

# Powering A Sustainable Energy Future

*WIND POWER AND HYDROELECTRIC OPPORTUNITIES  
IN SASKATCHEWAN*

June 2, 2010

# SaskPower's Story



***Working together for the past 80 years to meet the energy needs of the people of Saskatchewan now and into the future.***

- Our mission ... *Safe, reliable and sustainable power for our customers.*
- Formed through *The Power Commission Act* in 1929, SaskPower is a provincial Crown corporation.
- SaskPower manages \$4.5 billion in generation, transmission and distribution assets, and provides customer services and corporate support services.
- SaskPower's team is made up of more than 2,500 permanent full-time employees in 71 communities throughout the province.

# Electrical Generating Facilities

## AVAILABLE GENERATION (net capacity)

### HYDROELECTRIC

1. Athabasca Hydroelectric System - 23 MW
  - Wellington (5 MW)
  - Waterloo (8 MW)
  - Chariot River (10 MW)
2. Island Falls Hydroelectric Station - 102 MW
4. Nipawin Hydroelectric Station - 255 MW
5. E.B. Campbell Hydroelectric Station - 288 MW
12. Coteau Creek Hydroelectric Station - 186 MW

### NATURAL GAS

3. Meadow Lake Power Station - 44 MW
8. Landis Power Station - 79 MW
9. Ermine Power Station - 94 MW
11. Queen Elizabeth Power Station - 427 MW
14. Success Power Station - 30 MW

### WIND

15. Cypress Wind Power Facility - 11 MW
17. Centennial Wind Power Facility - 150 MW

### COAL

19. Poplar River Power Station - 582 MW
20. Boundary Dam Power Station - 824 MW
22. Shand Power Station - 276 MW

### INDEPENDENT POWER PRODUCER

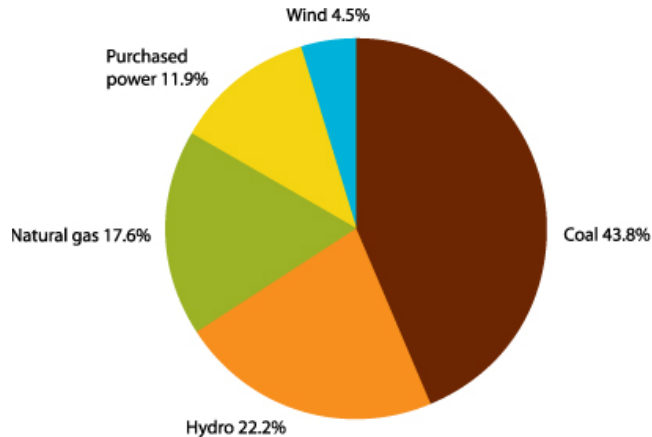
6. Meridian Cogeneration Station - 210 MW
7. NRGGreen Kerrobert Heat Recovery Project - 5 MW
10. Cory Cogeneration Station - 228 MW
13. NRGGreen Loreburn Heat Recovery Project - 5 MW
16. SunBridge Wind Power Project - 11 MW
18. NRGGreen Estlin Heat Recovery Project - 5 MW
21. NRGGreen Alameda Heat Recovery Project - 5 MW

## TRANSMISSION

- 230 kV
- 138 kV
- - - 138 kV line operating at 72 kV
- Switching station
- ⚡ Interconnection



# SaskPower Generation Sources



As of January 2010

- SaskPower operates three coal-fired power stations, seven hydroelectric stations, five natural gas stations and two wind facilities
- Power purchases from the SunBridge Wind Power Project, Meridian Cogeneration Station, Cory Cogeneration Station and the NRGreen Kerrobert, Loreburn, Estlin and Alameda Heat Recovery Projects
- SaskPower's total available generating capacity is 3,840 MW
- Coal-fired electricity serves as the foundation of the SaskPower system
- Efforts are made to maximize existing coal, hydro and wind generation, which have the lowest incremental cost per unit of generation

