User Guide: Energy Climate Scenario Catalogue

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2.1.2 Introduction

1.1 Purpose

This User Guide focuses on how to access and use the Catalogue and how it is structured.

For further information on the development of the Catalogue, details of the methodologies applied and the application of the Catalogue, please refer to the Catalogue landing page for further resources.

Please particularly read carefully through the terms of use and disclaimer in the Catalogue (see section 2.1.1) before using the Catalogue and its data.

Throughout this document, concrete examples of use cases are provided in italicized teal text as further clarification.

1.2 Background

The Climate Scenario Catalogue (the Catalogue) is designed to be used in association with and to support the Climate Scenario Reference Approach (the Approach) developed by the Energy Forum to enhance climate risk analysis and disclosure. The Approach was developed by the Energy Forum with the WBCSD Project Team to advance the project objectives and intended outcomes, including increasing the quantity and quality of strategic assessment and disclosure based on climate scenario analysis. It provides a yardstick for Forum members to enhance transparency, consistency, and comparability of scenario analysis in response to the Task Force on Climate-Related Financial Disclosures’ (TCFD) recommendations.¹

The Approach and the Catalogue follow six guiding principles developed by the Energy Forum:

Simplicity: forum members agreed that they did not want to add to complexity by adding new scenarios to the existing “scenario universe.” Instead, the Project focuses on “reference scenario families”, certain existing scenarios and variables, compiled in a “Catalogue” and their application.

Business relevance: by collating information from different sources and perspectives and providing key transition metrics and variables relevant to business, the Catalogue builds a bridge from scenario conditions to business drivers.

Comprehensiveness: offer an approach to scenario analysis that encourages resilience assessment across a range of possible outcomes, including those that align with the Paris Agreement as well as more ambitious (1.5°C) and BAU scenarios.

Neutrality: considers a range of possible future industry and market developments, options and solutions drawn from public scenarios.

Comparability and transparency: It compares different scenario outcomes transparently.

Ease of interpretation: the reference scenario approach is intended to provide a structured, transparent perspective to scenario analysis, the process and results of which can be more easily interpreted and compared by investors.

1.3 Catalogue overview and features

The Catalogue is a live online repository within which certain public climate scenarios are referred to as “catalogued scenarios”. It is a live tool designed to be updated as new and improved climate scenarios are released over time.

Publicly available scenarios from leading institutions were filtered, categorized and augmented for use in the Catalogue. Based on plausibility constraints (e.g. for bioenergy and carbon capture and storage) scenarios were filtered and categorized into scenario families.

1.3.1 Catalogue features

The Catalogue provides the user with three main features:

Scenario Explorer: shows how selected scenarios compare across key variables in ten year intervals between 2020 and 2050 to present the distribution of scenarios within their family to illustrate the range of uncertainty across those scenarios.

Variable Explorer: presents all variables in the Catalogue in their full sectoral and regional disaggregation.

Data Download: offers extraction of selected variables from the Catalogue for further analysis and disclosure.

1.3.2 Scenario Families

The catalogued scenarios have been grouped into climate reference scenario families (families). The families have been identified and implemented to ensure that users compare scenarios of similar climate ambition when conducting their analyses. These are:

- **Paris Ambitious 1.5°C**: Scenarios with outcomes designed to keep temperature rise within 1.5°C above pre-industrial levels with limited/no overshoot

- **Paris Aligned Well-Below 2°C**: Scenarios with outcomes designed to keep temperature rise within 2°C above pre-industrial levels with limited/no overshoot

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2 Overshoot means that temperatures rise above a certain global warming target before falling below it.
- **Current Policies/Business-as-Usual (BAU):** Scenarios that reflect the range of current climate policies and Nationally Determined Contributions (NDCs) or other national pledges, resulting in a temperature rise between 2.5 and 3.5°C by 2100.

A list and description of each scenario within a scenario family is included at the foot of the scenario family page. A full listing of scenarios in the Catalogue is presented in the Forum report and the Technical Documentation.

### 1.3.3 Catalogue Variables

The Catalogue includes more than 6,000 variables for strategic resilience testing and disclosure, which are either extracted directly from the selected scenarios, or were disaggregated or expanded by Vivid Economics.

