

Potential Future Natural Gas Generation Project

February 2017

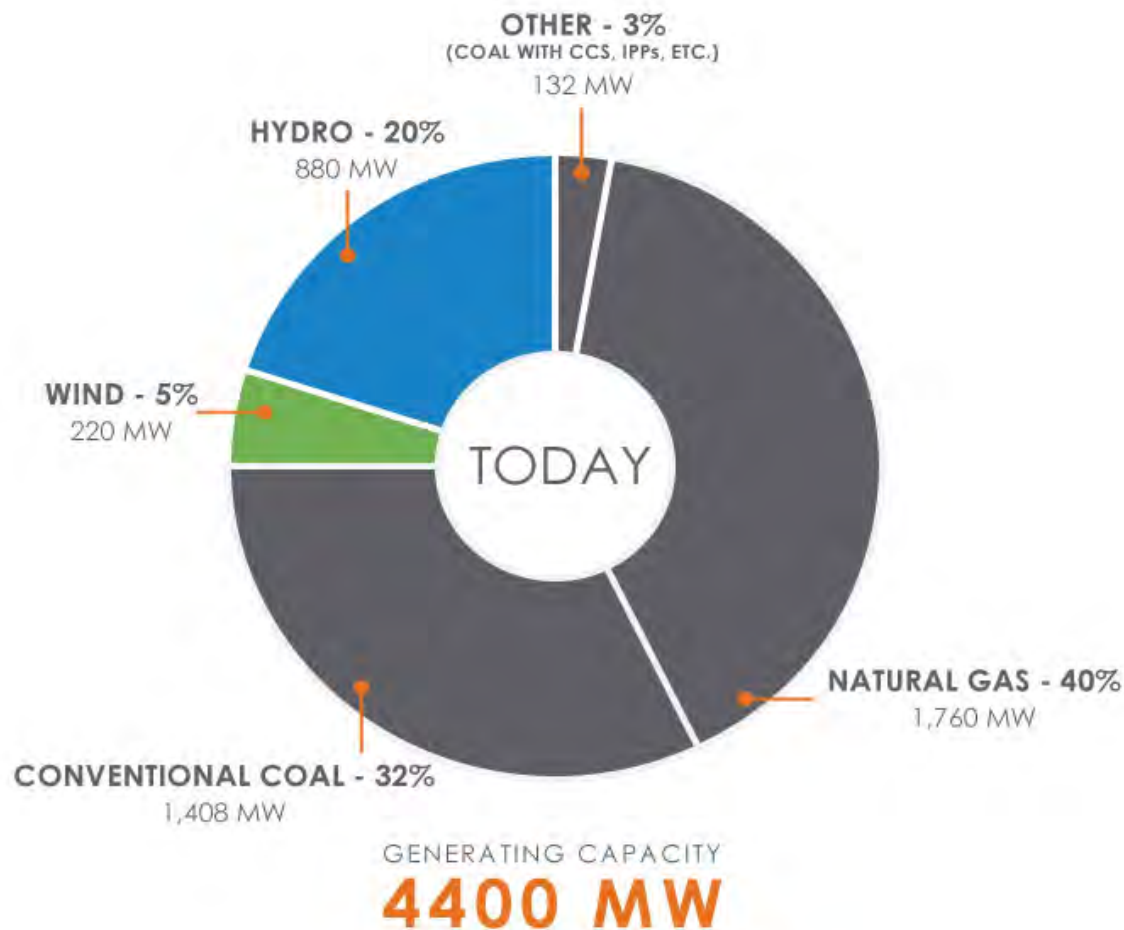


AGENDA

- Introduction
- Site Selection
- Natural Gas Generation Overview
- Environmental Considerations
- Next steps
- Discussions/Questions

INTRODUCTION

GENERATING CAPACITY - TODAY



OUR KEY CHALLENGES

- Demand for power growing significantly
- Aging system requires annual \$1 billion investment
- Emissions regulations eliminate one of our primary **baseload** power sources: coal without carbon capture
- Adding more renewable (but **intermittent**) generation sources