# SaskPower's Supply Challenge



- SaskPower has gone through a period of unprecedented demand for power from customers due to the momentum of the provincial economy
- Need to retire/refurbish aging infrastructure
- Environmental regulations have yet to be defined and may influence SaskPower's choice of electrical generation options
  - Coal-fired generation may not continue as it has in the past
- SaskPower will have to rebuild, replace or acquire 4,100 MW of electricity by 2030
- Operational challenges with adding new generation

# The Demand for Power



## Setting records at SaskPower

- Record spent on connecting new customers
- Record new applications for service in 2008
- Record peak load 3,231 MW on Dec 14, 2009

## Increasing demand for power

- In the past 10 years, demand has grown by an average of 1.3% each year
- During the next decade, demand is expected to increase by approximately 3% per year
- Average growth of over 110 MW per year
  - 110 MW is enough electricity to supply power to approximately 110,000 households

# Aging Infrastructure

## Transforming the system

- SaskPower's province-wide electrical infrastructure (generation/transmission and distribution) was mostly built 30-50 years ago
- Infrastructure is aging and running close to full capacity
- SaskPower continues to replace and refurbish aging electrical infrastructure to meet the electrical needs of the people of Saskatchewan as it has for the past 80 years
- Will extend the life of existing infrastructure, where prudent
  - Many areas have already been life-extended or rebuilt
- Problem common to electrical utilities throughout North America

