Towards a National Research Data Infrastructure for Interdisciplinary Energy System Research (NFDI4Energy)

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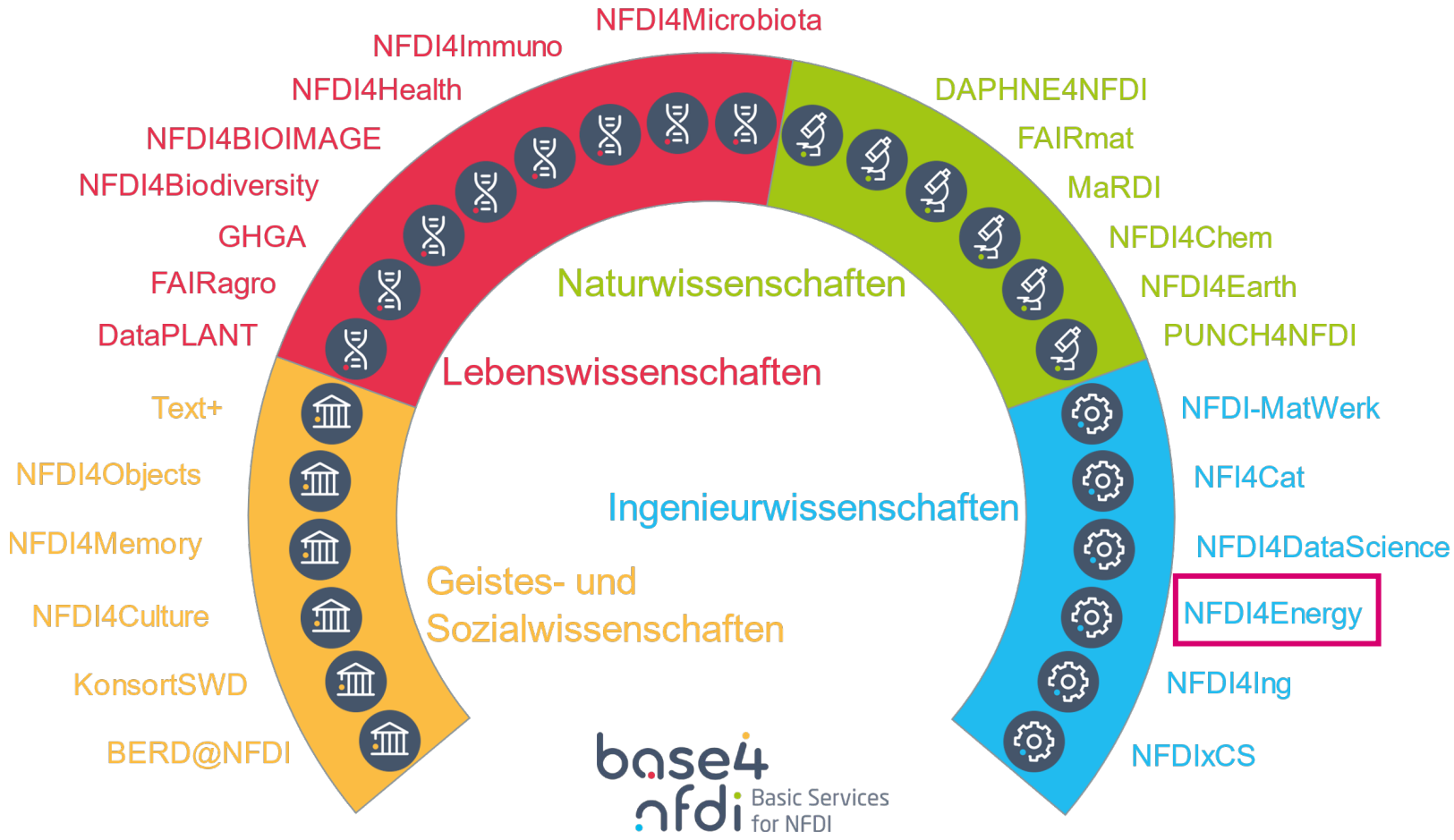
NFDI: German National Research Data Infrastructure

- Vision: All research data is FAIR. For all. Forever.
- FAIR = Findable, Accessible, Interoperable, Reusable
- Goals:
  - Increase the efficiency of the entire German science system
  - Establish and develop comprehensive research data management in Germany
  - Develop a long-term solution for research data management infrastructure
- Funded by state and federal governments with up to 90 million € per year
- NFDI4Energy started in March 2023

Different Consortia



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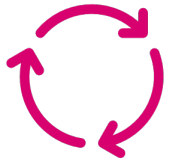
Energy Research

Research artifacts required as input

Research artifacts created as output

Research artifacts should be reusable!



Building an Open Ecosystem for FAIR Research Artefacts in Energy Systems Research

