



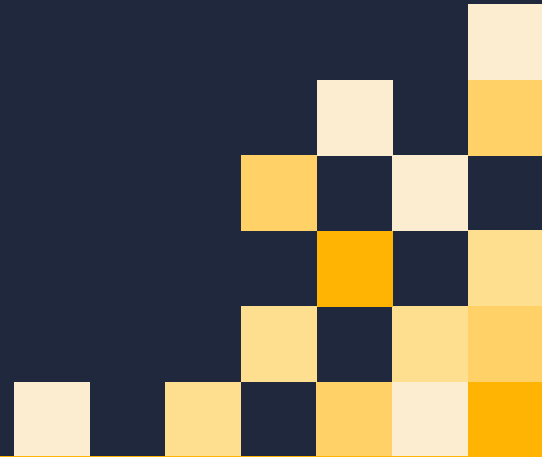
TransitionZero

Future Energy Outlook **Beta** **Launch**

Who we are

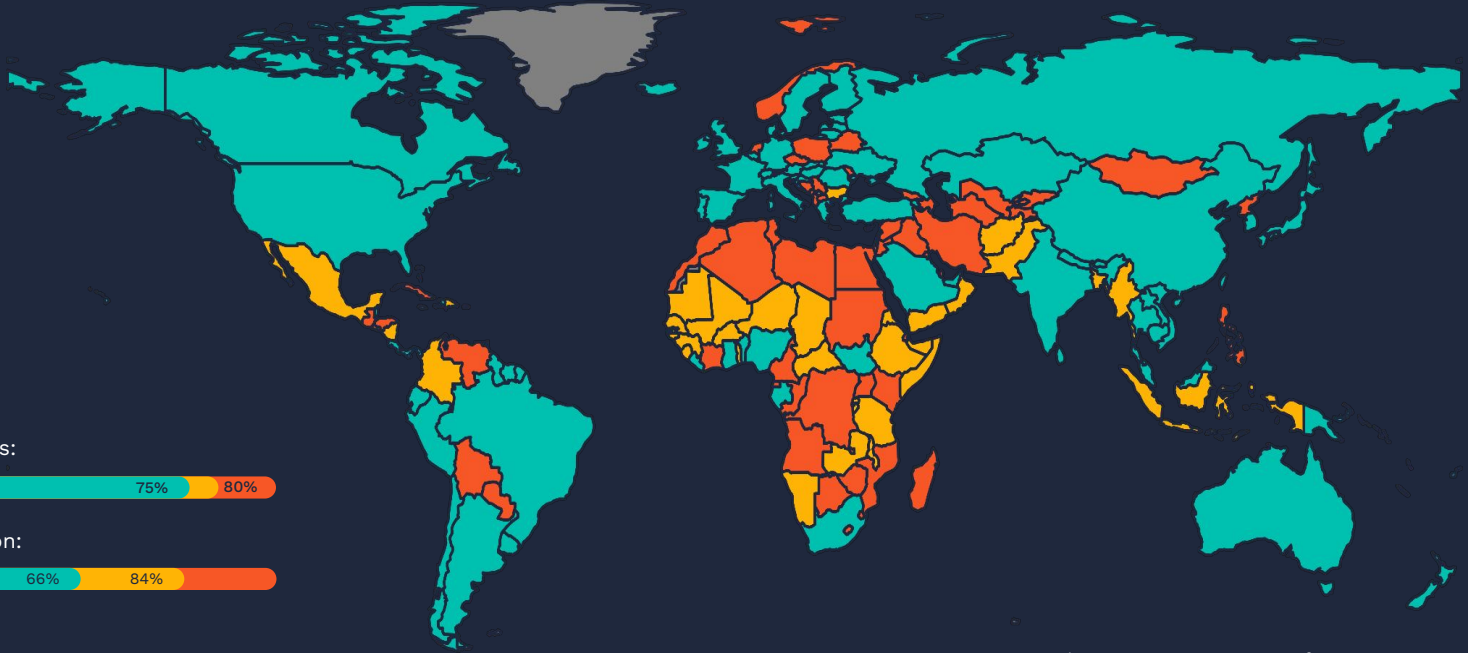
Empowering our partners with open data products to shape a clean energy future

We are a climate analytics not-for-profit established in 2021.
We build open energy transition products without usability
barriers and partner with mission-aligned organisations to help
scale a open data standard for energy transition planning.