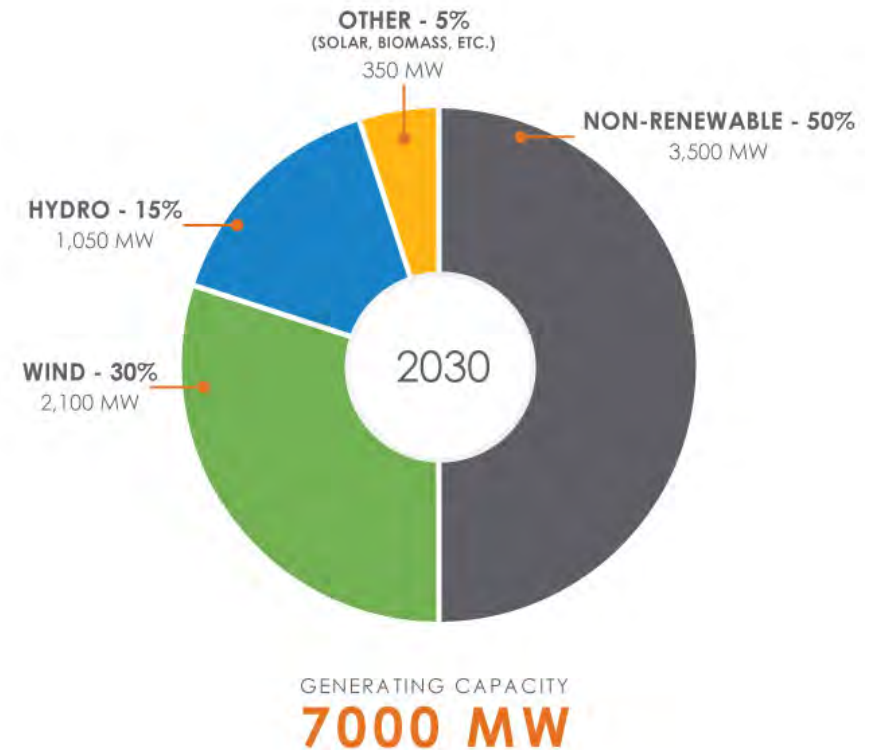
POTENTIAL GENERATING CAPACITY - 2030

SaskPower's goal is to reduce GHG emissions by about 40% from 2005 levels by 2030.

To help our emissions reduction goal, SaskPower has set a goal to have up to 50% of our power generation capacity from renewable sources by 2030.

We'll meet this target by:

- adding more wind power
- installing about 60 megawatts of utility scale solar by 2021.
- Looking at the potential for more hydro projects in Saskatchewan as well as importing hydro from other provinces.



ELECTRICAL GENERATION OPTIONS

- SaskPower has a wide range of electrical generation options to meet Saskatchewan's electrical supply.
- The ideal supply portfolio:
 - Meets our emission and renewable targets; and
 - balances cost, reliability and sustainability.
- Renewable generation will play a large role in the future plans.
- Natural gas generation supports the development of intermittent renewable generation due to its flexibility.