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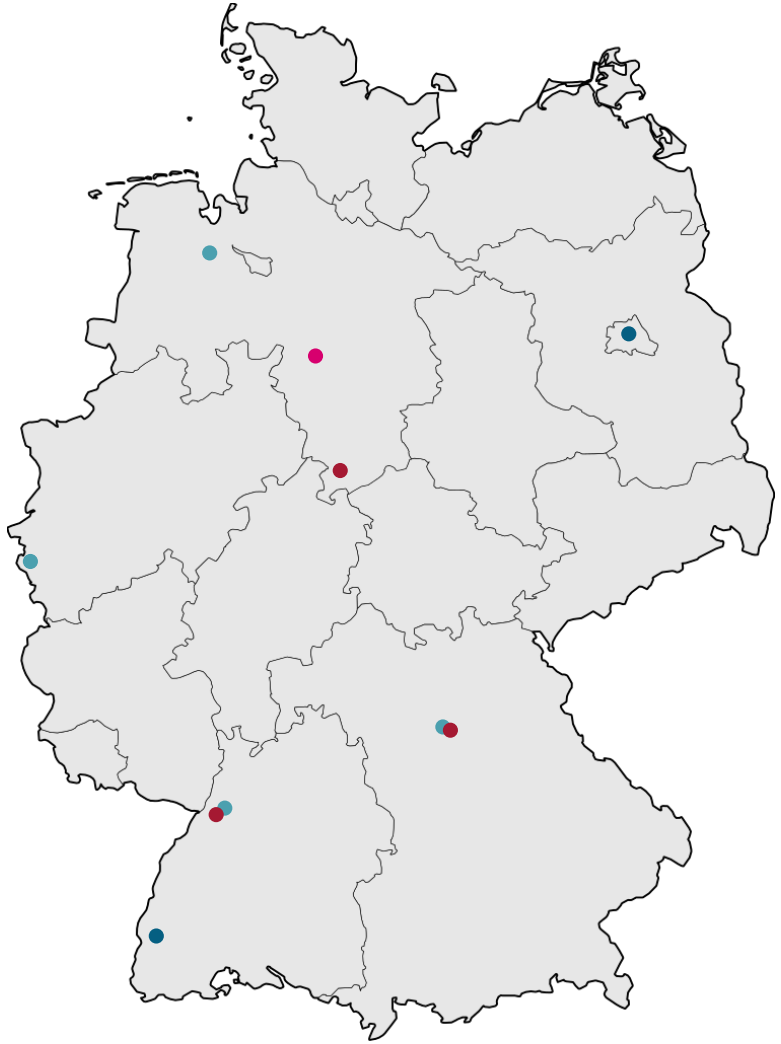
- Establish common research **community services** to allow **reproducibility, transparency, and reusability** of research artifacts.
- Simplify identification, integration, and coordination of **simulation-based models**.
- **Support the use of the services** in the research community.
- Enable and motivate the **involvement of society**.
- Promote better **collaboration and knowledge transfer** between scientific research institutes and **business partners**.
- Integrate the provided services within the **wider NFDI ecosystem**.

Our partners



Map by David Liuzzo, CC BY-SA 2.0 DE, via Wikimedia Commons, https://upload.wikimedia.org/wikipedia/commons/e/e3/Karte_Deutschland.svg

- Power grids, automation systems
- Long-term energy scenarios
- Energy policy and societal aspects
- Infrastructure & service provider

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Diverse stakeholders?

Collaboration in NFDI4Energy

- Main aim number 4: Promote **better collaboration and knowledge transfer** between scientific research institutes and business partners via FAIR research data management.
- This aim has been successfully addressed when industry and business partners within the energy domain **participate actively** in data sharing, supported by the FAIR criteria, access services provided by NFDI4Energy, or **transfer scientific results into practice** using community services, as **verified by usage statistics** and validated by stakeholder feedback.

Building and Serving the Energy Community

Research Community	Society and Policy	Business partners
• Main producer and user of research artefacts • Additional tools for handling of research artefacts are needed • Need for easy information on services	• Robust data on social and political factors are essential for energy modelling • High need for communication of scientific results to these stakeholders	• High relevance of data from business partners • Need for anonymized and artificial data • Data and models also relevant for business partners

Building and Serving the Energy Community through multiple mechanism

Collect requirements

- Identify key requirements as well as best practices from all stakeholders
- Use a methodical mix: interviews, surveys, and workshops

Community involvement

- We invite the different communities for involvement to different types of workshops and events
- e.g., industry workshops

Outreach

- Outreach to all stakeholders
- Through workshops, keynotes, booths at conferences, or other events