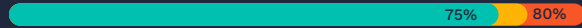


Net zero ambition

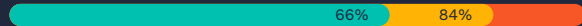
Most of the world now has pledged to be net zero



Coverage of Global Emissions:



Coverage of Global Population:

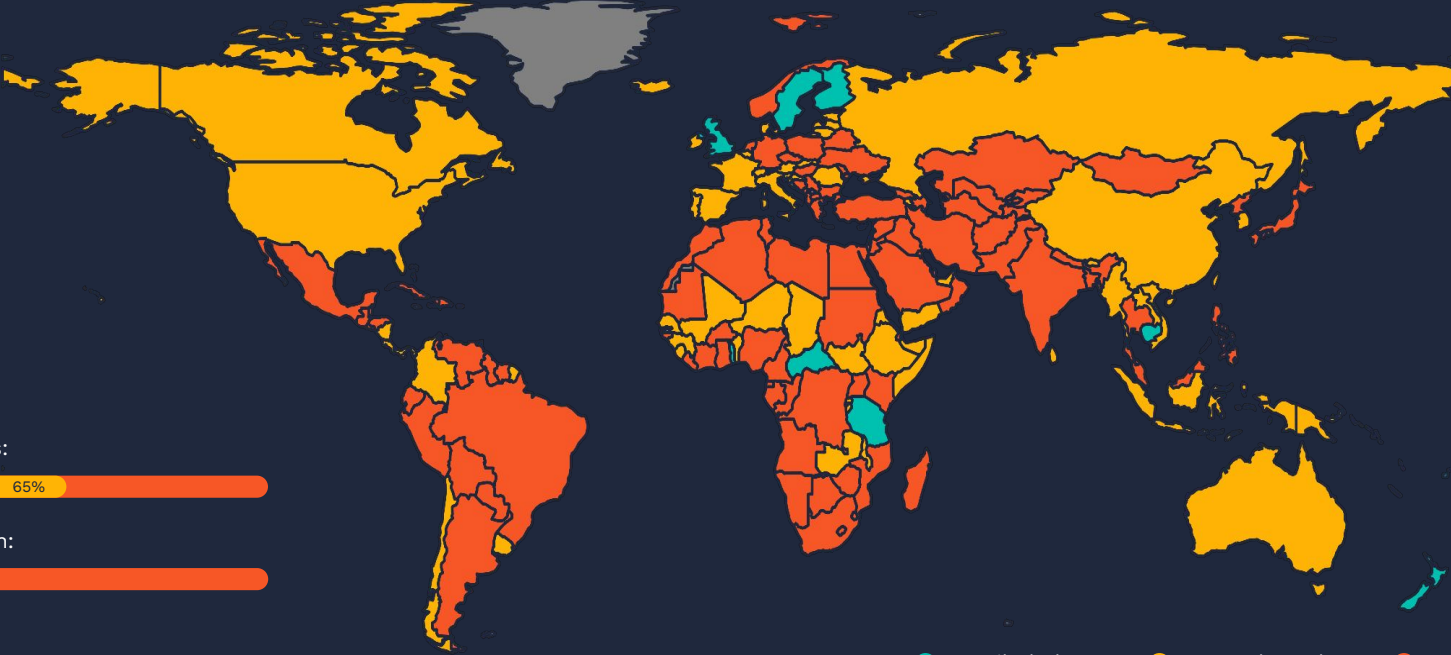


Data from Net Zero Scorecard (2023) Energy & Climate Intelligence Unit: [1]: "Declaration/pledge", "In Policy Document", and "In Law" categories; [2]: "Proposed/In Discussion" category; [3]: No data

● Implemented Policy¹ ● Proposed Policy² ● No Ambition³

Net zero reality

But most of the world doesn't have a plan for getting there



● Detailed Plan ● Incomplete Plan ● No Plan

Data from Net Zero Scorecard (2023) Energy & Climate Intelligence Unit

Future Energy Outlook

A software platform to answer 'what if' questions about the energy future

What if...