# Environmental Challenges



## Improving environmental performance

- Climate change has the single largest potential to shape the energy future of SaskPower
  - Federal and provincial regulations
  - Significant cost impacts for SaskPower and its customers
- 73% of SaskPower's available generation capacity is fossil-fuel based - using coal and natural gas
  - Regulations regarding coal generation are changing
  - Coal-fired generation may not continue as it has in the past
- Anticipated need to reduce sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), mercury and particulates
  - \$1.8 billion to reduce emissions to meet expected federal standards
- Last coal power station built in 1992 (Shand)



# Operational Challenges

## Balancing the system

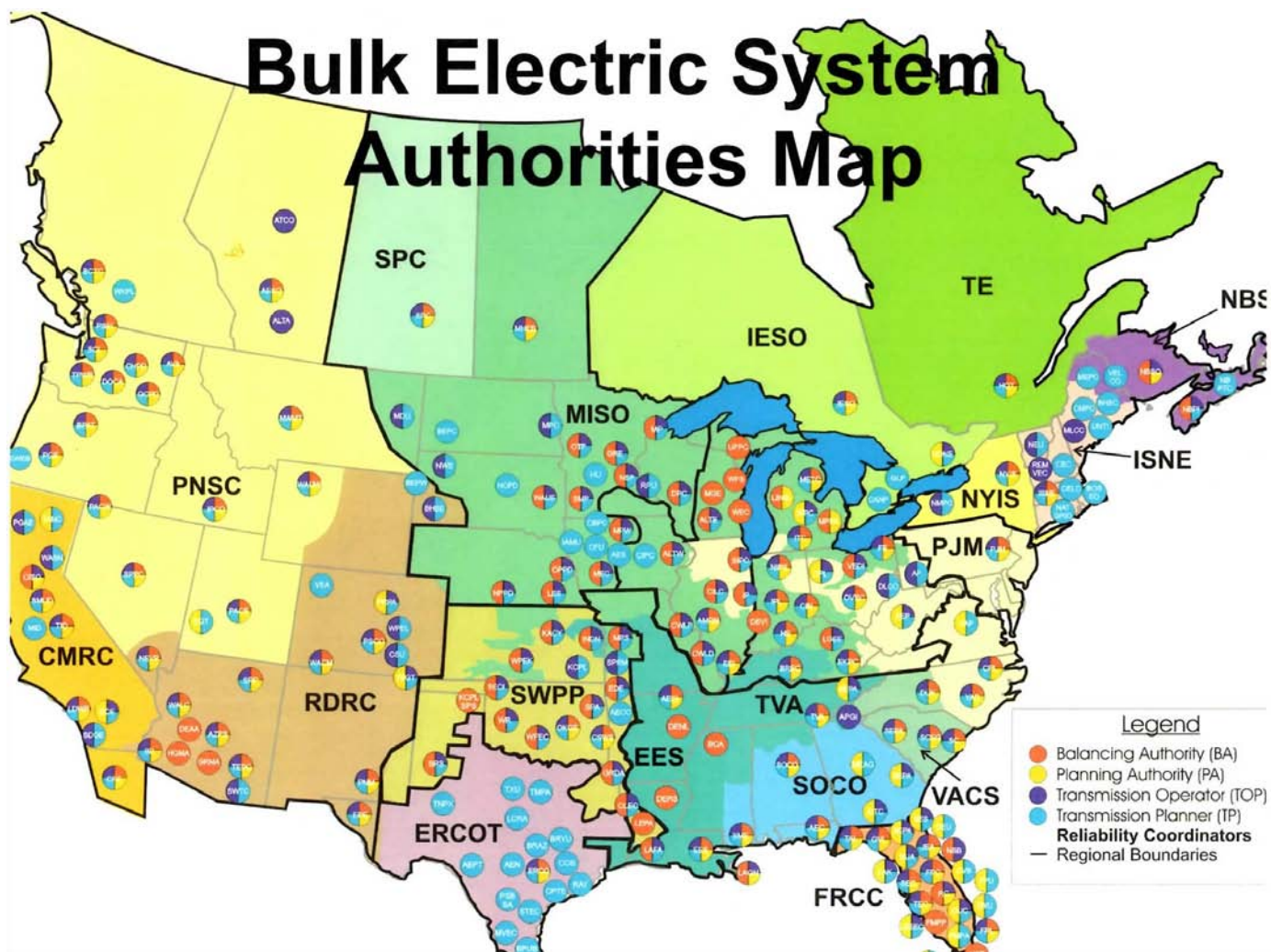
- A combination of baseload, intermediate, intermittent and peaking power are required to run the electrical system and meet the needs of the people of Saskatchewan
  - *Baseload power* is the minimum amount of electric power delivered or required over a given period of time at a steady rate
  - *Intermediate power* plants meet demand during peak business hours of the week and colder months of the year
  - *Intermittent power* facilities cannot be dispatched (turned off and on to meet demand) and only produce power when the resource they depend upon is available
  - *Peaking power* units only operate at times of peak system demand, such as supertime.
- This supply combination provides SaskPower with the flexibility to serve a demand for power that can swing from 500 to 1,000 MW daily – as loads drop overnight and rise in the morning