SITE SELECTION

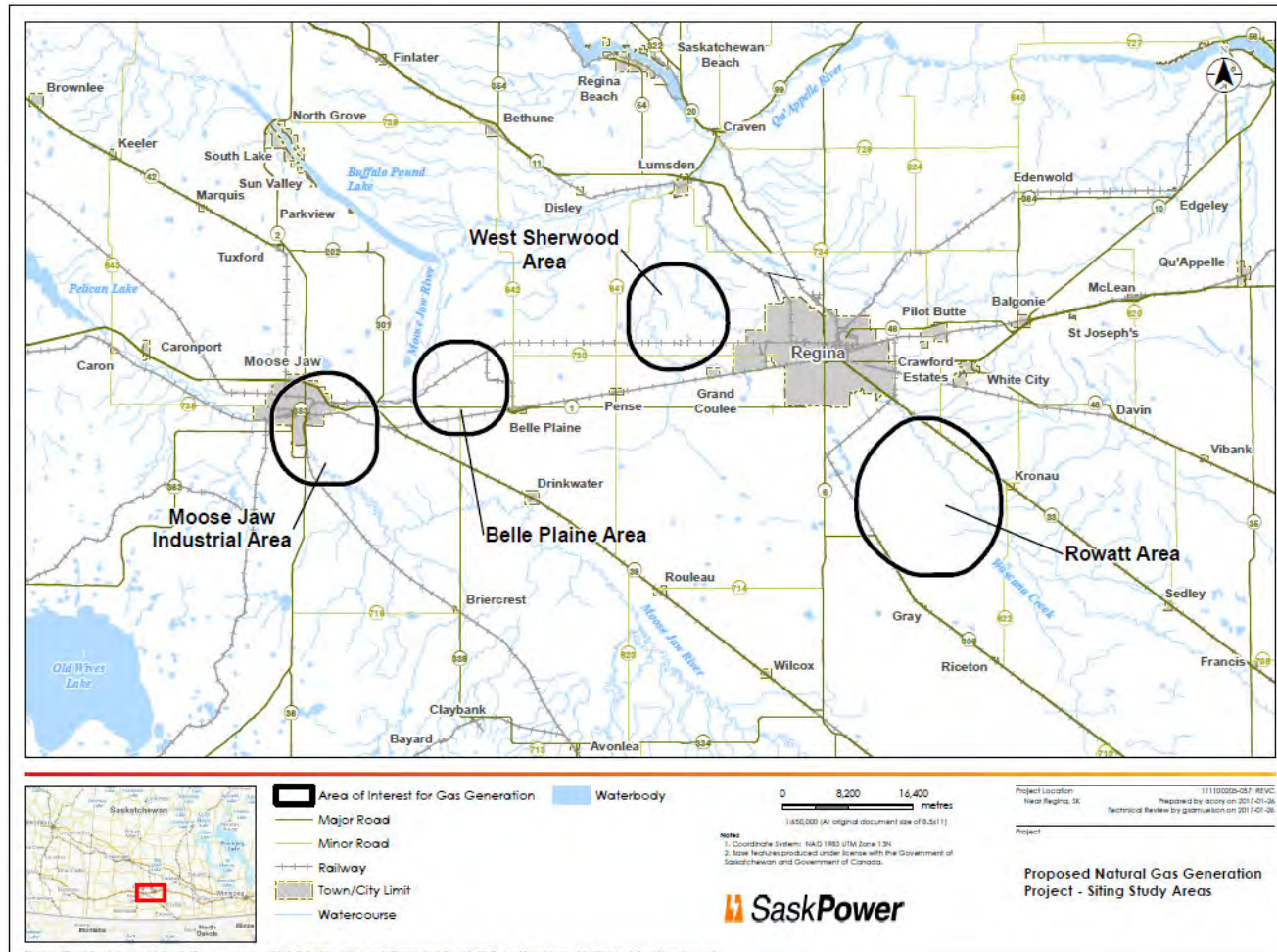
SITE SELECTION INTRODUCTION

- SaskPower's objective is to select a site or site(s) for the future/potential development of a natural gas fired facility in order to meet future demand when it is needed.
- At this time it is anticipated that a future gas-fired plant could be needed as soon as 2022. However, it is important to note that the schedule may fluctuate depending on electricity demand in Saskatchewan and other factors.
- The size of the plant is still to be determined. SaskPower is reviewing options around 350 MW, similar to the Chinook Power plant and is considering options of developing a larger facility (approx. 700 MW).
- SaskPower continues to monitor all generation options.

BENEFITS OF PRESELECTING A SITE OR SITES

- The next new natural gas generation site will be best suited to meet electric system needs.
- Gas and electrical costs can be optimized.
- Local communities will be able to incorporate the potential power plant into their land use plans.
- Positions SaskPower to ensure future generation and transmission system capacity is available and enables SaskPower to effectively respond to future load growth.