... RE100 membership requires 24/7 CFE

... coal generation is phased out by 2030

... extreme weather disrupts pacific LNG trade

... battery costs drop 90% by 2035

... an interconnector is built across the Arabian sea

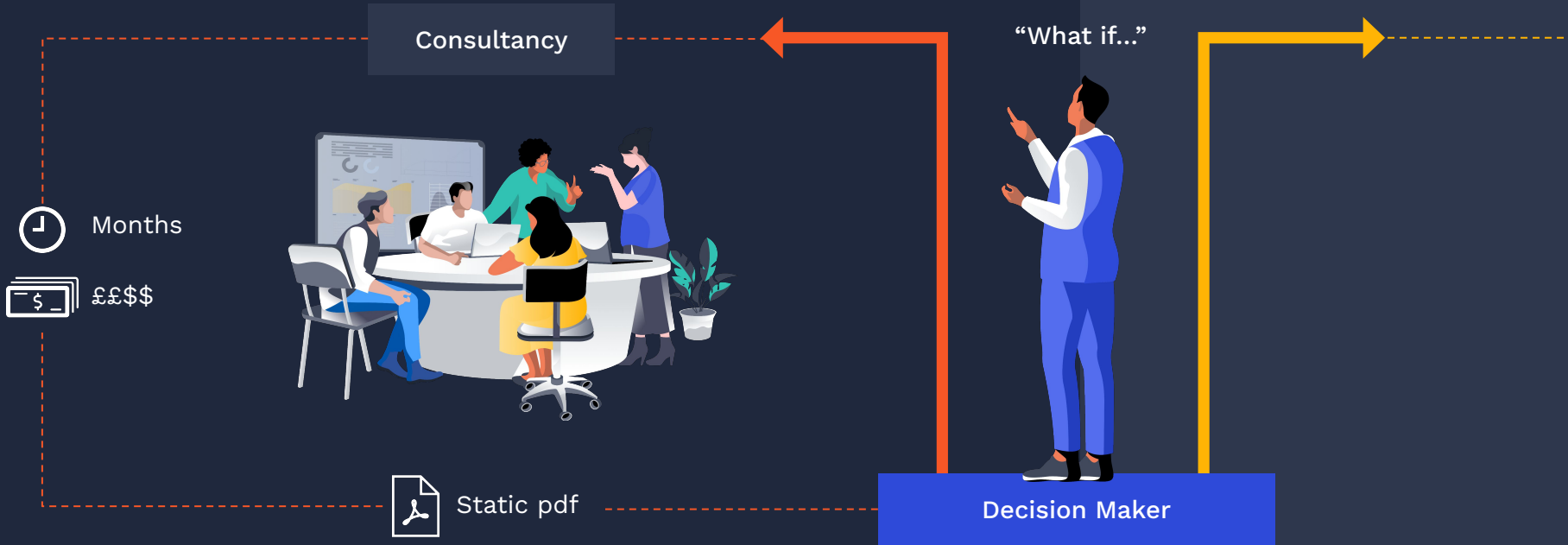
... air conditioning demand increases 10x by 2040

... water shortage disrupts lithium mining



Current status

Creating dependency in low-income countries when they should build capacity



Our solution

Future Energy Outlook

“What if...”



Decision Maker



Future Energy Outlook



Free



Hours



CSV + URL

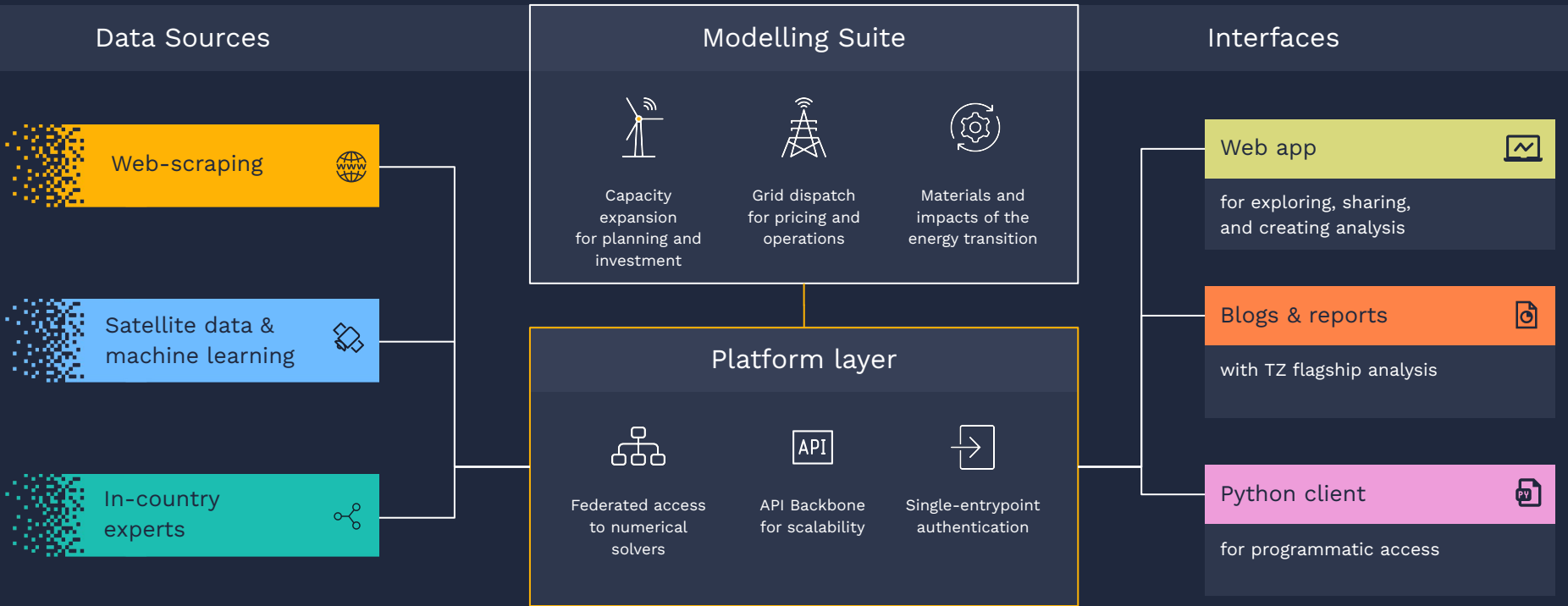


Live document with data,
continuously updating.