The Technical Documentation details the methodology for the additional disaggregated and expanded variables and contains a detailed list of the variables included in the Catalogue.

Further information on how to access the Catalogue and how to use the Catalogue features are presented in the following sections of this User Guide.
2.1.2 User guidance

This section describes how to use the Catalogue for scenario comparisons and variable extraction.

2.1 Entering the Catalogue – Home Section

Users enter the Catalogue through the Home section (Figure 1).

The Home section provides an overview of selected scenarios and illustrates the process of creating and using the Catalogue. Users can access other features of the Catalogue through the panel on the left or the blue action buttons at the bottom.

Figure 1 The Home section provides the entry into the Catalogue

2.1.1 Terms of use and Disclaimer

Terms applicable to the use of the Catalogue, the selected scenarios and associated data are presented at the foot of the Home section. These are important to consider to comply with the scenario providers’ rules when using their data. Details of the terms of use by scenario provider are also presented in the Data Availability and Terms of Use section of the Variable Explorer feature. See section 2.3.9 for further details.

The Home section also specifies WBCSD and Vivid Economics’ liability for the content of the Catalogue.
2.1.2. What’s New
The “What’s new” box on the main page summarises what is different in version 2.0 of the Catalogue, relative to version 1.0.

Figure 2 The “What’s new” box highlights key updates to the catalogue in v2.0

2.2 Scenario Explorer
The Scenario Explorer is a good point to start a strategic resilience assessment. Particularly, it helps to explain and navigate the variety of scenarios in each scenario family and the range of uncertainty in climate impacts. After going through this section, users will have a clearer picture of which scenarios they want to explore in detail.

The Scenario Explorer feature uses a slightly extended dataset than the Variable Explorer and the Data Download features. It includes further scenarios from the AR6 Scenario Explorer and Database, hosted by IIASA, to provide more context on and comparison to available scenarios. It also presents only a small subset of the available variables and none of the expanded or disaggregated variables.

The Scenario Explorer shows how selected scenarios compare across key variables in 10 year intervals from 2020 through to 2050 (Figure 2). It presents the distribution of scenarios within their family and illustrates the range of uncertainty across those scenarios, that is indicative of different assumptions and modelling techniques by scenario developers.
2.2.1 Exploration by Scenario family, Sector and Time horizon
Scenarios can be explored by scenario family, by sector and by time horizon.

2.2.2 Selecting a scenario family
First, the user needs to select a family, by clicking on one of the following options displayed at the top left of the Scenario Explorer page:

- Paris Ambitious 1.5°C
- Paris Aligned Well-Below 2°C
- Current Policies/BAU.

For example, in Figure 3 the Paris Ambitious 1.5°C scenario family is selected.

If a scenario family is not selected, the Paris Ambitious 1.5°C is automatically selected.

Figure 4 Selecting a scenario family
2.2.3 Selecting an end user category

Users can select an end user category to explore variables agreed by the Forum as being most business-relevant to the sector.

The user selects an end user sector by clicking on one of the following options displayed at the top right of the Scenario Explorer page:

- Utilities
- Oil and Gas
- Construction
- Mining
- Chemicals
- Any sector

For example, in Figure 4 the Oil and Gas sector is selected.

If the “Any sector” option is selected, the Scenario Explorer displays six key variables (and the projections for them across scenarios in 2050) that are considered by the Forum as most critical to the energy and climate transition and vary widely between scenarios. Table 1 displays the presented variables by sector.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Variables by sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any sector</td>
<td>Utilities</td>
</tr>
<tr>
<td>Carbon Capture &amp; Storage</td>
<td>X</td>
</tr>
<tr>
<td>Carbon Sequestration from Land Use</td>
<td>X</td>
</tr>
<tr>
<td>Electricity Share in Final Energy Use</td>
<td>X</td>
</tr>
<tr>
<td>Final Energy Use</td>
<td>X</td>
</tr>
<tr>
<td>Hydrogen Use</td>
<td>X</td>
</tr>
</tbody>
</table>
Any sector | Utilities | Oil and Gas | Construction | Mining | Chemicals
---|---|---|---|---|---
Solar and Wind Share in Electricity Generation | X | X | | | X
Nuclear Share in Electricity Generation | X | | | | |
Electricity Share in Transportation | X | | X | | |
Oil Price | | X | | | |
Primary Energy from Oil and Gas | X | X | | | |
Final Energy Use from Buildings | | | | X | |
Gross Domestic Product (GDP) | X | X | X | | |
Bioenergy Use | | X | | X | |
Final Energy Use from Transport | | | | X | X
Agricultural Demand | | | | | X