AREAS OF INTEREST

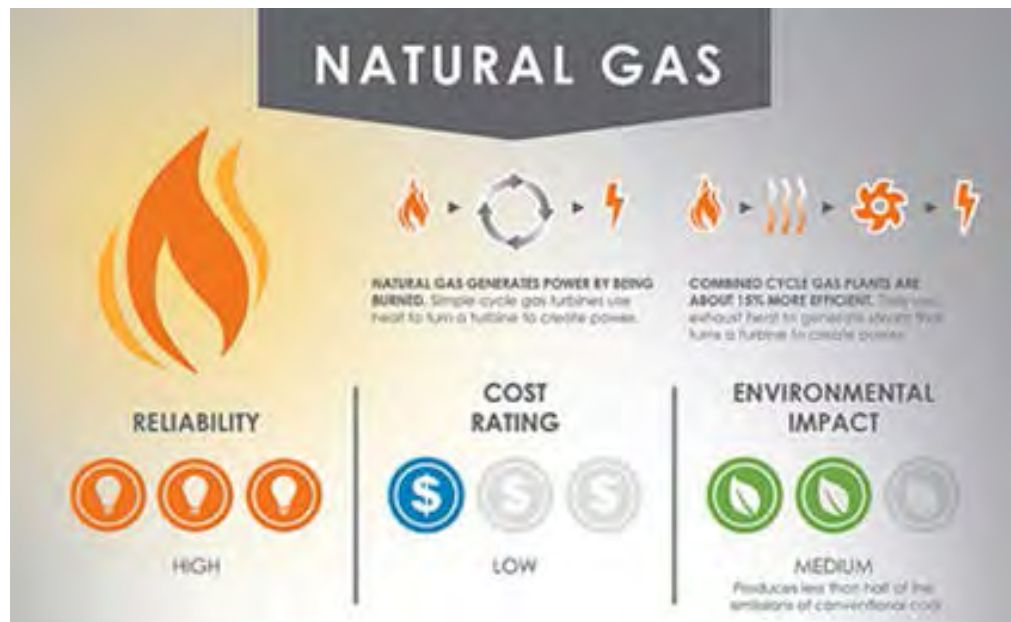


SITE SELECTION PROCESS

- Analysis will be conducted in the areas of interest to select potential sites for new natural gas generation based on:
 - Availability and cost of the fuel supply infrastructure (gas pipeline).
 - Exploratory cost of connecting to the transmission grid.
 - Water availability at the site for a combined cycle gas plant.
 - Wastewater Management
 - Environmental impacts associated with construction, operation and maintenance of the facility.
 - Constructability within the area of the site.
 - Accessibility to the site location.

Natural Gas Generation Overview

NATURAL GAS HELPS US ADD RENEWABLES



- Lower CO₂ emissions
- Shorter build time
- Provides ideal back-up to wind/solar

APPLICATIONS OF NATURAL GAS GENERATION

Combined Cycle

- Provides intermediate and base-load capability
- Gas is utilized more efficiently
- Load following capability
- Lower emissions output per KW