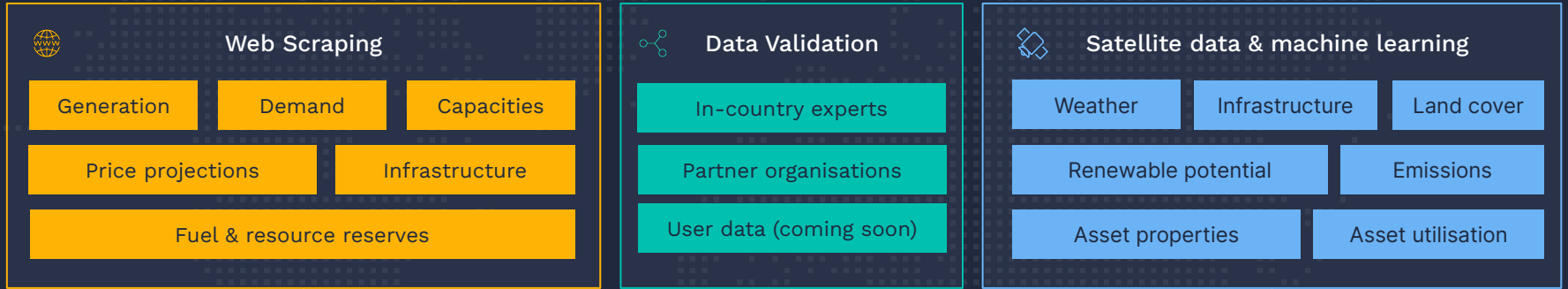


Future Energy Outlook

Accessible and auditable model, tool, and data platform

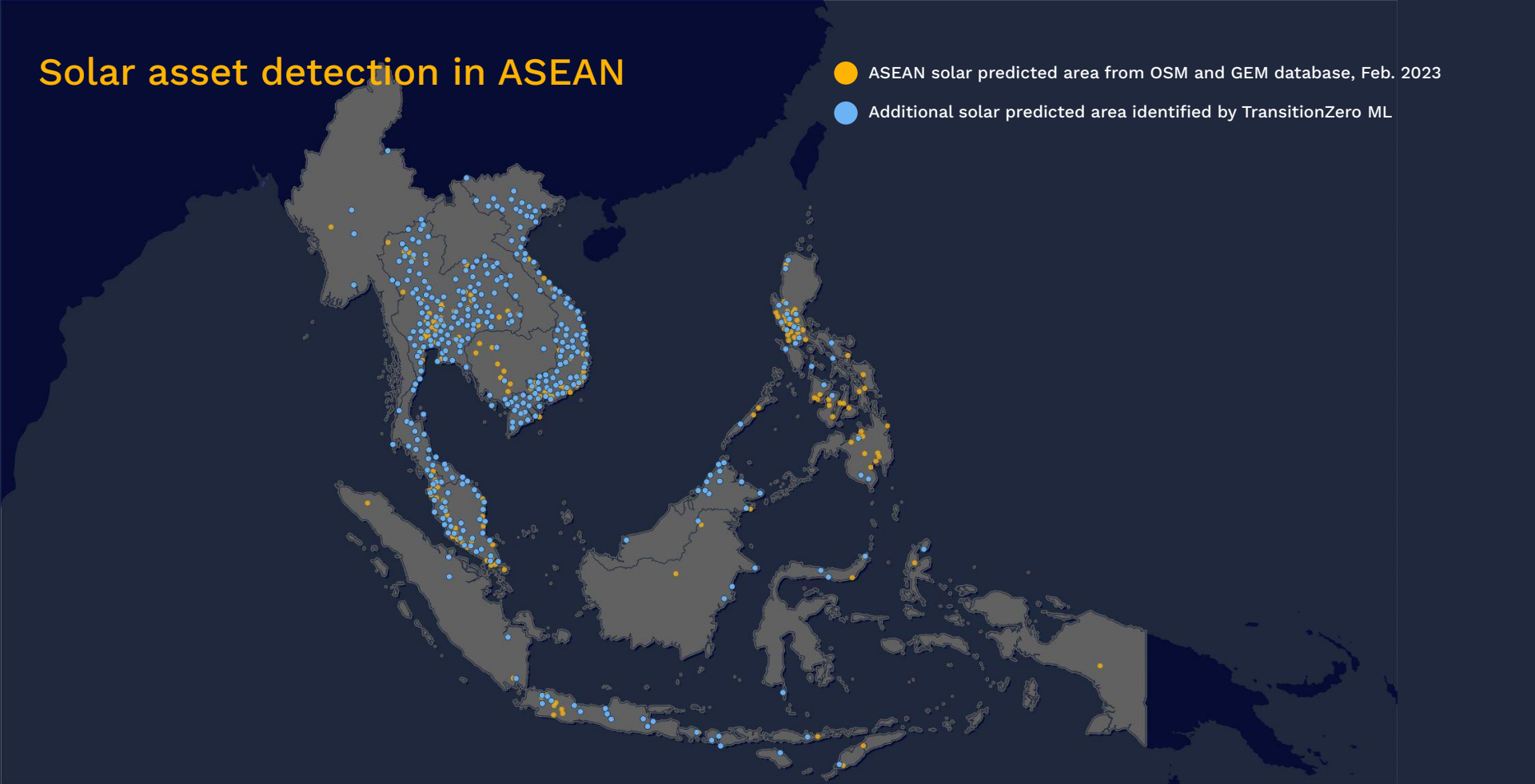


Data Sources

