TRANSMISSION ACCESS REFORM

PUBLIC FORUM ON SIMPLIFIED MODEL

22/09/2020

AEMC

Agenda

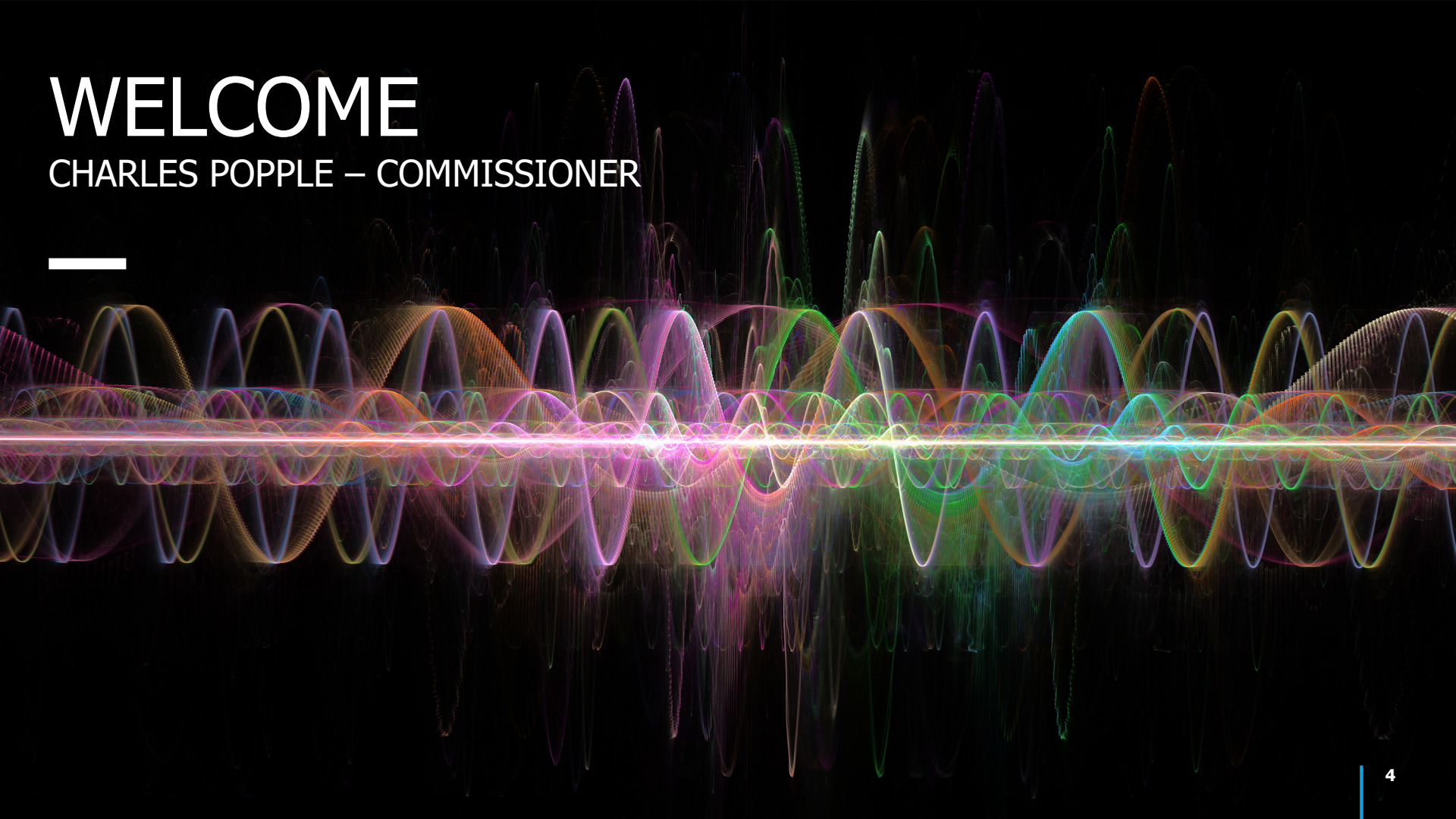
1.	Introduction and ground rules – Victoria Mollard *(5 mins)*
2.	Welcome – Charles Popple *(5 mins)*
3.	Overview of simplified model– Ben Davis *(5 mins)*
4.	NERA simplified model of access reform – George Anstey & Michael Dawes*(90 mins)* Q&A
5.	Close and next steps – Michelle Shepherd *(5 mins)*