Simple Cycle

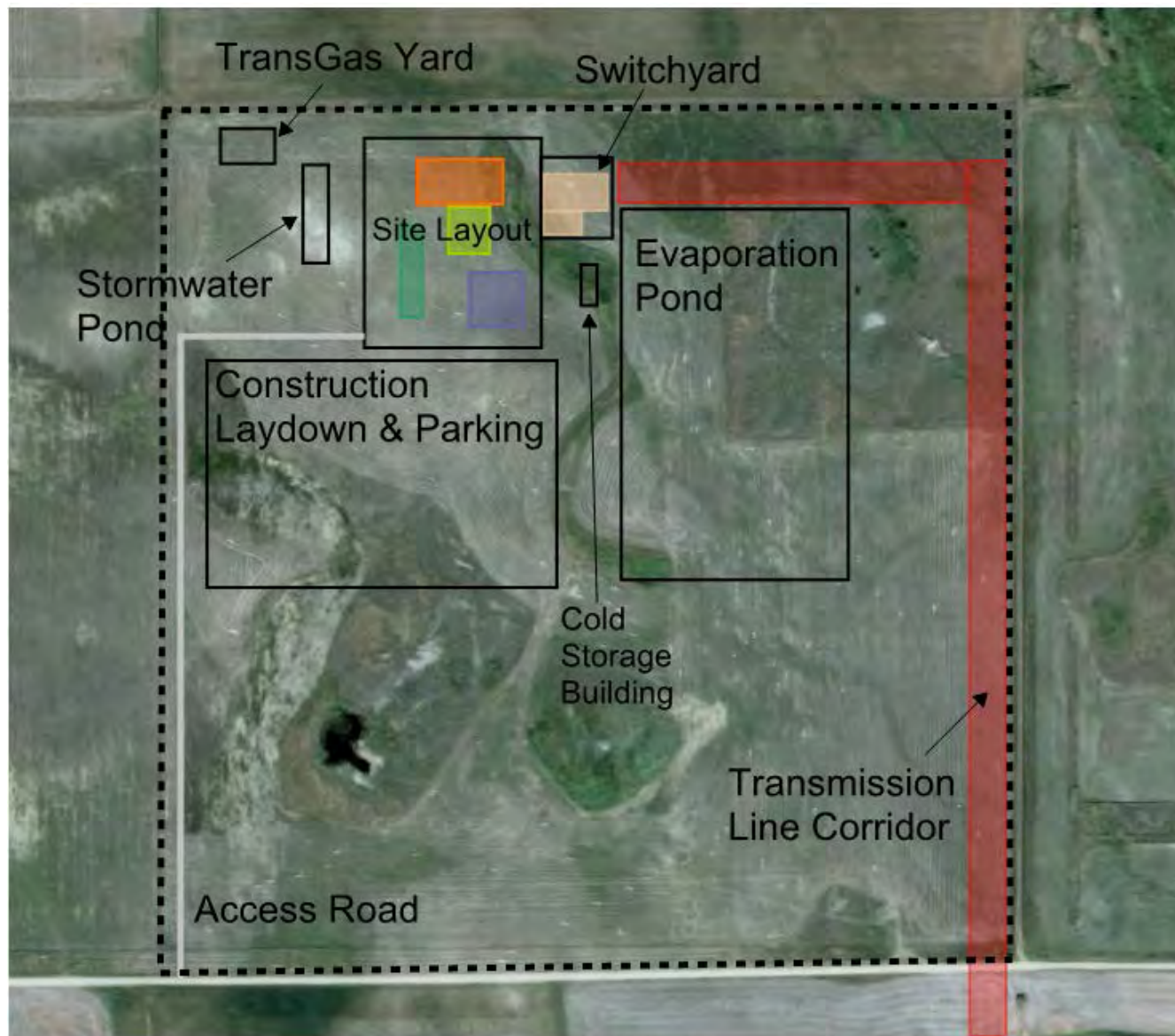
- Provides peak load and load following capability
- Provides fast start-up
- Faster and less expensive to construct
- Less equipment, smaller footprint
- Less water usage

COMBINED CYCLE NATURAL GAS FACILITY EXAMPLE



North Battleford Generating Station - Combined Cycle Power Plant, 2013 16

Example: CHINOOK GENERAL ARRANGEMENT



- Gas Turbine/HRSG
- Steam Turbine
- Admin & Water Treatment
- Air Cooled Condenser

- Typical Footprint (350 MW plant) – approximately 40 to 75 acres (plant, construction facilities, parking, laydown area).
- Evaporation pond may or may not be needed.
- Larger options (~700 MW) – close to a quarter section – if an evaporation pond is needed.

SIMPLE CYCLE LAND REQUIREMENTS

- Typical Footprint – 7 to 15 acres to support the plant, construction facilities, parking and laydown area.
- SaskPower purchased approximately 40 acre parcels for the development of its last two simple cycle natural gas facilities.



Ermine Power Station (2 x LM6000PD)

Environmental Considerations

ENVIRONMENTAL CONSIDERATIONS

- Noise – A new gas generating facility will be required to meet recognized noise regulations. The effect on nearby residences is determined performing noise modeling.
- Air – A new gas generating facility will be required to meet Saskatchewan air quality standards. Air emissions modeling is completed to confirm compliance.
- Water – Water assessments will be undertaken to determine the water supply source and confirm the site's capability to support the natural gas generation facility.
- Environmental Impact Analysis - A new generating facility will have to assess the potential impact on socio-economical and environmental components.
- Other Environmental Considerations
 - Review under The Canadian Environmental Act may be required for federal approval.
 - Review under The Environmental Assessment Act (provincial) will be required for provincial approval.