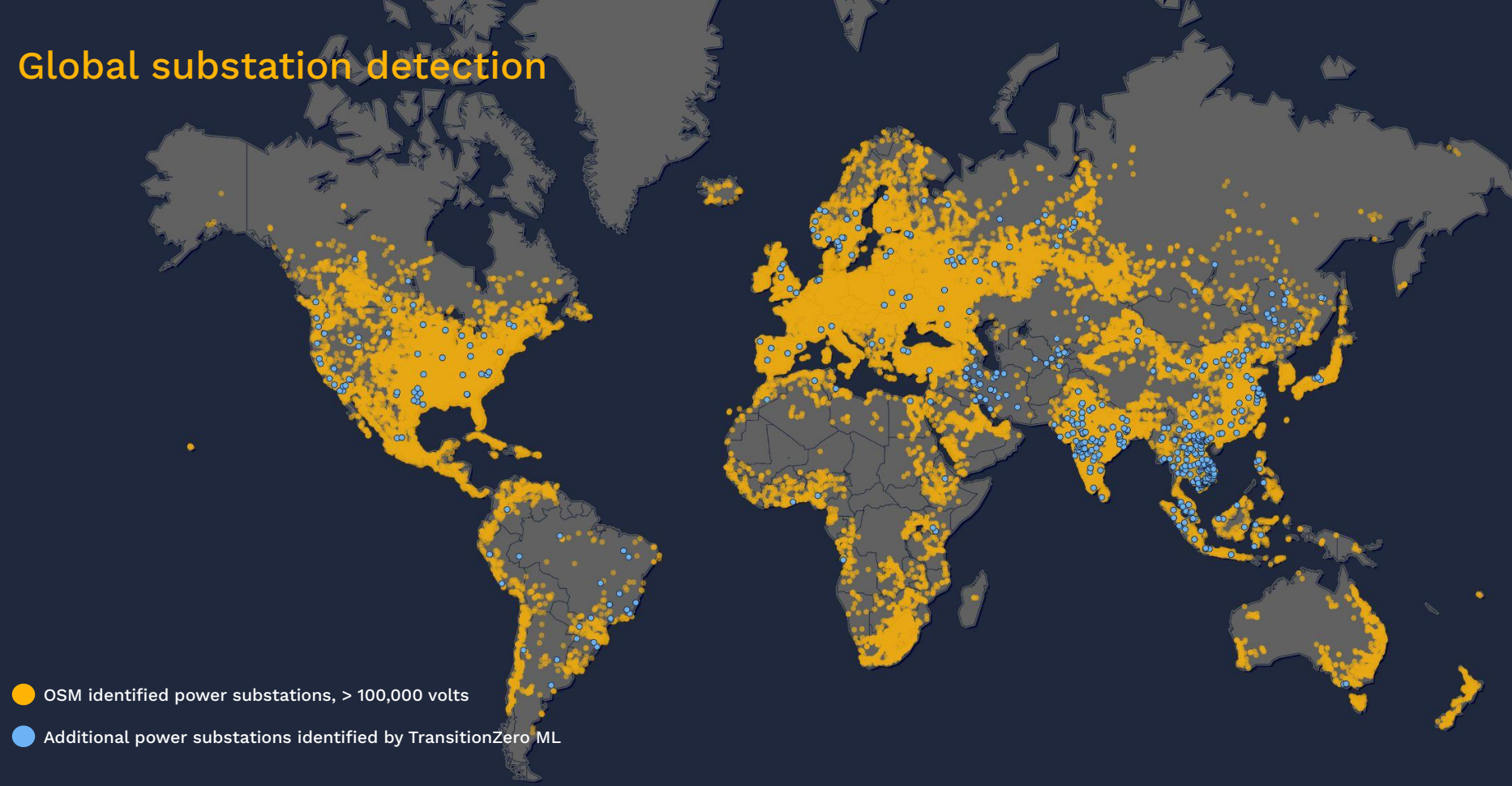


Solar asset detection in ASEAN

- ASEAN solar predicted area from OSM and GEM database, Feb. 2023
- Additional solar predicted area identified by TransitionZero ML