# Operational Challenges

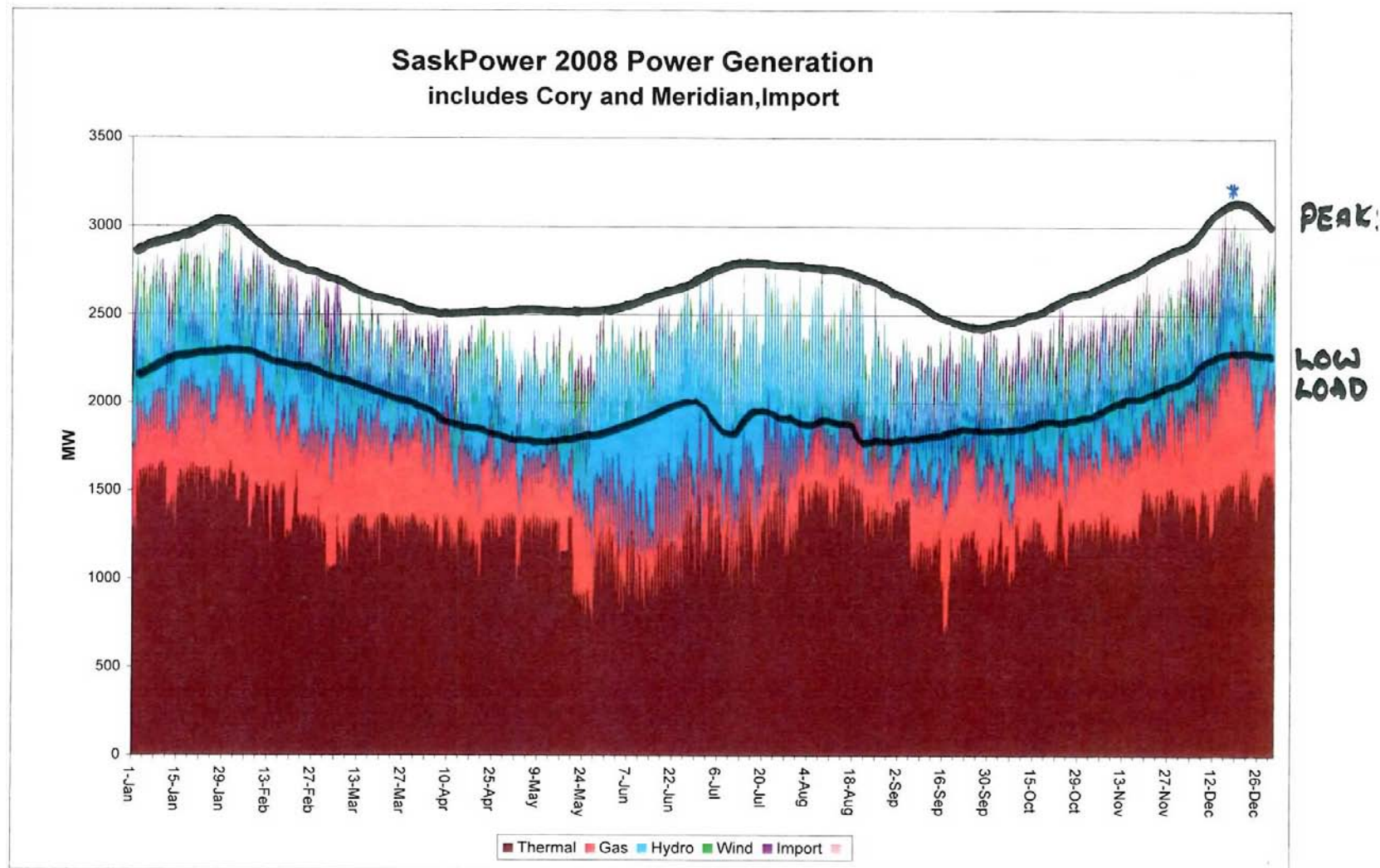
## Balancing the system

- SaskPower must constantly and precisely balance the supply of power and the demands of customers.
- Interconnection with neighbouring jurisdictions can have a significant impact on the reliability of the interconnected systems.
- Reliability standards require SaskPower and other electric system operators to maintain sufficient transmission infrastructure and generating capacity to withstand the sudden loss of the largest generators in their fleets.