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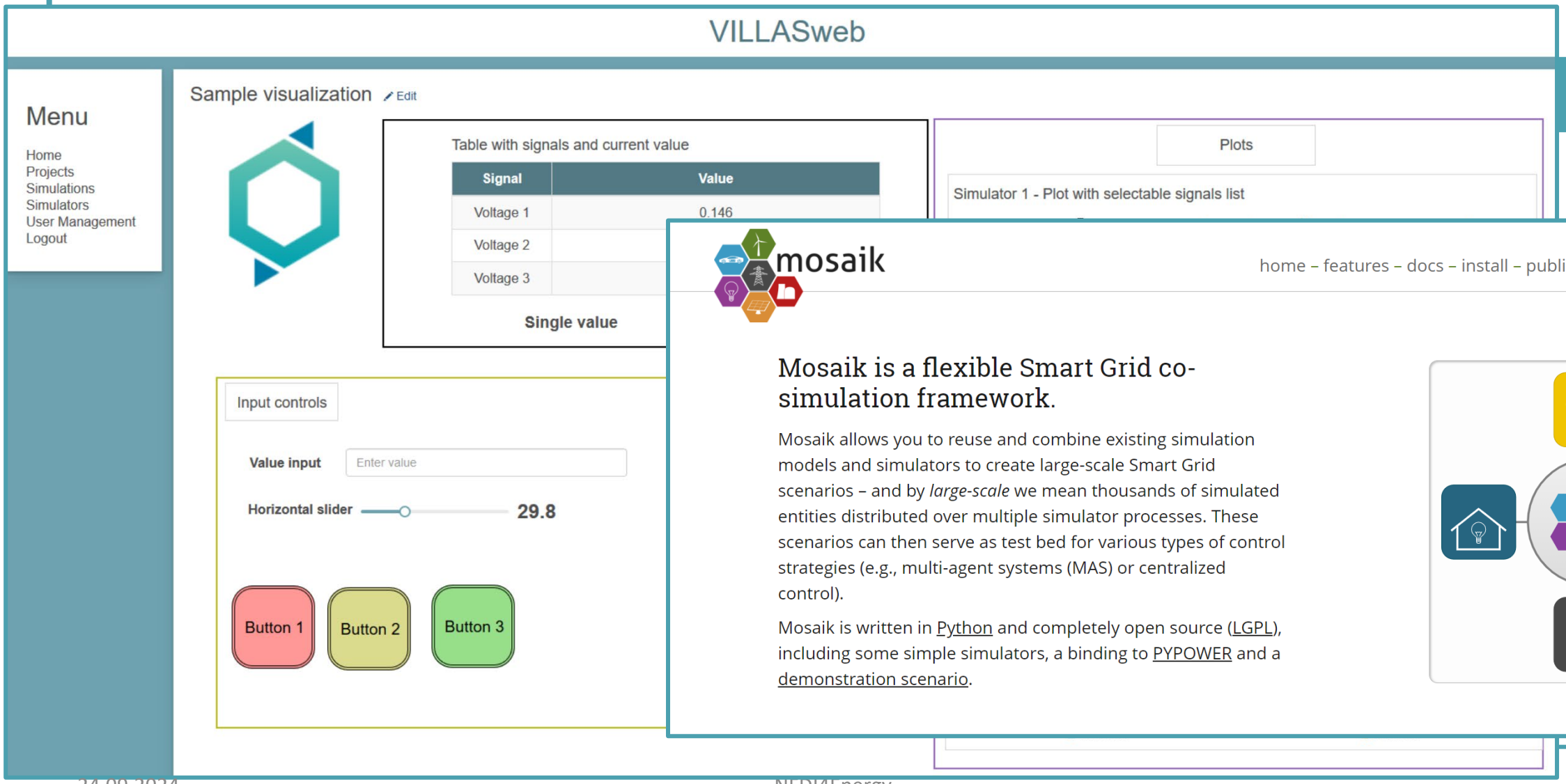
Research Artifacts in Energy Research (Examples)



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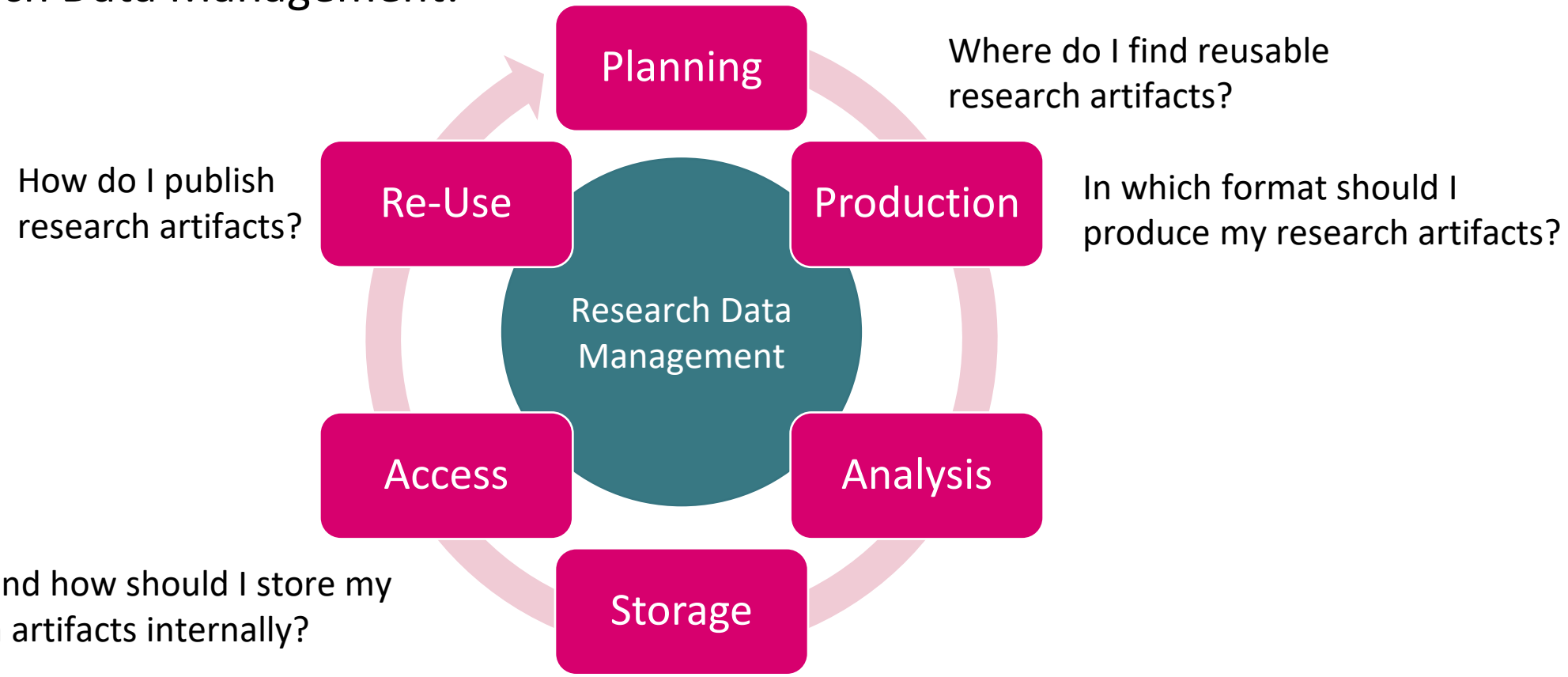
What kind of services?