Global substation detection



- OSM identified power substations, > 100,000 volts
- Additional power substations identified by TransitionZero ML

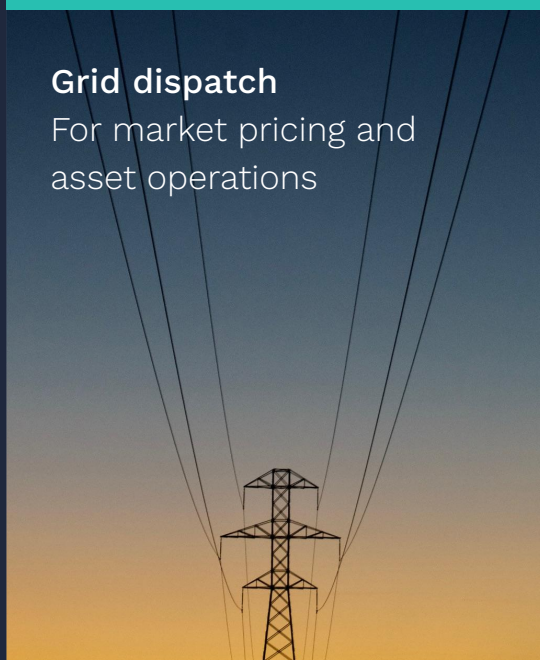
Modelling Suite

Tools for short- and long-term energy transition planning

Capacity expansion
for planning and
investment



Grid dispatch
For market pricing and
asset operations



Sector coupling,
materials, and impacts of
the energy transition



FEO Today



FEO Data Viewer UI for non-technical users to easily view results for different net zero and coal phase-out scenarios and for comparing against current policies

<https://feo.transitionzero.org>



Python Client for easy-entry programmatic access

Jupyter notebooks to follow guided walk-throughs of platform capability and use cases.

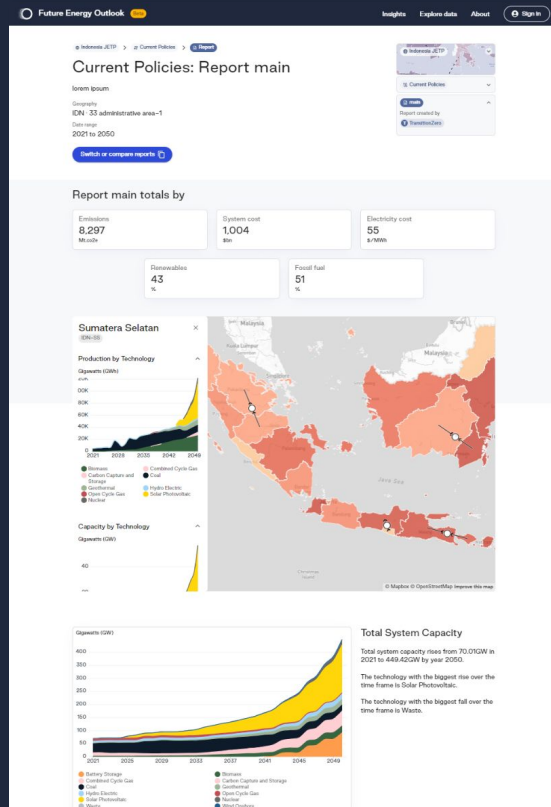
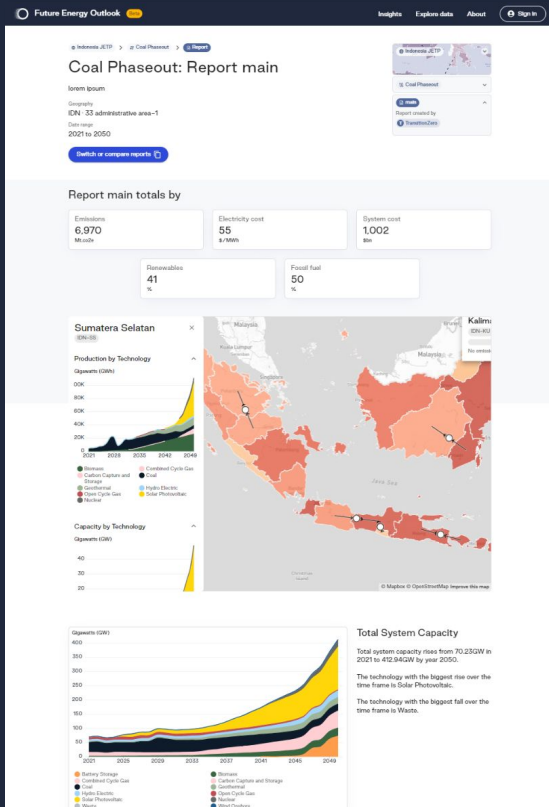
```
pip install feo-client
```