# Operational Challenges



# Operational Challenges

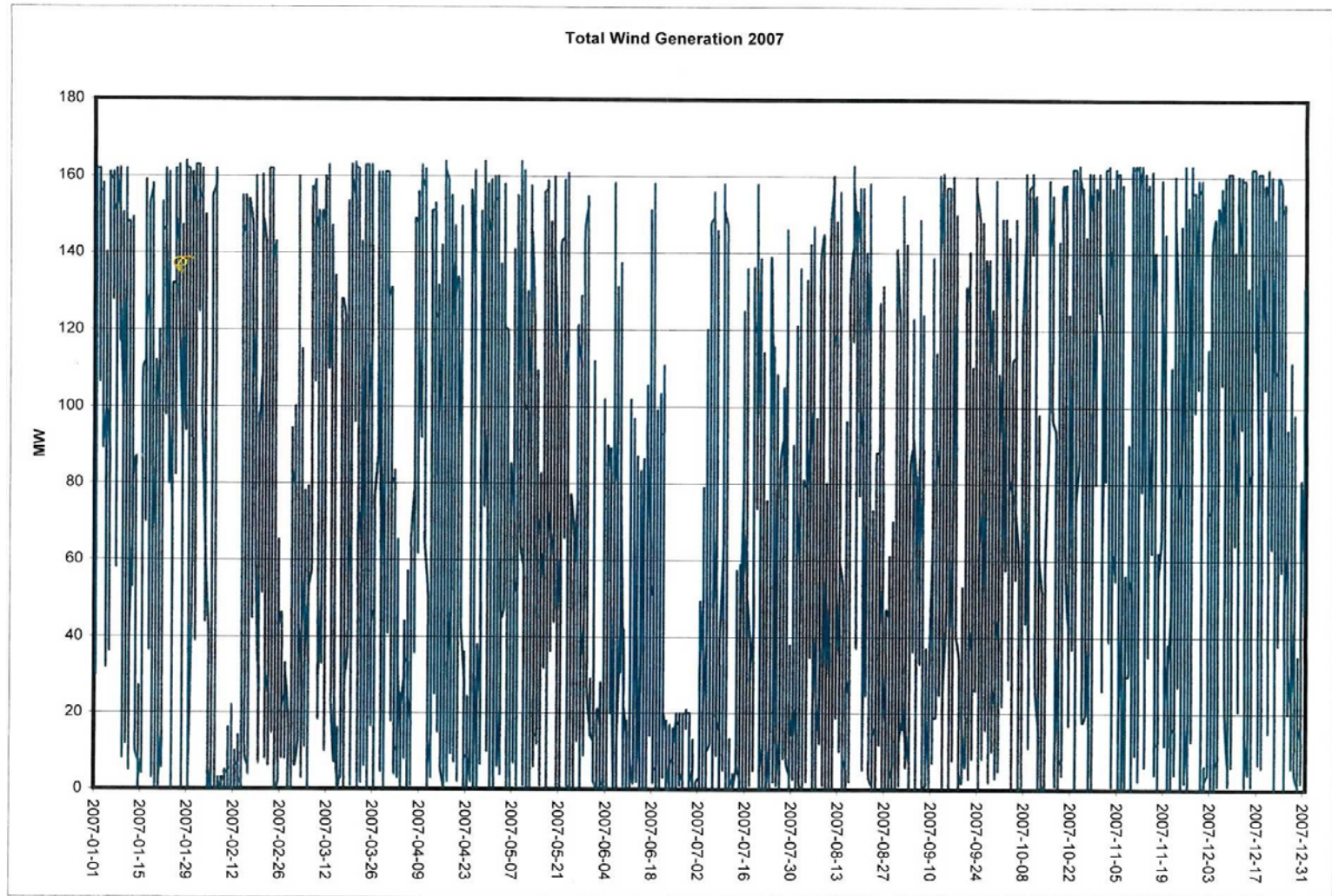


# Wind Power Update

- **172 MW installed capacity**
  - 3 operating facilities
    - Centennial Wind Power Facility – 150 MW
    - Cypress Wind Power Facility – 11 MW
    - SunBridge Wind Power Project – 11 MW
  - 4.5% of installed/purchased capacity
  - 25 MW under development – Red Lily Wind Project
- **SaskPower is gaining first hand experience with the production characteristics of wind power on a relatively large scale**
  - Variable energy production
  - Non-dispatchable
- **Many developers are pursuing a PPA with SaskPower**
  - Many have secured land leases
  - Many are conducting wind power studies
  - Level of interest exceeds system needs
- **Interest in a First Nation policy framework**
- **Considerable interest in small wind turbines by individual consumers and the turbine suppliers**