Services from NFDI4Energy for FAIR Research Data Management

- NFDI4Energy aims to provide useful services for energy researchers in FAIR Research Data Management:



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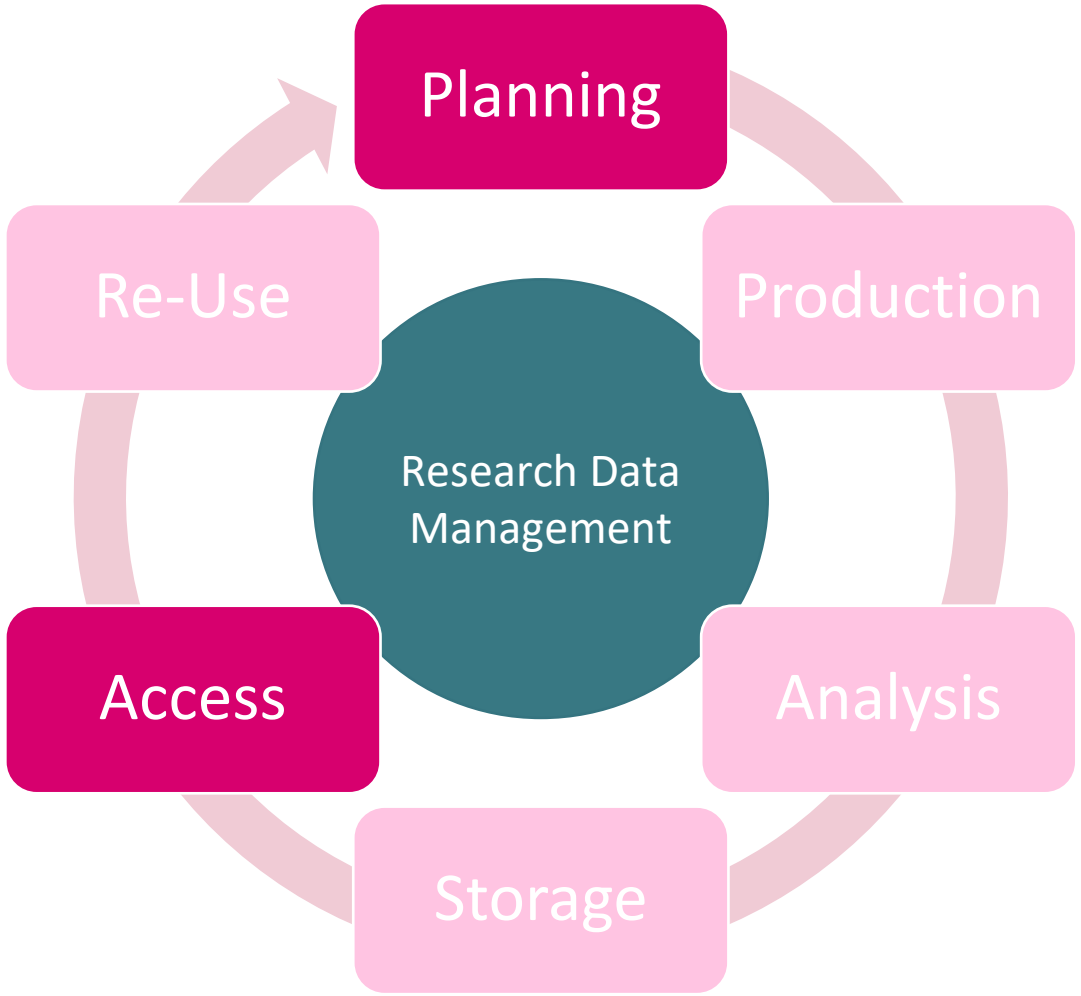
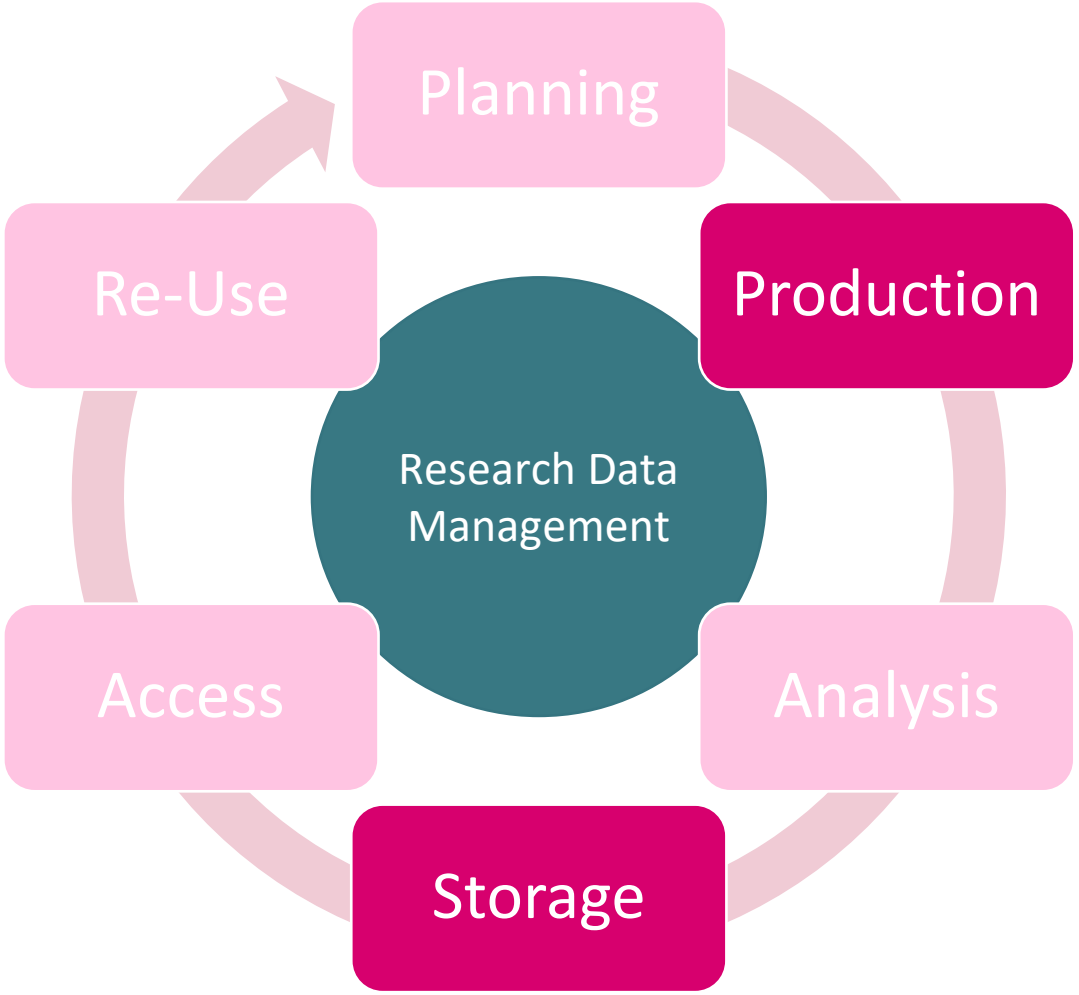


