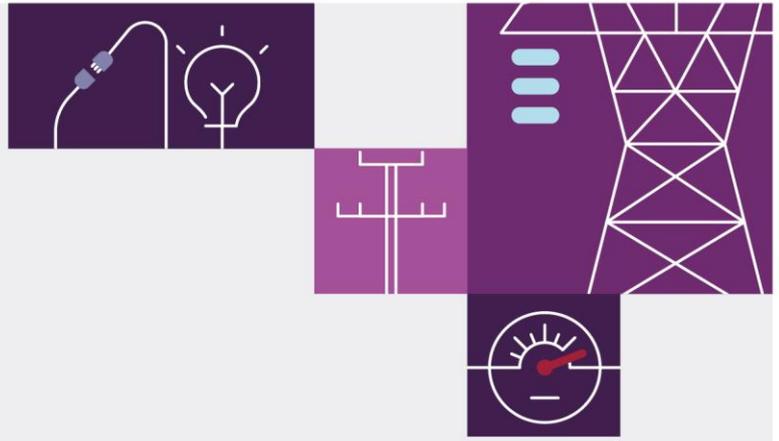# Final 2022 ISP Market Model Instructions

June 2022

A guide to using the published
2022 ISP PLEXOS model

Important notice

Purpose

AEMO has prepared this document to assist stakeholders in interpreting and using input data produced for the purposes of modelling the National Electricity Market (NEM) for the 2022 Integrated System Plan (ISP).

AEMO's dataset covered by this guide is configured for use in the PLEXOS Integrated Energy Model software; the PLEXOS database itself containing the market models underpinning the 2022 ISP is also published as part of this data package.

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This data package has had any and all confidential data removed, and as such the model may not replicate the exact modelled outcomes produced by AEMO as published in the 2022 Integrated System Plan report.

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This data package (or the conclusions reached in using it) does not include all the information that an investor, participant or potential participant in the national electricity market might require and does not amount to a recommendation of any investment.
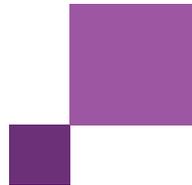
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Version control

Version	Release date	Changes
1.0	30/06/2022	Initial release

AEMO acknowledges the Traditional Owners of country throughout Australia and recognises their continuing connection to land, waters, and culture. We pay respect to Elders past, present and emerging.

Contents

Tables

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1   Final 2022 ISP DLT Model

This document outlines how to setup the Detailed Long Term (DLT) model and its input assumptions that AEMO makes publicly available to stakeholders.

The capacity outlook process uses two interacting models to address different aspects of long-term optimisation. The Single-Stage Long-Term Model (SSLT) and DLT.

The DLT model determines outcomes for generation expansion and retirement, transmission expansion, storage, and dispatch options. The DLT model takes some outputs from the SSLT and incorporates them as inputs to the optimisation.

The DLT allows a chronological optimisation of each day and ensures a more detailed representation of demand and VRE variability than the SSLT. Detailed information about the DLT and the other models used within the 2022 ISP can be found in the "2021 ISP Methodology" report[1].

1.1   Market model and data package content

The publication of the 2022 ISP DLT Model comprises:

- One PLEXOS database in .xml format for each scenario below, with data which corresponds to the optimal development path and input assumptions for each scenario:
    - *Progressive Change*
    - *Step Change*
    - *Slow Change*
    - *Hydrogen Superpower*
- Demand, renewable generation, timeslice specifications, and load subtracter traces in PLEXOS format.

1.1.1   Supporting data: Trace Files

AEMO optimises expansion decisions across multiple historical weather years known as "reference years" to account for short- and medium-term weather diversity. AEMO uses a "rolling reference years" approach to capture weather diversity in the capacity outlook models.

Consistent with the rolling reference years approach, these traces were obtained by combining time series of ten historical weather years. The reference years were matched to the SSLT and DLT planning horizon in the following sequence described in Table 1 with the 10-year sequence repeating in the same order until the end of the outlook period.

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1   2021 ISP Methodology Report available at: https://aemo.com.au/-/media/files/major-publications/isp/2021/2021-isp-methodology.pdf.

Table 1   Rolling reference years sequence in capacity outlook models

Planning Year	Reference Year	Hydrological Reference Year	Variable Renewable Energy (VRE) Reference Year
2021-22	2010-11	2010-11	2010-11
2022-23	2011-12	2011-12	2011-12
2023-24	2012-13	2012-13	2012-13
2024-25	2013-14	2013-14	2013-14
2025-26	2014-15	2014-15	2014-15
2026-27	2015-16	2015-16	2015-16
2027-28	2016-17	2016-17	2016-17
2028-29	2017-18	2017-18	2017-18
2029-30	2018-19	2018-19	2018-19
2030-31	2019-20	2019-20	2019-20
2031-32	2014-15[2]	2006-07 (Dry year)	2014-15

2 Configuring the Final 2022 ISP Model

The following section outlines the steps needed to set up the 2022 ISP DLT PLEXOS market model, including the configuration of the input data package. The PLEXOS version used for simulating the 2022 ISP DLT is the PLEXOS 8.3 Release 9 (R09)[3].