MAJOR NOISE SOURCES (unmitigated)

The table below identifies the major noise sources from a combined cycle power plant and typical sound levels at 120 metres.

Equipment Name	dBA at 120 metres
Gas Turbine – Combustion Air Inlet (with 16' silencer)	42
Gas Turbine – Generator Set	62
Steam Turbine – Generator Set	58
Air Cooled Condenser	55
Heat Recovery Steam Generator – Casing (including transition duct)	61
Heat Recovery Steam Generator – Stack (unmitigated)	67
Lube Oil Cooler (standard)	54
Transformers	40

Noise from the Gas Turbine Enclosures, Steam Turbine Generator and Heat Recovery Steam Generator Casing can be minimized when located within a building.

TYPICAL NOISE LEVELS

Table 2
Typical Noise Levels

Noise Source	dB(A)
pneumatic chipper at 1 metre	115
hand-held circular saw at 1 metre	115
textile room	103
newspaper press	95
power lawn mower at 1 metre	92
diesel truck 50 km per hour at 20 metres	85
passenger car 60 km per hour at 20 metres	65
conversation at 1 metre	55
quiet room	40

Source Canadian Center for Occupational Health and Safety

NOISE MITIGATION TECHNIQUES

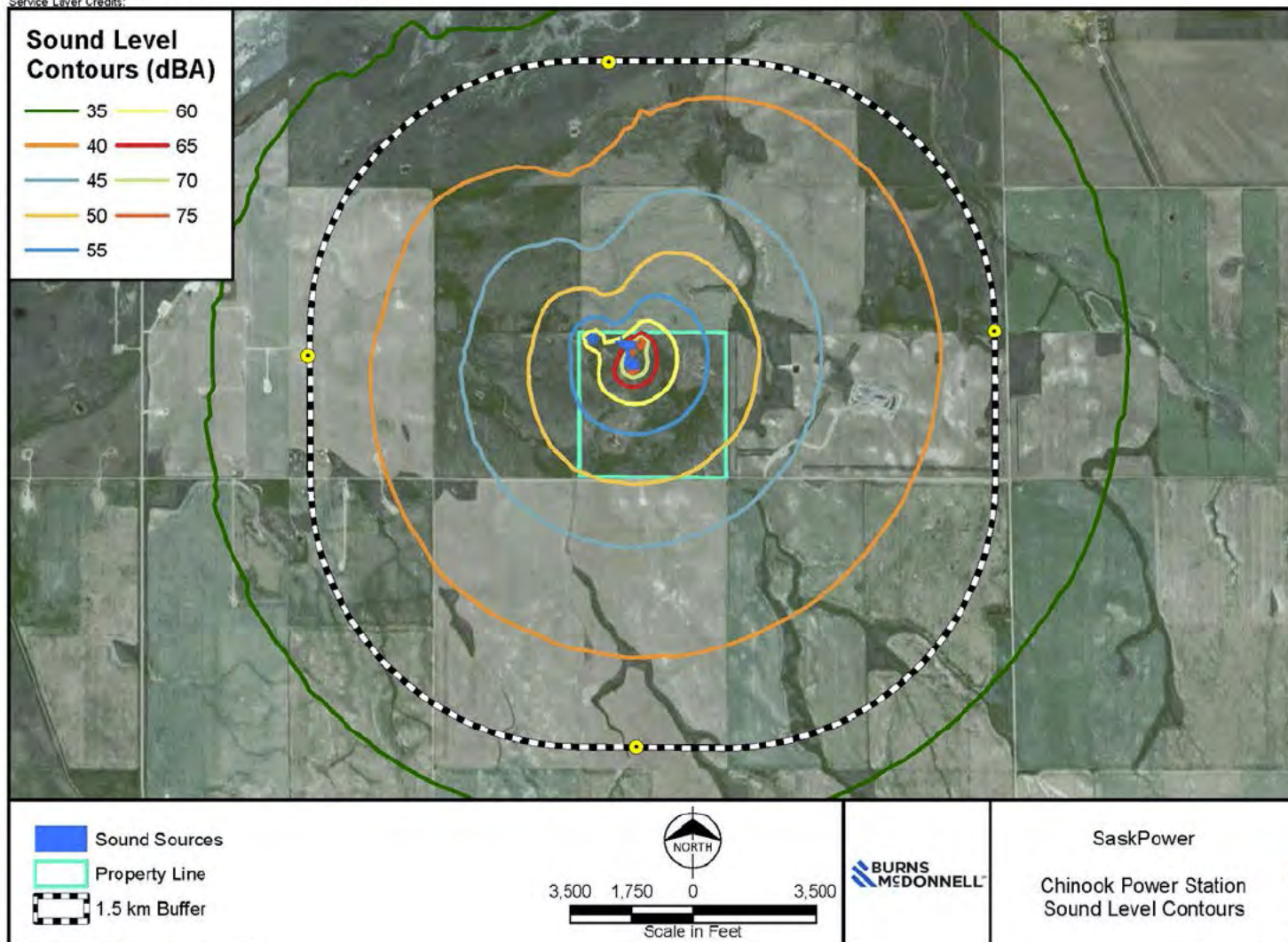
- **Equipment Specification** – Most equipment is specified to meet 85 dBA at 3 feet. More stringent requirements can be imposed on the equipment suppliers if necessary to meet the standard. For outdoor equipment it is common to specify noise levels at a distance of 120 metres. The ACC can be specified to meet 52 dBA at 120 metres.
- **Facility Orientation** – Facility can be oriented to minimize the noise effects at specific receptors (residences) by directing noise away from them and by using facility building to screen the noise.
- **Equipment Location** – Most of the equipment on the site is expected to be within buildings or enclosures which helps to limit noise levels at site boundaries.
 - Buildings – The majority of the noise sources are expected to be located within a building including the gas turbine generator, HRSG, steam turbine generator, and pumps.