- Help to navigate in an interdisciplinary field:
- Provision of a **database** for **profiles** from scientists and industry partners that are open to new ideas.
- Provision of **research networks** through visualizations.
- Provision of **overviews** on existing databases and experimental set-ups.

Services from NFDI4Energy for FAIR Research Data Management



- Help to produce and store FAIR data and results:
- Provision of **recommendations for** existing **data repositories** and **source codes** for specific needs (e.g. high-temporal resolution) through a **registry**.
- Provision of **terminology services**.
- Provision of a **tool** for **assigning Persistent Identifiers** to FAIR research objects.
- Provision and linkage to **Open Research Knowledge Graphs.**
- Provision of **metadata** for FAIR research objects.

Provision of **Metadata** for FAIR Research Objects

- Metadata is indispensable to meet the requirements of the FAIR principles for research data and other research objects.
- From our proposal:

Year	Milestones
1	[MS4.3.1] Requirements for metadata standards for energy system research data collected
2	[MS4.3.2] Overview of domain-independent standards completed
5	[MS4.3.3] Metadata standards for energy research data developed

- We also have a working group that has the following objectives:
  - Establish a common ontology development process.
  - Coordinate the development of ontologies and metadata standards to ensure interoperability with the NFDI4Energy services.
  - Provide a discussion forum for sharing knowledge, tools, and techniques related to ontology development among the task areas.

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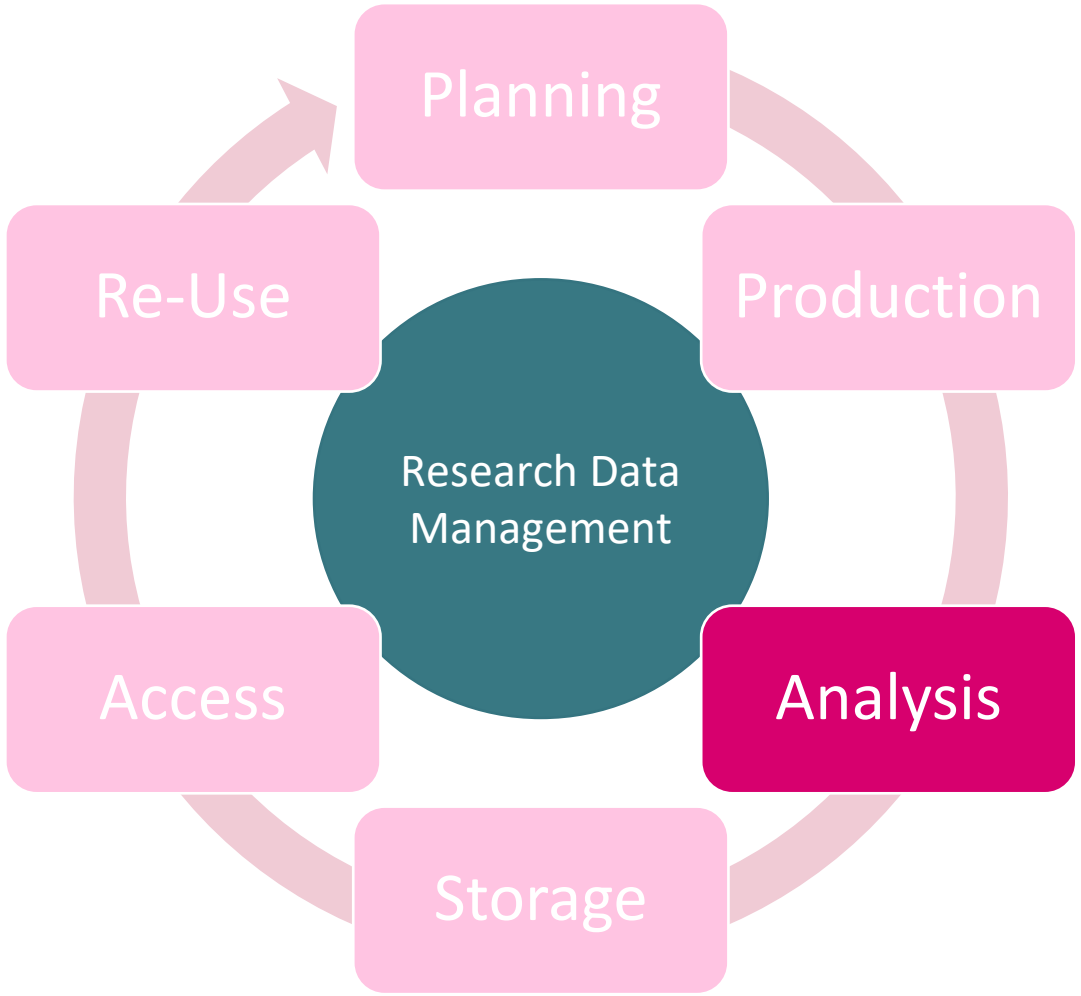