Source: Vivid Economics

*For example, let’s say you are working for an oil & gas company and select your sector. This removes carbon sequestration from land use from the comparison and adds primary energy supply from oil and gas.*

**2.2.4 Selecting a time horizon**

Users can set the time in 10 year intervals from 2020 at which scenario variables are compared and presented – i.e. as per their values as measured at 2020, 2030, 2040 or 2050.

To set the time, the user moves the button on the slidebar under the *Select time* field to the relevant year or by click on slidebar above the relevant year. For example, in Figure 5, the user has chosen to compare the scenario variables as per their values at 2030.
If no time horizon is selected by the user, the time horizon is automatically set to 2050.

**Example**

Figure 6 illustrates the information presented in the Scenario Explorer feature for a user selecting the following criteria:

<table>
<thead>
<tr>
<th>Scenario family</th>
<th>Paris Ambitious 1.5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
<td>Oil and Gas</td>
</tr>
<tr>
<td>Select time</td>
<td>2030</td>
</tr>
</tbody>
</table>

**Figure 7** Comparison for Paris Ambitious 1.5°C scenario variables at 2030 for the Oil and Gas sector

### 2.2.5 Scenario providers - coverage comparison

Below the “Scenario Comparison” graphs, the Scenario Explorer also shows and compares the variable and sector coverage of different providers within the catalogue (see Figure 7).
The coverage comparison graph shows how many scenarios each provider includes, as well as how many variables are available for each scenario, and the presence of regional disaggregation. It enables users to quickly identify providers and scenarios that may be able to provide the most breadth of data in a relevant sector or variable type.

Figure 8    Scenario providers comparison table to compare coverage

![Scenario providers - coverage comparison](chart.png)

Further information about the modelling approach and narrative behind each scenario, as well as the source, can be found and accessed in the Background section (see Figure 8).
### Figure 9  Background descriptions of scenarios and models

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDG翁</td>
<td>The International Energy Agency's (IEA) Global Energy Model (GEM) is a bottom-up partial equilibrium model that includes energy demand, supply, transformation, and trade.</td>
</tr>
<tr>
<td>BDG翁</td>
<td>The International Energy Agency’s  (IEA) provides a detailed modelling of the energy system with a focus on renewables.</td>
</tr>
<tr>
<td>BDG翁</td>
<td>The network for assessing the financial system (NIFS) provides scenario modeling with the aim to develop climate risk management for the financial sector. NIFS is a partial equilibrium model of the energy sector and the macroeconomy. It includes energy consumption and production.</td>
</tr>
<tr>
<td>BDG翁</td>
<td>The network for assessing the financial system (NIFS) provides scenario modeling with the aim to develop climate risk management for the financial sector. NIFS is a partial equilibrium model of the energy sector and the macroeconomy. It includes energy consumption and production.</td>
</tr>
<tr>
<td>BDG翁</td>
<td>The network for assessing the financial system (NIFS) provides scenario modeling with the aim to develop climate risk management for the financial sector. NIFS is a partial equilibrium model of the energy sector and the macroeconomy. It includes energy consumption and production.</td>
</tr>
<tr>
<td>BDG翁</td>
<td>Hallo et al. (2015) use a multi-model approach to estimate the emission and land use implications of the Shared Socioeconomic Pathways. The three scenarios presented here have the broadest high-end GDP growth trajectories of all the AR6 Scenarios and Explorer scenarios.</td>
</tr>
</tbody>
</table>

The integrated energy system's (IES) scenarios are not connected to the global energy system in all scenarios. The T-5 scenario is an extreme climate scenario with a focus on reducing energy emissions to 2050. The model is calculated based on energy demands with a focus on macro-symmetric models for socio-economic aspects. The final sector is not covered.