The step-by-step guide is documented below:

1. Download the 2022 Final ISP Model zip file from AEMO's 2022 Final ISP webpage[4].

2. Unzip the file 2022 Final ISP Model. This will generate the 2022 Final ISP Model folder.

3. Open the 2022 ISP Model folder. There will be one folder for each of the four scenarios.

4. Download and unzip the three other folders, i.e., 2022 ISP Wind traces, 2022 ISP Solar traces solar, and 2022 ISP Timeslice traces. Those contain wind, solar, and timeslice traces that are the same for all scenarios.

5. Copy the three unzipped folders (wind, solar, and timeslice) and paste them into the Traces folder within the scenario of interest. The Traces folder must contain six folders with the names exactly as shown in Figure 1.

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[2] The dry year traces (2006-07) were replaced with 2014-15 traces for renewable and demand as they were most similar in profile to the 2006-07 year.

[3] The ISP model may be able to be used in other versions of PLEXOS but these have not been tested by AEMO.

[4] See https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp

Figure 1   Content of Traces folder

Name ^

📁 demand
📁 hydro
📁 load_subtractor
📁 solar
📁 timeslice
📁 wind

6. The list and respective content of files is presented in the Table 2 for *Step Change*.

Table 2   Zip files for 2022 ISP *Step Change*

File	Description	File location
2022 Step Change ISP Model	Contains the .xml model for *Step Change*	Placed in the 2022 ISP Step Change folder
PLEXOS_Solverparam	Contains .xml file	Placed in the 2022 ISP Step Change folder
Traces	Contains six folders with traces for demand, hydro, load subtracter, solar, wind and timeslice.	Placed in the 2022 ISP Step Change folder
Demand	Contains half-hourly sub-regional demand traces for operational demand	Placed in the 2022 ISP Step Change\'Traces\demand' folder
Hydro	Contains Hydro daily inflows traces.	Placed in the 2022 ISP Step Change \'Traces\hydro' folder
Load_ subtractor	Contains half-hour load subtracter traces used to improve the accuracy of the approximation of load and VRE output.	Placed in the 2022 ISP Step Change\'Traces\load_substractor' folder
Solar	Constrains half-hourly generation traces for solar	Placed in the 2022 ISP Step Change \'Traces\solar' folder
Timeslice	Contains timeslices traces.	Placed in the 2022 ISP Step Change \'Traces\timeslices' folder
Wind	Constrains half-holy generation traces for wind	Placed in the 2022 ISP Step Change\ 'Traces\wind' folder

7. Open the .xml file in PLEXOS. The model consists of System and Simulation tabs, as shown in Figure 2. The PLEXOS System tab comprises all objects, as well as their memberships and properties. The PLEXOS Simulation tab contains the model object and all the settings used in the simulation.[5]

Figure 2   System tab of the .xml file

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[5] Note that the published *Hydrogen Superpower* model uses a smaller number of load blocks (6) than what was used in the final ISP (8) as some simulation instability was observed when applying 8 blocks on standard desktop machines, resulting in infeasibilities. The number of load blocks can be increased in the Simulation settings.

8. Execute the highlighted model in the Simulation tab, corresponding to *Step Change* CDP12 as shown in Figure 3.
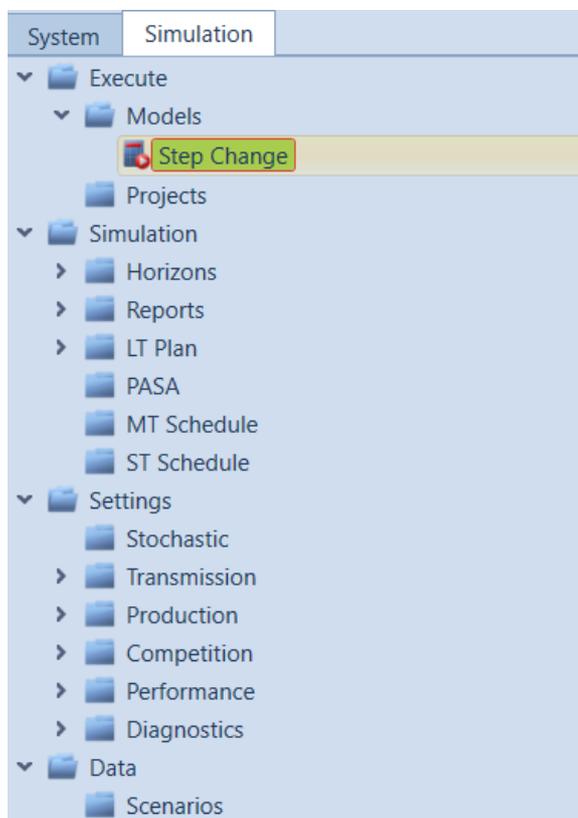
2.1 Further Modelling Details

The size of the problem and the length of the planning horizon require some simplifications in the assumptions, trading off some model accuracy for computational manageability. These simplifications include:

- Aggregating half-hour demand across the 28-year planning horizon into a representative number of load blocks.

- Dividing the optimisation horizon into smaller steps (4 steps of 7 years).

- Using notional transfer limits between sub-regions to simplify network representation.

- Preliminary screening of new entrant generation candidates by optimising the DLT model for a selection of snapshot years to determine if a technology is part of the most economically efficient solution at any time across the planning horizon.

Further information can be found in AEMO's ISP Methodology[6].

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[6] ISP Methodology available at: https://aemo.com.au/-/media/files/major-publications/isp/2021/2021-isp-methodology.pdf.