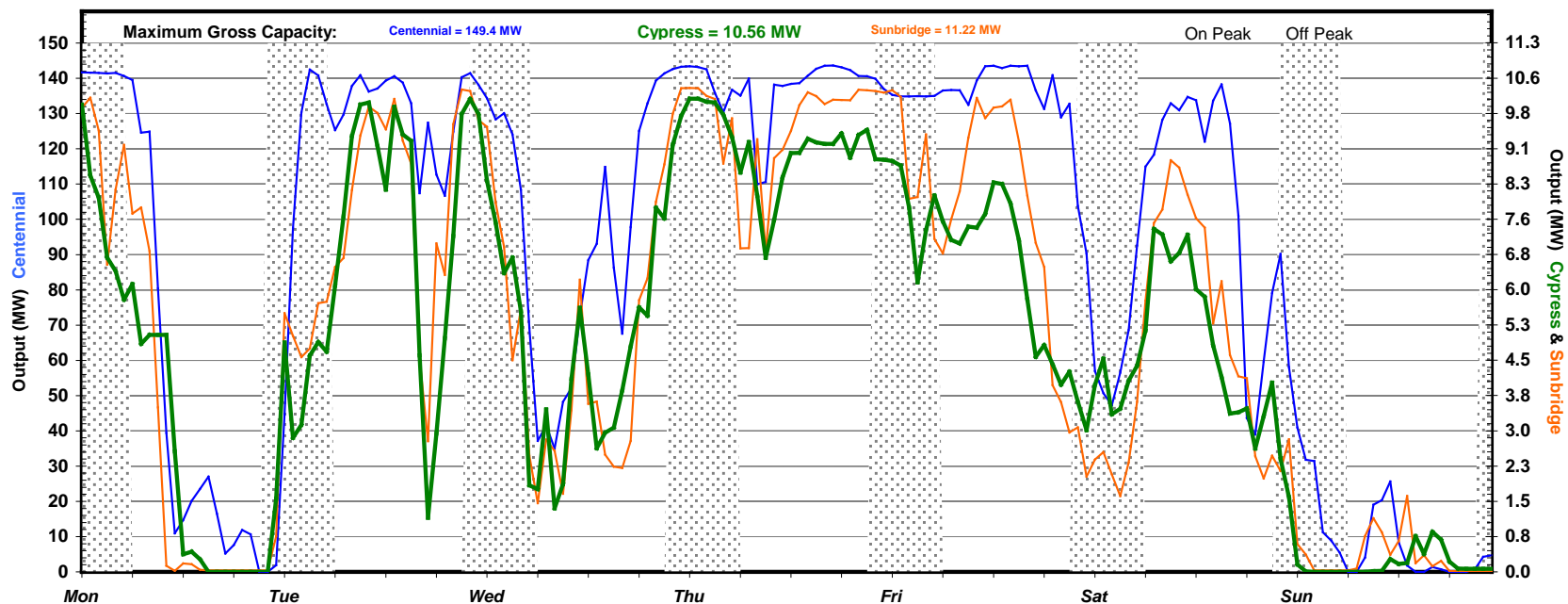


# Operational Challenges – Wind



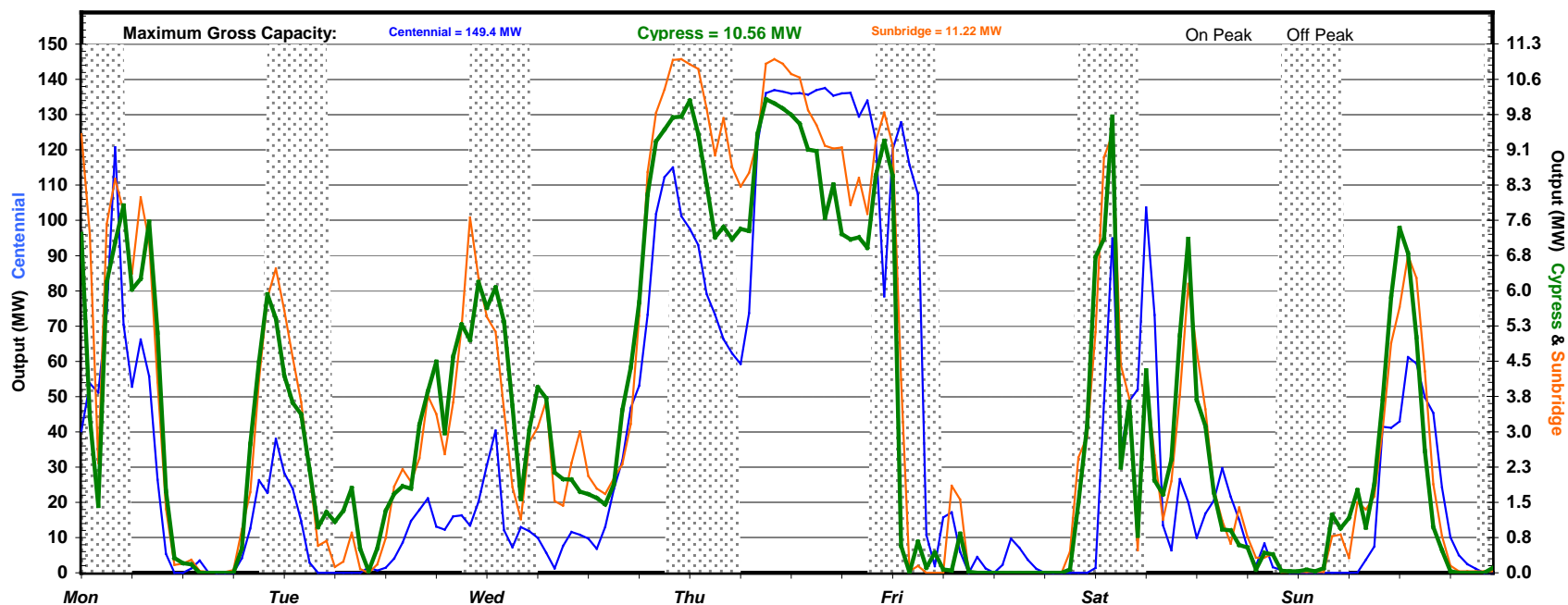
# Operational Challenges - Wind

Wind Output for