The Japanese energy scenario assumes that the entire sector’s primary energy consumption is reduced immediately after 2050 to bring the mean temperature below 1.5°C. In 2050, after a limited temperature overshoot, a reduction in greenhouse gas emissions is achieved through enhanced energy efficiency and deployment of renewable energy sources. The national government sector takes actions to achieve the temperature target in 2050. The policy assumption that most carbon prices are fixed with the long-term target is implemented immediately after 2050.

The Japanese energy scenario assumes that optimal carbon prices are fixed with the long-term target is implemented immediately after 2050 to bring the mean temperature below 1.5°C. In 2050, after a limited temperature overshoot, a reduction in greenhouse gas emissions is achieved through enhanced energy efficiency and deployment of renewable energy sources. The national government sector takes actions to achieve the temperature target in 2050. The policy assumption that most carbon prices are fixed with the long-term target is implemented immediately after 2050.

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2.3 Variable Explorer

The Variable Explorer presents and compares all available variables in the Catalogue. Users can select a variable and see how the variable evolves over time on a line graph (as a solid line), and optionally in comparison to multiple scenarios from the same family (as dashed lines). The Catalogue also allows for a comparison between two variables at the same time, by checking the “Comparison mode” checkbox, (Figure 9) and to download a list of all variables in the Catalogue (see section 2.4).

Figure 10 The Variable Explorer can contrast two variables

2.3.1 Selecting variables for exploration

On entry to the Variable Explorer feature, the user has several options to filter and extract variables for examination. The options, illustrated in Figure 10, are discussed below.
2.3.2 Exploring scenario variables by scenario family
To examine variables within a specific scenario family, the user should:

1. Highlight the “Scenario family” option by clicking on the related circle

   *Select scenarios by scenario family or modelling suite*
   - Scenario family
   - Modelling suite

2. Select the desired scenario family from the drop down menu

   *Select scenario family*
   - Paris Ambitious 1.5C

2.3.3 Setting the time range
The user can set the time range applied to the timeseries of selected variables by moving the buttons on the slidebar. The start of the range can be set at 5 year intervals from 2010 with an end point of 2050.
2.3.4 Displaying individual scenarios or all scenarios within a scenario family

Confirm whether or not you wish to display timeseries for all scenarios in the scenario family in which the desired variable appears by clicking “Yes” or “No” in the box below.

Show scenarios from the same family or modelling suite

- Yes
- No

If “Yes” is chosen, timeseries for all scenarios in the selected scenario family that contain the desired variable are presented in the main figure.
If “No” is selected, the user chooses a scenario from the drop down box under Select scenario and only that timeseries is presented in the main figure.
2.3.5 Comparing two variables

To display and compare two variables on screen, tick the *Comparison mode* option. When *Compare mode* is activated, the user can select two variables for which the timeseries of selected scenarios are presented side by side – see Figure 11.
2.3.6 Variable category selection

The optional variable category suggestions filters the full list of variables to a smaller set of similar variables, to facilitate screening.

To examine suggested variable categories, choose the relevant sector from the buttons displayed and available under the Variable category suggestions field.

2.3.7 End-user sector level variable exploration

The optional end-user category suggestions provide a smaller set of variables that might be particularly relevant for the selected sector in case a user is unsure about which variables to look at.

To examine variables relevant to end users from a specific sector, choose the relevant category from the drop down menu available under the End-user category suggestions field. These categories, and the variables associated, match those displayed in the Scenario Explorer tab. Note that an end-use category suggestion can only be selected if no variable category suggestion has been selected.
2.3.8 Variable selection approach

Users can search the variable list by typing keywords like “hydrogen” or “oil demand” into the Select variable field. In order to activate this keyword search function, users can click on the Select variable field and press “backspace” on their keyboard. Users can also select a region of interest in the drop-down menu under the Select region field.

Note that the Comparison mode creates a second line graph. Users can contrast two different variables or look at the same variable for different regions as comparison. The shape of the markers on the line graphs indicates variable type (e.g. “Extracted” variable types are indicated as dot markers).

For example, you continue your journey as an oil & gas analyst and have selected the IEA Net Zero Energy 2050 scenario because it provides the highest risk for your business. You choose primary oil demand as your first variable because you want to understand how it evolves between 2020 and 2050 under net zero. At the same time, your business considers investments in solar energy to make the business more resilient and you select solar electricity generation as the second variable. The Catalogue shows you both variables next to each other.