- Couple and analyse the different models and data to one simulation scenario:
- Provision of FAIR **co-simulation-as-a-service tools,** like mosaik or villasnode.
- Allow to **run** simple co-simulation online as simulation-as-a-service.

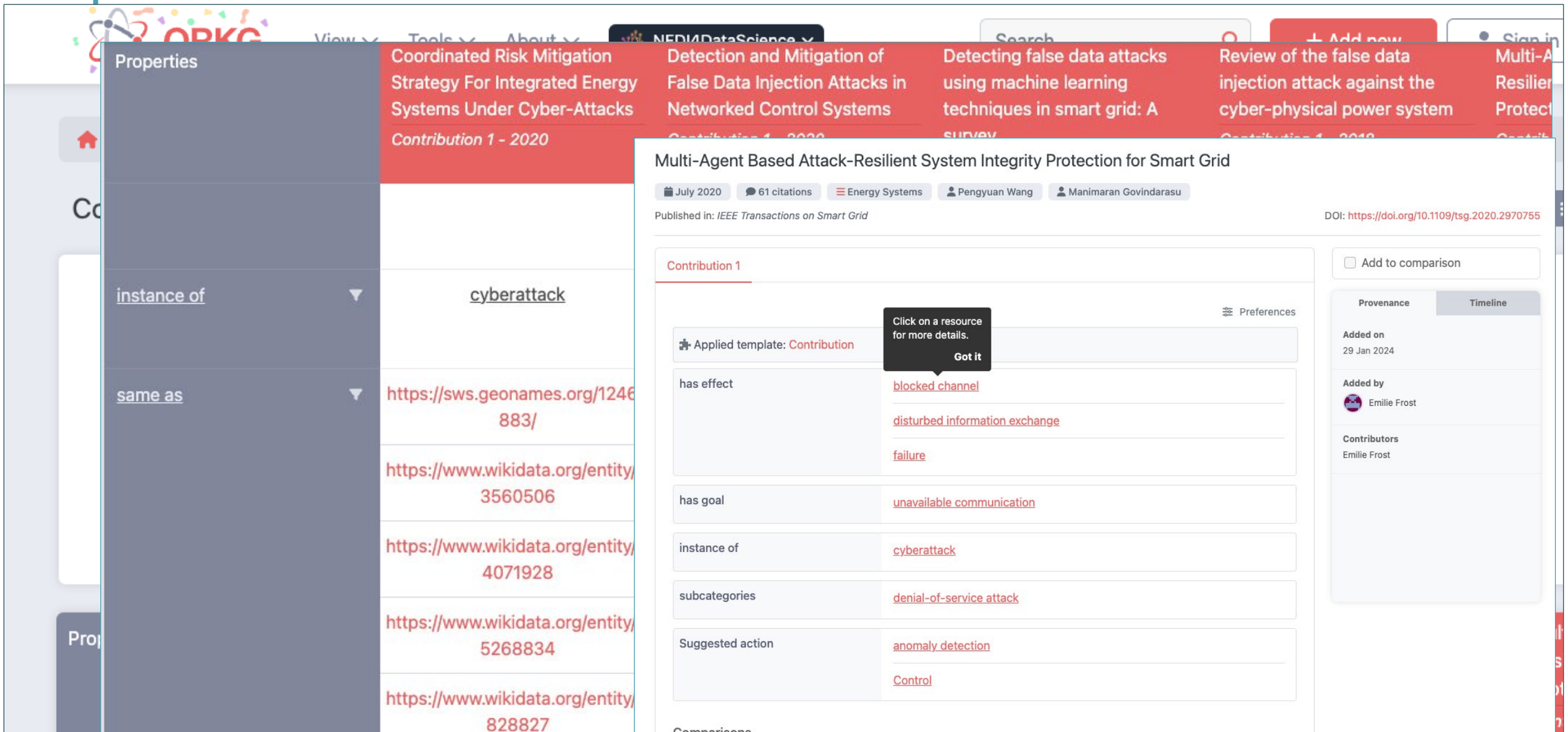
VILLASframework

mosaik

Services from NFDI4Energy for FAIR Research Data Management

- Help to make results re-usable:
- Provision an **overview** of **best practices** on how to conduct FAIR RDM through teaching materials and reports.
- Provision of a tool for the **publication** of research artifacts as FAIR Data Objects.
- Provision of **hands-ons** for publishing energy research results.