Format for the forum

- You will have the option to make comments or ask questions via the Q and A function on your screen.
- When asking questions or presenting comments, please relate them to the purpose and scope of the meeting.
- In the Q and A area please first indicate whether you are asking a question or making a comment, then add your remarks, and then finally please include your name and organisation at the end.
- We will attempt to answer all questions during the scheduled Q and A sessions - if we don’t get to your question during the forum, we will follow up after the event.
- Comments will also be raised during the Q and A sessions. Where possible, and time permitting, participants will be invited to present their comments - if this happens, your mic will be taken off mute, and you will be asked by the presenter to make your comment.

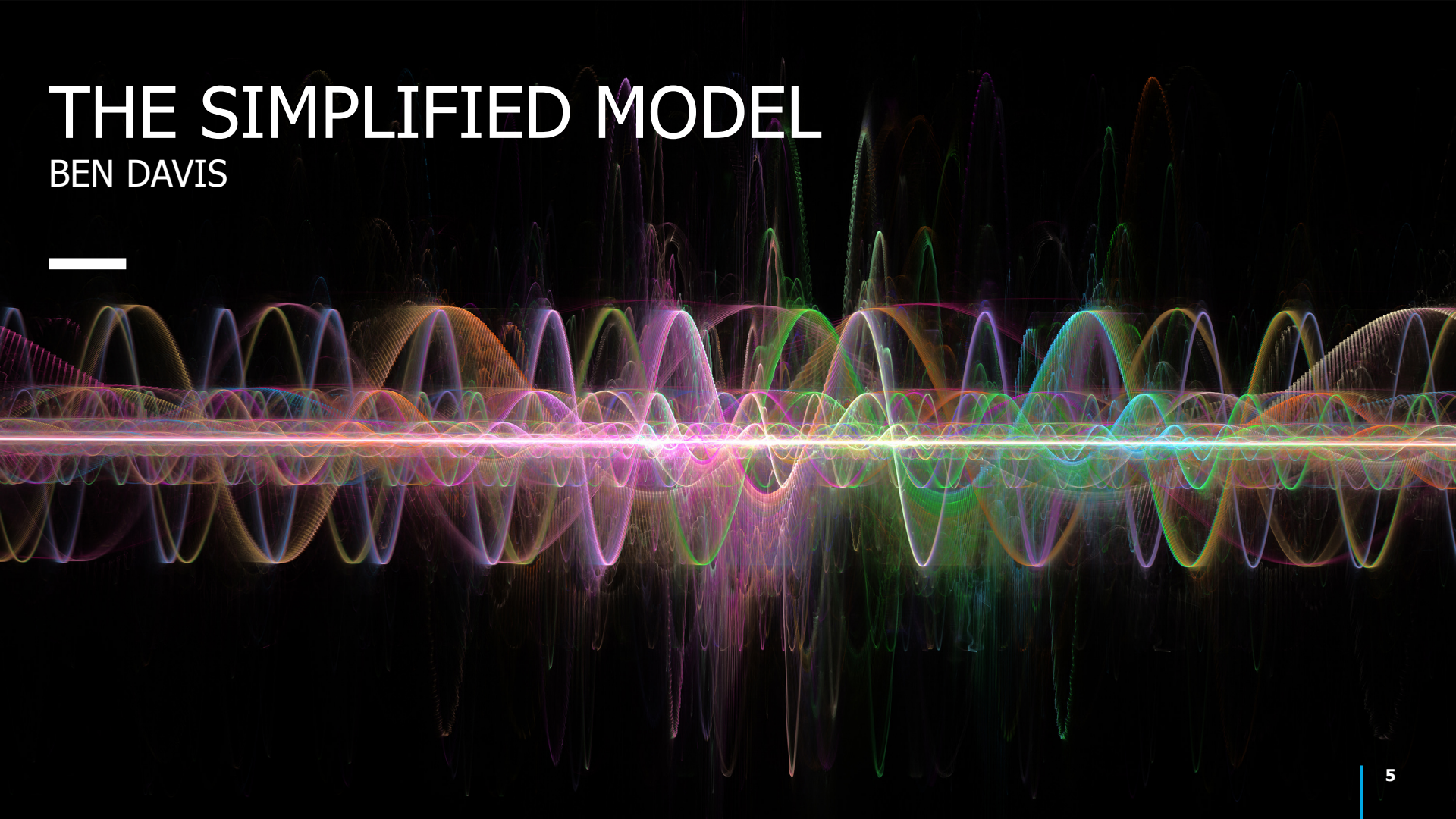
WELCOME

CHARLES POPPLE – COMMISSIONER



THE SIMPLIFIED MODEL

BEN DAVIS



Overview of the simplified model

We have heard that stakeholders want to understand the reforms better

So we asked NERA to develop a simplified model of the reforms in action – illustrating how specific elements of the reforms operate and how they impact different participants in different ways

The model would be available for stakeholders to download, scrutinise and understand at their convenience.

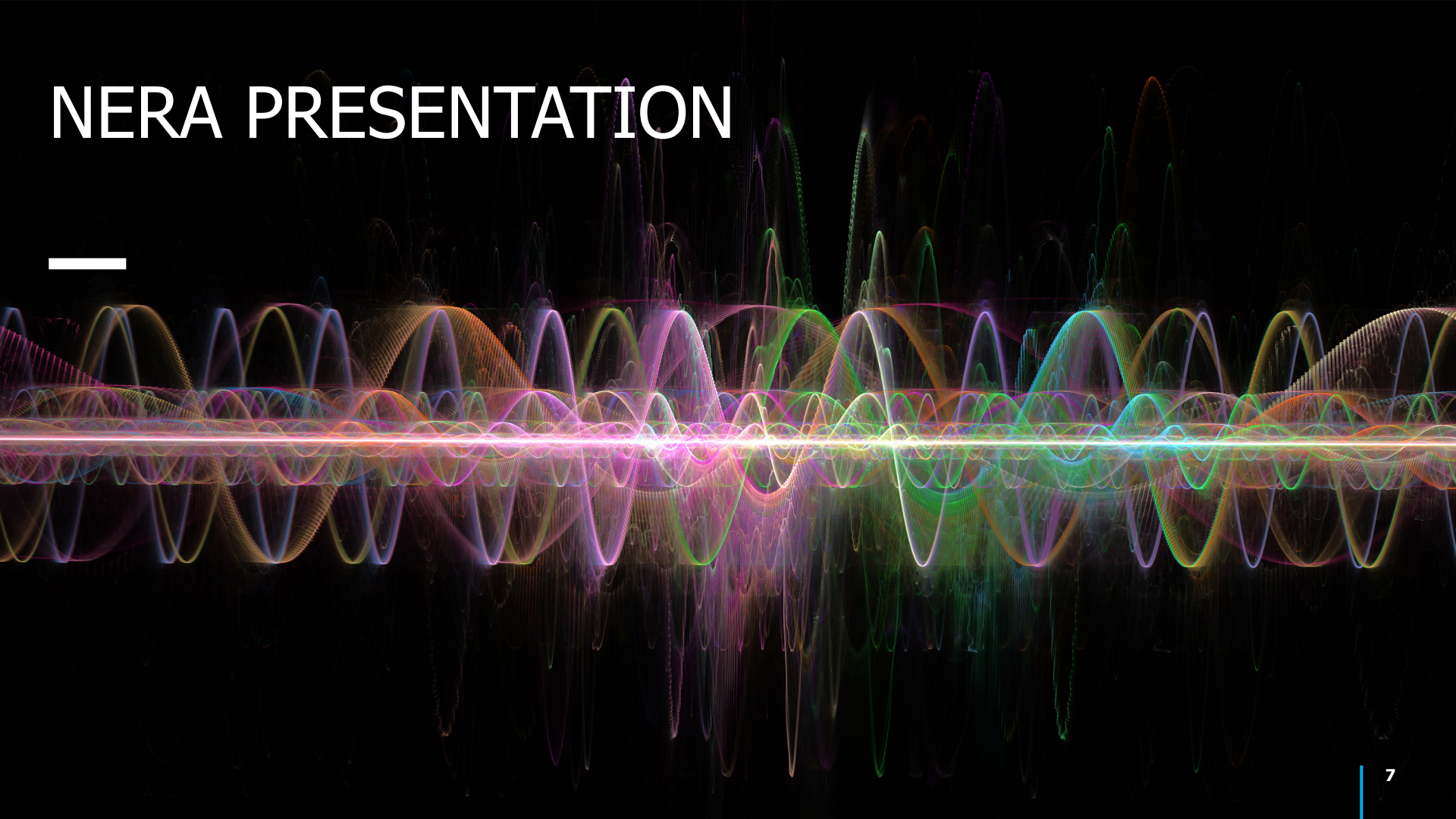
The model was to include a small number of nodes, less than ten, demonstrating settlement outcomes given:

- **Demand**
- **Supply bids**
- **FTR holdings**
- **Network configuration and capacity**

The model is designed to have a user-friendly interface for stakeholders to play with the model, allowing them to change inputs and observe outputs. With outputs including:

- **LMPs at each node**
- **VWAP**
- **Settlement residue**
- **FTR payouts**
- **Interactions with existing contracts**

NERA PRESENTATION



NERA
ECONOMIC CONSULTING

SIMPLIFIED MODEL OF ACCESS REFORM IN ACTION

22 SEPTEMBER 2020

George Anstey
Director

Will Taylor
Associate Director

Michael Dawes
Economic Analyst

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Agenda

1. Model Overview and Purpose
   - Pause for Questions
2. Scenario 1 and Inputs Overview
   - Pause for Questions
3. Scenario 2
   - Pause for Questions
4. Scenario 3
   - Pause for Questions
5. Scenario 4
   - Pause for Questions
6. Scenario 5
   - Pause for Questions
7. Scenario 6 and Generator Financial Outcomes
   - Pause for Questions
8. Model Extensions and Wrap-up

1 Model Overview and Purpose

Purpose of the Model

The model illustrates how the mechanics of locational marginal pricing and financial transmission rights work using a simplified model

What does the model do?

- The model illustrates the calculation of locational marginal prices (LMPs) for a simplified network
- The model illustrates the influence of congested transmission constraints on the calculation of LMPs
- The model allows the user to examine the financial outcomes for generators within the simplified model
- The model illustrates how financial transmission rights (FTRs) would change the financial outcomes for generators

What does the model not do?

- The model is not representative of the National Electricity Market
- The dispatch engine is simplified and the results represent a simplified dispatch pattern
- The model does not explain differences between the current market operation and the reform
- The model does not explain how FTRs are distributed or sold

Structure of the Simplified Model

The model is comprised of three panels

Model Inputs

In this section, you can customise the setup of the nodal market including specifying generation capacities and load at each node, as well as transmission capacity connecting the nodes. After setting inputs, loading a scenario, or choosing to randomise inputs, you may then solve the model.

Model Results

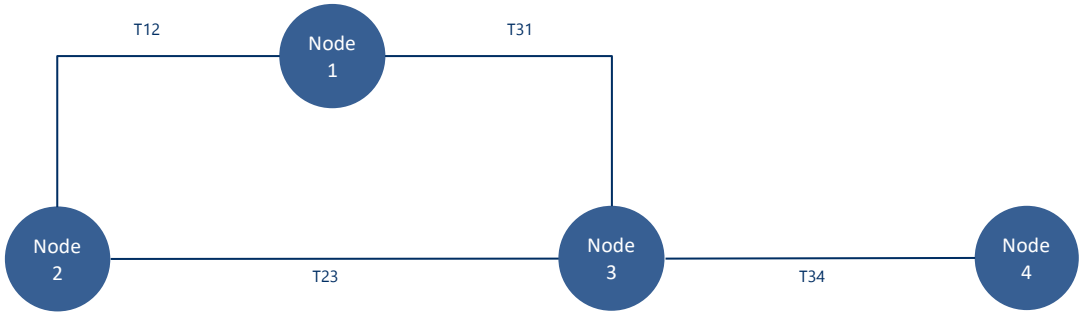
In this section, you can review the results from the model run. In particular, you can see the outturn LMPs, volume weighted average price (VWAP) as well as generation, load, and flows across/between nodes. In addition, you can examine a node in detail.

Generator Financial Outcomes

In this section, you can examine the financial outcomes for any generator in the model. You can see the FTR pay-outs resulting from the model run, as well as the calculation of settlement residue. You can also choose the size of the generator, where it is located, and examine how contract market positions and holding FTRs affects the financial outcomes for the generator.