Figure 13 Selection and comparison of primary oil demand and solar electricity generation
There are two selection approaches available to the user to explore and to extract variables:

- “Basic” – the default selection approach; and
- “Advanced” – an approach which provides further variable selection and filtering options
“Basic” variable selection approach

Using the “Basic” approach, the user can examine the full list of variables. Users can search the full variable identifier, for example by typing “cost hydrogen” to find the Variable “Cost|Production cost|Energy|Hydrogen”.

As of version 2.0, the list of variables appearing in the “Select variable” field is no longer restricted to the variables available in the selected scenario, to allow users to identify all the variables available in the catalogue. If the variable you select is not available in the scenario selected above, the plot(s) will not load. The message “Loading content” will remain on your screen, as in the example below – the REMIND-MaPIE scenarios only include a shadow carbon price, but no explicit carbon price. If this error occurs, select another variable or another scenario. To identify all the variables covered by a specific scenario, download the variable list using the button circled below.

"Advanced” variable selection approach

Using the “Advanced” approach, the user has the option to filter the list of variables by an extended range of classes, sub-classes, sectors and sub-sectors. This allows for a more specific search. For example, users could select “Secondary energy” as variable subclass and explore which technologies and fuels are available. As for the “Basic” approach, the list of variables is not restricted by scenario.
2.3.9 Exploring scenario variables by modelling suite
The user can explore variables across scenarios within a specific scenario modelling suite.

The approach and options to exploring variables by modelling suite mirror those applied to scenario families.

To explore variables by modelling suite, the user selects the *Modelling suite* option and selects the relevant modelling suite from the dropdown menu.

Once a modelling suite has been selected, the user can choose whether to display variable data from single model or from all the models within the modelling suite.

Once a variable has been selected, the graph will display single or multiple timeseries as per the user selection. See, for example, Figure 12.

Note that when exploring variables by modelling suite, the objective is to examine how timeseries vary across models. Extracted scenarios may therefore be classified in different scenario families.
### 2.3.10 Additional variable information

Below the graph, the Catalogue offers three tabs with additional information relating to the selected variable(s):

- The first tab provides *Underlying Data* of the graphs (Figure 13)
- The *Variable Information* tab provides access to a short description of the variable (Figure 14); and
- The third tab contains details of the *Data Availability and Terms of Use* including the scenario author, the data source and whether specific scenario data are available for download (Figure 15).

Figure 14  The Underlying Data tab provides details the underlying data presented in the graphs

![Underlying Data](image1)

Figure 15  The Variable Information tab provides additional background information on variables

![Variable Information](image2)
2.4 Data Download

The Data Download section allows users to extract variables from the Catalogue for further analysis and disclosure. The selection by scenario, variable, region and time are similar to the Variable Explorer, but users can choose an unlimited number of scenarios and variables in the Data Download section (Figure 16). The Catalogue will provide users with an Excel file with all the data selected that can be used as an input for internal modelling and decision making, as well as climate disclosure. Note that not all data from the Variable Explorer is available for download due to the terms of use of scenario providers. Users are required to ensure that their use of the data is in line with those terms of use as detailed in the "Data availability and terms of use" tab (Figure 15).

For example, after browsing through the Catalogue in your role as oil & gas analyst, you want to use some variables for internal P&L modelling to understand how the market for oil and solar changes. You select the two Paris 1.5°C scenarios that caught your attention in the Scenario Explorer. Since you are unsure about the climate ambition, you are also adding the two equivalent scenarios from the Paris 2C family. You select all primary energy demand, the price for oil, gas and electricity as well as the cost of solar. Since your main markets are in Asia and Europe, you add those regions to the selection.
Figure 17  The Data Download section allows unlimited selection of scenarios and variables

The Catalogue shows a preview of the variables and scenarios selected below (Figure 17). Click the green ‘Download’ Button to produce an Excel file of the selection.

2.5 Documentation

The technical documentation for the Catalogue can also be accessed via the “Documentation” button on the panel on the left of the Home section (see Figure 18). A copy of this User Guide is also available.
Figure 19  Catalogue access to documentation from panel on Home section

Links to the Catalogue, Forum Report and technical documentation can be also be found at [www.wbcsd.org/CSARA](http://www.wbcsd.org/CSARA).