An example: Open Research Knowledge Graphs



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Wider NFDI ecosystem?

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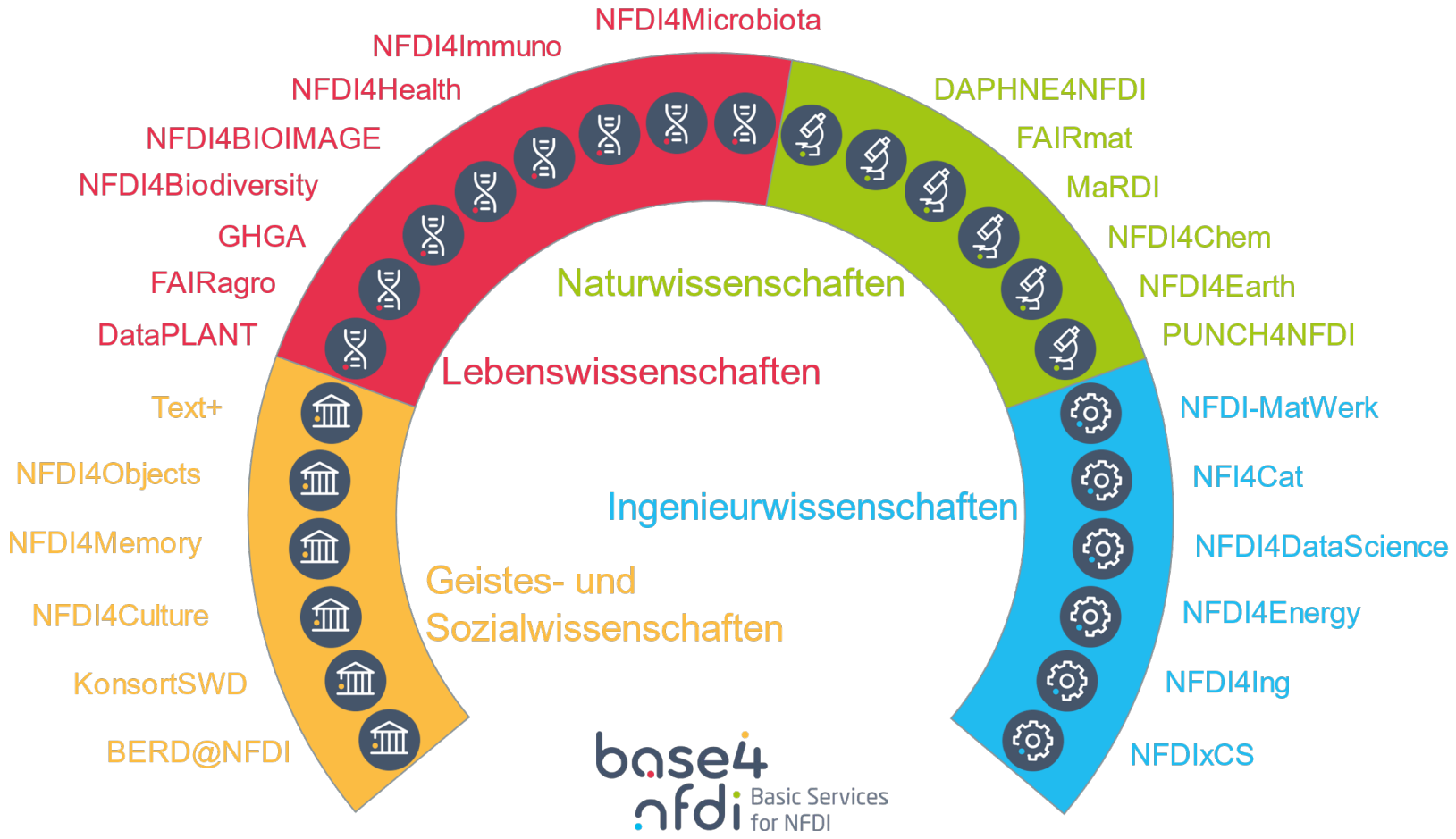
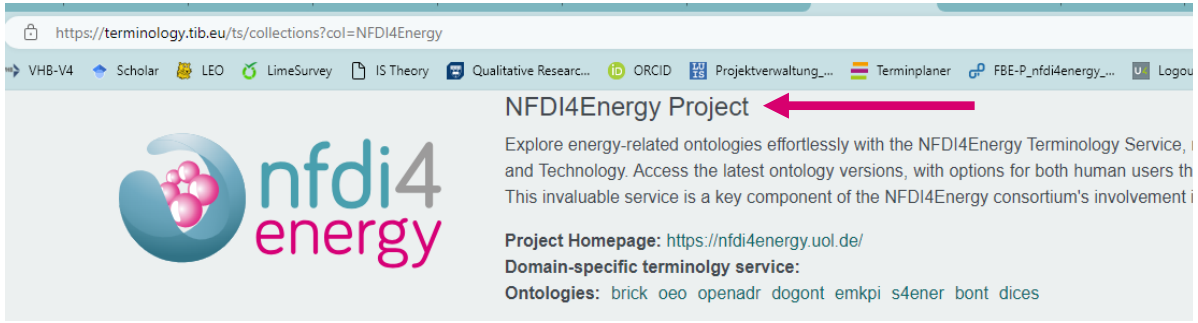