NOISE MITIGATION TECHNIQUES (cont'd)

- **Enclosures** – Outdoor equipment can be installed in enclosures to help mitigate noise.
- **Location on site** – Major noise sources that cannot be located in a building include the Gas Turbine Generator Air Intake, Heat Recovery Steam Generator Stack, Lube Oil Cooler and the Air Cooled Condenser. During the design of the plant layout, special consideration can be taken to ensure that this equipment is located such that the contribution to the overall noise levels at the site boundaries is limited to ensure noise standards are met.
- **Silencers** – Silencers can be included in the plant design to further limit noise levels. Silencers are commonly specified for the stack, gas turbine air intake, building ventilation as well as steam vents.
- **Noise barriers** – Noise barriers can be constructed on site between the equipment and the site boundary as necessary to further reduce noise levels.

Example: PROJECTED CHINOOK OPERATION NOISE LEVELS

Path: G:\Projects\Air-Noise Dept\Project Files\SaskPower\2015 Saskpower\Noise Modeling\GIS\Presentation Figure Layout.mxd irbrewe 10/5/2016
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AIR QUALITY

- Major air emissions contaminants from a natural gas generation facility include:
 - NO_x (NO₂ and NO)
 - PM_{2.5}
 - CO
- A new facility must comply with Saskatchewan's Ambient Air Quality Standards (AAQS) and Canada-Wide Standards (CWS)

AIR DISPERSION MODELING

What is an Air Dispersion Model?

- Air dispersion modeling is the mathematical simulation of how air pollutants disperse in the ambient atmosphere from emission sources.

The Air Dispersion Models will be used for air quality analysis

- The AERMOD model is recommended by Saskatchewan Ministry of Environment for this purpose.
- It is an AMS/EPA Regulatory Model (AMS/EPA: American Meteorological Society/Environmental Protection Agency)