the week starting January 29, 2007



# Operational Challenges - Wind

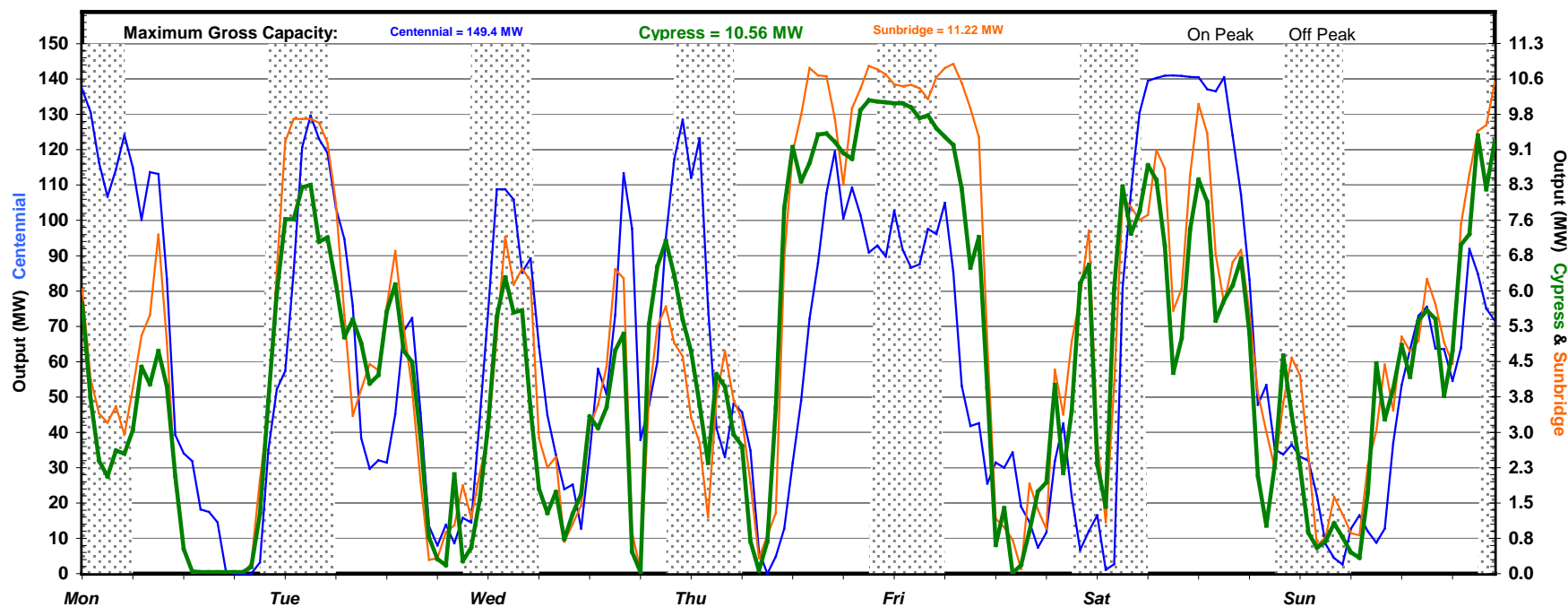
Wind Output for the week starting July 16, 2007