The Network Typology in the Model

The model is comprised of four nodes connected by four transmission lines

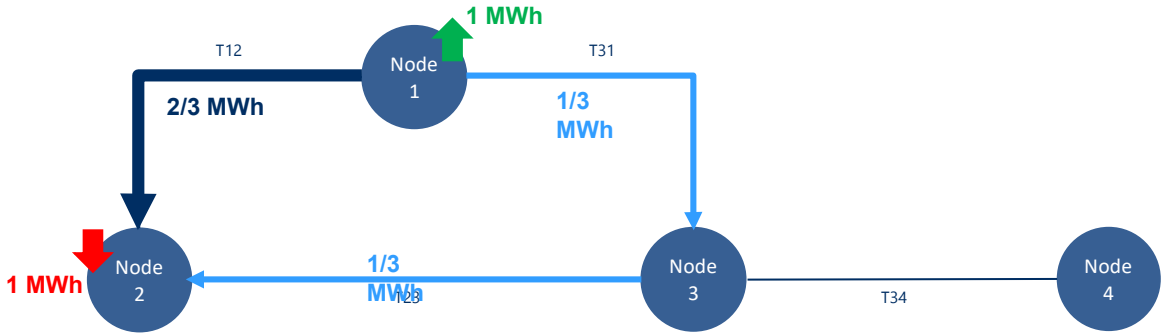


Key Model Assumptions

- Each node may contain generation and/or load
- There are three fuel types of generation allowed in the model, each with their own marginal cost of generation
- All generators are assumed to bid the marginal cost of generation which determines how they are dispatched
- Transmission losses are assumed away for simplicity, but flows obey Kirchhoff's law
- The Value of Lost Load is set at $15,000 per MW

Power Flows

Power flows in the model obey Kirchhoff's Law



Explaining Model Power Flows

- Suppose that **1 MWh** of power is injected at Node 1 to meet **1 MWh** of load at Node 2
- We assume that each transmission line in the model has equal characteristics other than capacity (e.g. reactance is the same)
- Power faces twice the "resistance" flowing from Node 1 to Node 2 via Node 3 than flowing directly from Node 1 to Node 2
- Therefore, for every 1 MWh of power injected at Node 1 and taken off at Node 2:
  - **2/3 MWh** flows on T12 from Node 1 to Node 2; and
  - **1/3 MWh** flows from Node 1 to Node 2 via Node 3

Model Prices

There are two main sets of prices calculated in the model

Locational Marginal Prices (LMP)

The locational marginal price or LMP is determined at each node and is set by the system marginal cost to serve an additional 1 MW of load at the node:

- If load at Node 1 is 100 MW, then the LMP is the additional cost that would be incurred to serve 101 MW of load at Node 1
- If load at Node 1 is 0 MW, then the LMP is the additional cost that would be incurred to serve 1 MW of load at Node 1

Volume Weighted Average Price (VWAP)

The volume weighted average price or VWAP is set for the entire system (because our model contains only one region) and is calculated as a load-weighted average of LMPs across nodes.

Formally:

$$\text{VWAP} = \frac{(\textit{Load @ Node 1 x LMP @ Node 1}) + (\textit{Load @ Node 2 x LMP @ Node 2}) + \ldots + (\textit{Load @ Node 4 x LMP @ Node 4})}{(\textit{Load @ Node 1} + \textit{Load @ Node 2} + \ldots + \textit{Load @ Node 4})}$$

We have Included Six Pre-Loaded Scenarios

The scenarios increase in complexity, and illustrate theoretical outcomes of locational marginal pricing across patterns of dispatch and congestion

Pre-loaded Scenarios

See the User Guide for an Explanation of the Results

- Scenario 1 One Node Dispatch
- Scenario 2 Two Node Dispatch
- Scenario 3 No Congestion
- Scenario 4 Congestion on Branch
- Scenario 5 Congestion on Loop
- Scenario 6: Congestion on Loop and Branch

Questions

2 Model Use and Scenarios

3 Model Extensions

The Model Can Be Easily Extended

The model is designed to be the simplest model to illustrate the main mechanics in the reform world, but may easily be extended to incorporate other features

Generator outages, or lack of wind/sun for solar or wind production	Multiple regions, or FTRs to other regional VWAPs	More hours of dispatch
A wider array of hedging products e.g. Peakload, Cap products	Other network layouts	Portfolios of generation
Purchasing of FTRs, two-way FTRs etc.	More representative balance sheet structures	More nodes/generator fuel types

