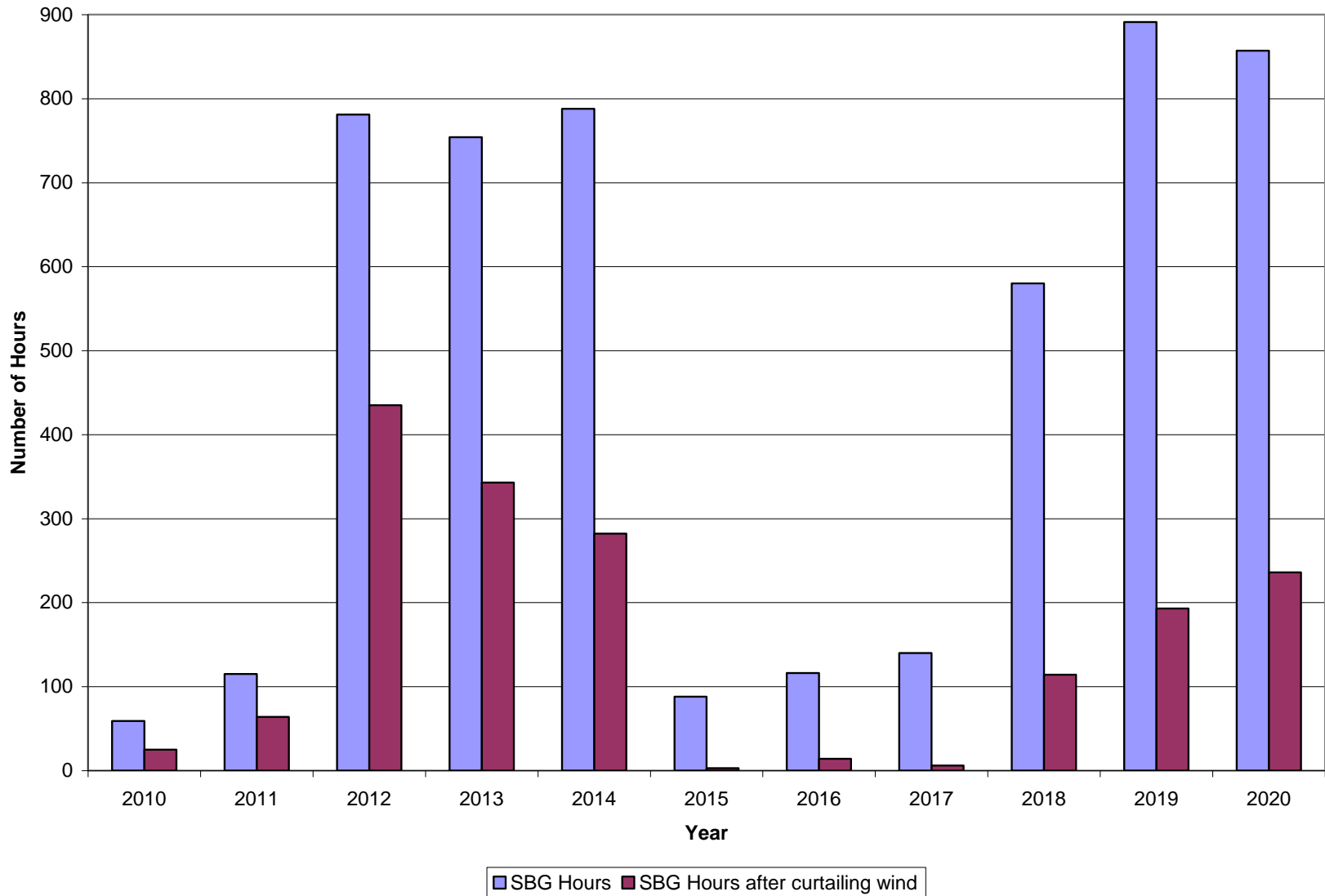
- **Human performance issues**
 - Unexpectedly manoeuvring a nuclear unit increases the risk of a human performance event which could lead to a forced outage.











SBG in the Future



IESO Operability Review of IPSP



IPSP Investigation and potential impact on SBG

Minister's Directive	Potential Effect on SBG
The amount and diversity of renewable energy sources in the supply mix.	
The viability of accelerating the achievement of stated conservation targets, including a review of the deployment and utilization of smart meters	
The improvement of transmission capacity in the orange zones in northern Ontario and other parts of the province that is limiting the development of new renewable energy supply	
The potential of converting existing coal-fired assets to biomass	 
The availability of distributed generation	 
The potential for pumped storage to contribute to the energy supply during peak times	



Market Based Mechanisms to Address SBG

- Average demand forecast in pre-dispatch (on-going)
- Market announcements of over-generation
- Open restricted window for additional exports
- Expanded NISL (or dynamic NISL)
- Eliminate IOG in off-peak hours
- Refinement of scheduling protocols to minimize failed exports (on-going)
- Curtail import transactions for Ontario ‘security’
- Address loop flow concerns that restrict exports from Ontario



Key Messages

- SBG is Bruce Power's #1 operational concern
- SBG is happening now and it will be increasing dramatically
- Bruce Power asserts that manoeuvring nuclear units represents a significant reliability risk to the province