API for programmatic access at scale

docs.feo.transitionzero.org/api

FEO Data Viewer UI



API for programmatic access

The screenshot shows an API documentation page for the endpoint `get_models_v1_models__slug__get`. The page is divided into several sections:

- Header:** A large circular logo on the left and the endpoint name `Get Models V1` on the right.
- Method:** `get_models_v1_models__slug__get`
- AUTHORIZATIONS:** `OAuth2PasswordBearer or APIKeyHeader`
- PATH PARAMETERS:** A table with one entry: `slug` (string) with a `required` status.
- QUERY PARAMETERS:** A table with one entry: `includes` (Includes (string) or Includes (null) (Includes)) with a default value of `"{val}"`.
- Responses:** A section showing a `200` status with a `Successful Response` message. Below this is a `RESPONSE SCHEMA: application/json` section with a table of fields: `name` (Name (string) or Name (null) (Name)), `slug` (string (Slug)), `description` (Description (string) or Description (null) (Description)), `version` (string (Version)), and `time_scope` (object (TimeScope-Output)).
- Response samples:** A dark-themed panel on the right showing a `200` response with `application/json` content type. It displays a JSON object with fields like `name`, `slug`, `description`, `version`, `time_scope` (with sub-fields `contiguous` and `representative_slices`), `datetime_range_start`, `datetime_range_end`, `sectors`, `status`, `node_ids`, and `representative_node_ids`.

Python client and jupyter tutorials

The screenshot shows a GitHub repository page for `transition-zero/feo-client-examples`. The repository is public and has 16 stars. The current view is for the file `2_technology_projections.ipynb` in the `main` branch, merged by `joconnor-ecaa` 8 hours ago. The file is 5.16 KB and contains 200 lines of code.

The notebook content includes the following code cells:

```
In [ ]: !pip install feo-client
```

```
In [ ]: from feo.client.auth import login
login()
```

Technology Projections

Object-oriented interface for technology projections via the Python Client

FEO supports a default set of `Technologies`. Technologies are stylised representations of physical plants and equipment that convert energy and materials in systems models.

Technologies have a set of 'parameters' that describe, for example, their capital or operational costs, their thermal efficiency, or emissions factors. Forward-looking views of these parameters are called projections.

```
In [ ]: from feo.client import Technology
```

Technologies can be searched for using the `search` method.

```
In [ ]: Technology.search(slug="coal")
```

Technologies can also be directly instantiated using the `from_id` method.

```
In [ ]: gas_combined_cycle = Technology.from_id("combined-cycle-gas-turbine")
```

Technology projections can be retrieved using the technology object

```
In [ ]: gas_combined_cycle.projections
```

The left sidebar shows the file structure of the repository, including `0_nodes.ipynb`, `1_assets.ipynb`, `2_technology_projections.ipynb`, `3_system_model_results.ipynb`, `4_geometries.ipynb`, `index.md`, `.cruff.json`, `.gitignore`, `.pre-commit-config.yaml`, `CODE-OF-CONDUCT.md`, `CONTRIBUTING.md`, `LICENSE`, `README.md`, and `mkdocs.yml`.



Cables to change the world

The benefits of transmission to decarbonise global electricity supply



Report collaborators:



Global interconnector report

Scenarios:

FEO (Future Energy Outlook)

Results database:

A global energy systems planning model

No Grid Scenario (NGS)

Meet net-zero by 2040
without expanding
existing grid systems

Grid Upgrade Scenario (GUS)

Meet net-zero by 2040
allowing expansion of
existing grid systems



2020-2040



Covers 163 countries and
99% of the world's population



Subnational scale
(at least one node per country)



Hourly, seasonal and annual
representation



Captures generation, storage and
transmission systems

Total System cost (USD)

Generation Capacity (GW)

Storage Capacity (GWh)

Grid Capacity (GW)

Emissions (MtCO₂eq.)

FEO Model Building

Future Energy Outlook

Dashboard System Models About Create new

1 Targets 2 Assumptions 3 Interconnectors 4 Finish

Assumptions

Non-specified fields will be populated with TransitionZero defaults. All fields marked with an asterisk (*) are mandatory.

Technology installation costs (CAPEX)

See the TransitionZero Glossary for a definition of overnight installation cost. Multiple time points are linearly interpolated. COG refers to Combined Cycle Gas.

The overnight installation cost of **Combined Cycle Gas** will equal **800 \$/MW** in **2040** in **all geographies** Advanced Reset

The overnight installation cost of **Solar** will equal **800 \$/MW** in **2040** in **all geographies** Advanced Reset

The overnight installation cost of **Wind** will equal **800 \$/MW** in **2040** in **all geographies** Advanced Reset

100 \$/MW

50

0

2020 2030 2040

Move the orange dots to adjust the curve.