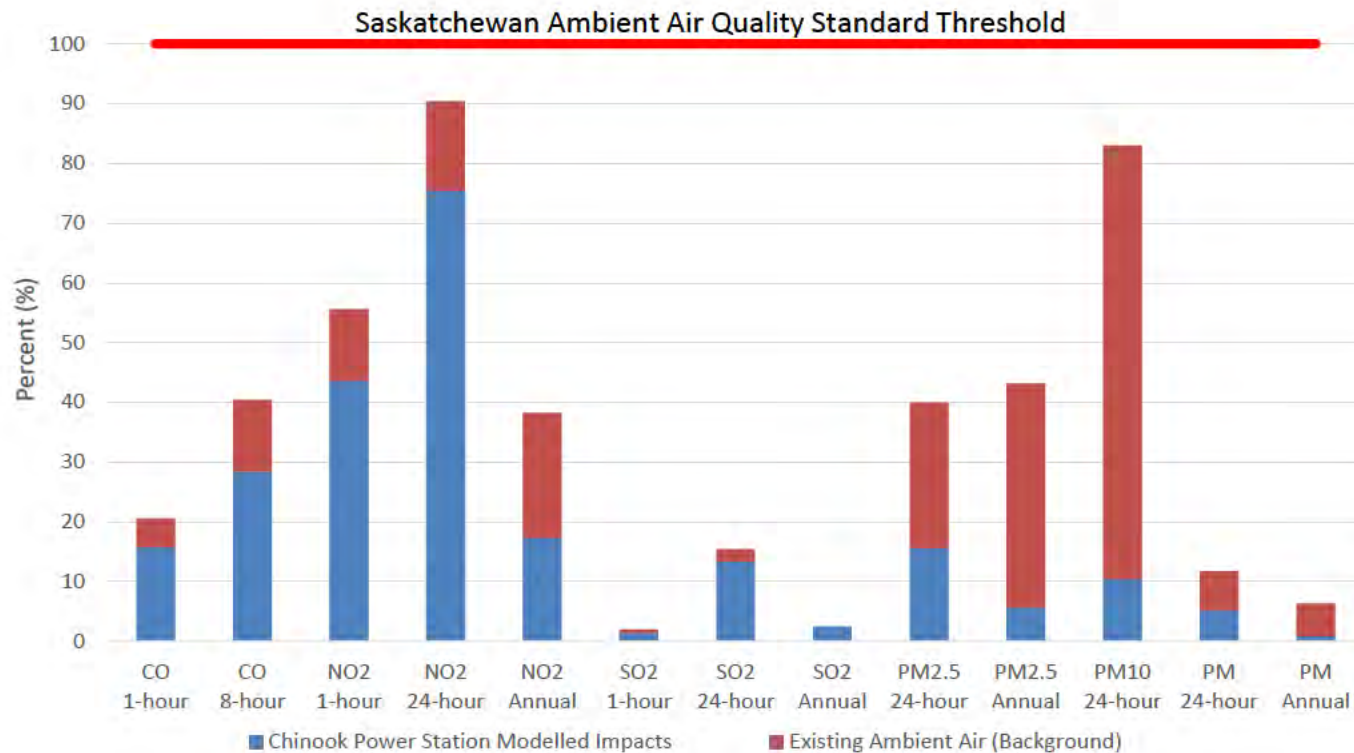
AIR DISPERSION MODEL

- **Inputs:** Emission sources, buildings, meteorological data, geophysical data (terrain and surface roughness), and user-defined receptor grid.
- **Outputs:** Maximum air impacts at a single receptor for a specific time and pollutant averaging period (e.g. hourly and annually).

MODELLED IMPACTS

- Saskatchewan Ambient Air Quality Standards (SAAQS) established so risk to human health and ecosystem health are minimized.
- The modelled impacts include ambient background concentrations, which is the portion of ambient concentration due to natural and nearby sources. These concentrations were provided by the Saskatchewan Ministry of Environment.
- The modelled results represent the maximum impact at a single receptor for a specific time and averaging period.

Example CHINOOK MODELLED IMPACTS



NEXT STEPS

- Acquire land options
- Conduct site assessments and evaluations
- Additional public consultation
- Recommend land purchase

OPEN HOUSES

Four public open house information sessions are planned as follows:

Pense Town Hall

Pense, SK

Wednesday, February 15, 2017

Belle Plaine Town Hall

Belle Plaine, SK

Thursday, February 16, 2017

Wakimow Valley Sportsman
Centre

Moose Jaw, SK

Wednesday, February 22, 2017

Kronau Memorial Hall

Kronau, SK

Thursday, February 23, 2017

All events are come and go from noon until 7:00 p.m.

Questions?