QUALIFICATIONS, ASSUMPTIONS, AND LIMITING CONDITIONS

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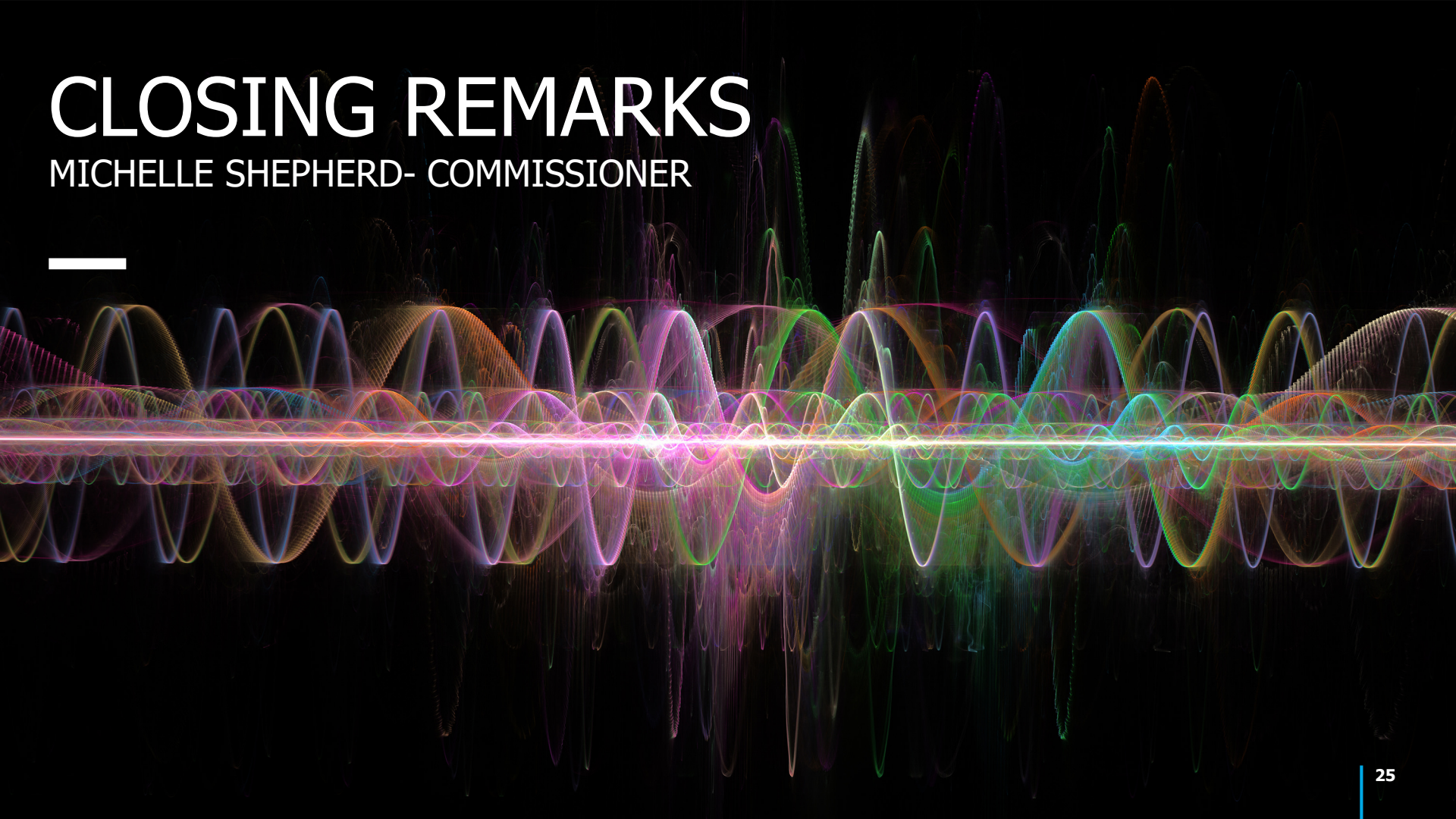
CLOSING REMARKS

MICHELLE SHEPHERD- COMMISSIONER



We want to hear your views on access reform

- Submissions are due on 19 October 2020
- We are always happy to chat – reach out to one of the team