Show 9 more default assumptions

Technology running costs (OPEX)

See the TransitionZero Glossary for a definition of overnight installation cost. Multiple time points are linearly interpolated. COG refers to Combined Cycle Gas.

In [yyyy] the price of **wind** will equal **40 \$/1** in **all geographies** Advanced Reset

Show 9 more default assumptions

Fuel prices

All prices are in US Dollars

The price of **coal** will equal **40 \$/1** in **2040** in **all geographies** Advanced Reset

Show 9 more default assumptions

Technology build rates

The year-on-year build rate of **solar PV** must not exceed **10 %** in **all geographies** Reset

Future Energy Outlook

Dashboard System Models About Create new

1 Targets 2 Assumptions 3 Interconnectors 4 Finish

Interconnectors

You can set specific interconnectors between various geographies (nodes). The new flows can then be taken into account by the model.

Existing and confirmed interconnectors

Interconnection between **Hokkaido** and **Tohoku** exists with a capacity of **5 GW** Disable

Interconnection between **Node A** and **Node B** exists with a capacity of **10 GW** Disable

Interconnection between **Node A** and **Node B** is under construction starting in **2028** with a capacity of **2 GW** Disable

Show all existing interconnectors

Possible future interconnectors

+ Add all possible interconnectors

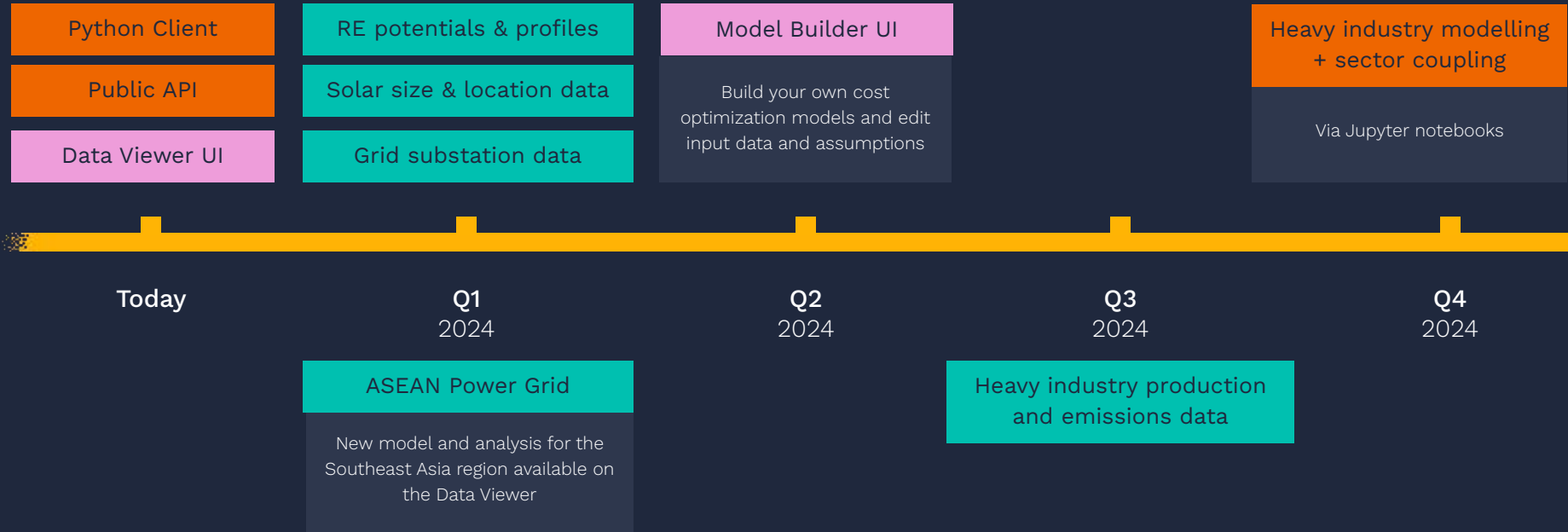
Interconnection between **Node A** and **Node B** Remove

may be built starting in **2040** at the cost of **200,000,000 \$**

+ New interconnector + Increase capacity of an existing interconnector

FEO Development Roadmap

■ Programmatic Access ■ Web UI Feature ■ Dataset Release





Access FEO
Beta today

Reach out at:

info@transitionzero.org



Panellists

Google.org



Matt Gray
CEO, TransitionZero

Lucas Kruitwagen
CTO, TransitionZero

Alu Dorotan Tiuseco, Esq.
Undersecretary of Finance,
Republic of the Philippines

Brigitte Hoyer Gosselink
Director of Product
Impact, Google.org

Brian Dean
Director for Energy
Transition, SEforAll

Join the FEO revolution

Join the Future Energy Outlook

Get started on FEO
with the dataviewer,
Jupyter notebooks,
and Python client



**Read the 'Cables to
change the world'
report** and access
other resources



**Sign up to our mailing
list** for updates on FEO
and our reports