# Operational Challenges - Wind

Wind Output for the week starting September 24, 2007



# Wind Power Strategy

- *Announced in 2007*
- **Established a Wind Power Integration and Development Unit (WPIDU)**
  - Impacts on the electric system and tie-lines
  - Capacity benefits
  - Use of hydro stations for shaping wind power
  - Wind forecasting
  - Load shaping/following & ancillary service costs
  - Investigate wind power storage technologies
  - Practical limits in the quantity of wind power
  - Regional dispersion of wind power
- **Continue work on previously selected projects (Red Lily Wind Project)**
  - Decline all other large wind power proposals
  - Net Metering Policy still available for small projects
- **Issue a Wind Power Deployment Strategy in 2009**

# Key WPIDU Findings

- **Up to 200 MW of wind power can be added in the short term**
  - Operational impacts should be manageable
  - Additional costs will be incurred
- **All new wind power projects must be curtailable**
  - Avoids impacting must-run baseload units
  - Provides operating flexibility
  - Helps to manage tie-line flows
  - Unit curtailments increase as more wind power capacity is added
- **15% capacity factor is reasonable for capacity planning**
  - 20% winter rating
  - 10% summer rating
- **Storage technologies are not yet commercially viable**
- **Wind power forecasting needs to improve**
- **Limited ability for hydroelectric plants to shape wind power**
- **Large wind farms are the most economical way to deploy wind**

# Wind Power Deployment Strategy

- Procure up to 200 MW of curtailable wind power
  - Issue an RFP for 175 MW through the Green Options Plan
    - Select wind power project(s) based on lowest cost
    - Oversight by a fairness advisor
  - Allocate 25 MW to the Green Options Partners Program
- Investigate ways to improve wind power forecasting
- Monitor and strategically support energy storage technologies
- Consider wind power when planning transmission upgrades
- Continue to facilitate small customer-installed units
  - Applicable for units up to 100 kW in size
  - 2 Program initiatives:
    - Net Metering Program
    - Small Power Producer Policy
  - Provincial grants are available to help defer costs

# Wind Power Deployment Strategy



- ***Implications:***
- \$1.0 to \$1.4 Billion Power Producers' Agreement cost over 25 years
- Minimal impact on long term rates
- Double the planned wind power capacity
  - Increase wind capacity to 8.5% by 2014
- Reduce greenhouse gasses by an estimated 225,000 tonnes/year

# Hydroelectric Power Update



- **854 MW installed capacity**
  - Saskatchewan River System
    - Coteau Creek – 186 MW
    - Nipawin – 255 MW
    - E. B. Campbell – 288 MW
  - Churchill River System
    - Island Falls – 102 MW
  - Athabasca System
    - Wellington – 5 MW
    - Waterloo – 8 MW
    - Charlot River – 10 MW
  - 22% of installed/purchased capacity

# Hydroelectric Power Update

- The last hydro station built in Saskatchewan was Nipawin Hydroelectric Power Station in 1982
- SaskPower is currently investigating two hydro projects in the province:
  - ***Elizabeth Falls***
    - 42 – 50 MW run-of-river plant on the Fond-du-Lac River
    - Black Lake First Nation
  - ***Pehonan Hydro Electric Project***
    - 200 – 250 MW project on the Saskatchewan River d/s of “the Forks”
    - A project partnership has been established:
      - James Smith Cree Nation
      - Chakastaypasin First Nation
      - Peter Chapman First Nation
      - Brookfield Renewable Power Corporation
      - Peter Kiewit Sons Co.

# Hydroelectric Power Update

- From 1982 to 1988, SaskPower investigated hydro power potential in Saskatchewan
  - Identified a potential inventory of 3,240 MW:
    - Saskatchewan River: 2,053 MW
    - Churchill River: 734 MW
    - Athabasca River System: 453 MW
- In 2006, SaskPower undertook a study to identify northern hydro projects within 25 km of a transmission line or load centre
  - 27 sites were identified
    - 13 were 10 MW or larger with a capacity factor of at least 80%
    - 7 were between 2 MW and 10 MW
    - 10 were less than 2 MW
- SaskPower has not been active in the development of other hydro opportunities