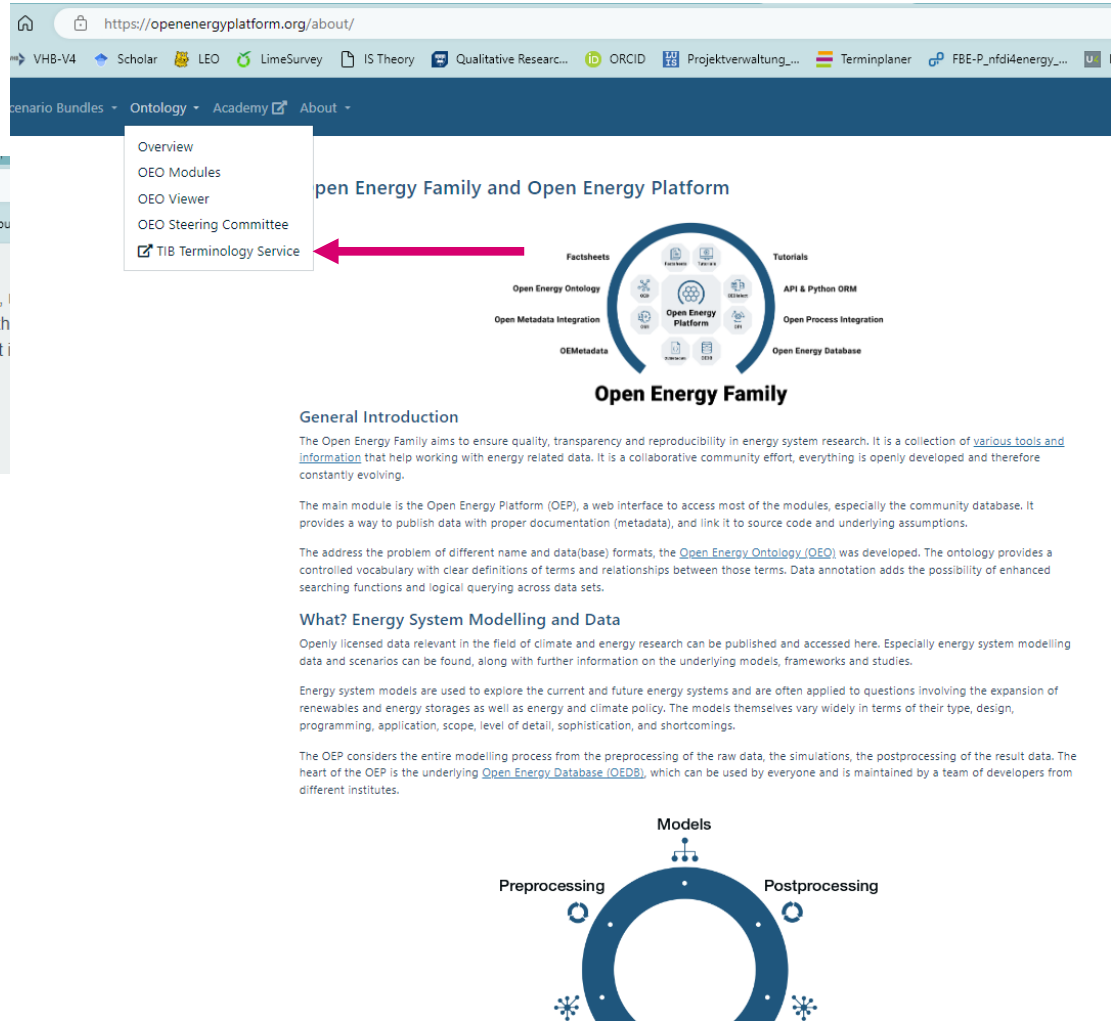
Services within the wider NFDI ecosystem

- An example from NFDI4Energy: **NFDI4Energy Terminology Service**
- What is a terminology?
  - Terminologies: A body of terms used with a particular technical application in a subject of study summarized and visualized in **Ontologies.**
- Energy researchers can explore energy-related ontologies effortlessly with the NFDI4Energy Terminology Service and find the most recent versions.
- In NFDI4Energy we orchestrate and link existing terminology service-related offers from the (NFDI)-community.

Services within the wider NFDI ecosystem

- **NFDI4Energy Terminology Service:**





How does NFDI4Energy fit into the international landscape?

- NFDI e.V. is the mandated member of the European Open Science Cloud (EOSC) for Germany
  - “The ambition of the European Open Science Cloud (EOSC) is to develop ’Web of FAIR Data and services’ for science in Europe.”
- Our (co-)spokesperson(s) are highly active in the ACM SIG Energy
- We are connected to multiple EU Horizons projects with similar focus like **EriGrid**, int:net, …
- Ontology-connected work items work on integrating the OSS world (Open Energy Family) with international industry standards CIM/IEC61970

NFDI and GAIA-X Activities (FAIR Data Spaces)

- Funded by the Federal Ministry of Education and Research (BMBF) from May 2021 to May 2024.
- Vision: Common cloud-based data space for business and science (based on the FAIR data principles).
- Mission: Create and expand synergies between existing technologies and communities.
- Some examples:

Biodiversity data space

A deployment of the Geo Engine software in a Gaia-X compatible cloud.

Gaia-X + NFDI4Biodiversity

Research data quality assurance

FAIR Research Data Quality Assurance and Workflows

Gaia-X + NFDI4Ing (Engineering)

Cross-platform data analytics

The demonstrator relies on already published medical data which can be publicly accessed without any restriction and used to train a classification model in the Gaia-X setting

Gaia-X + NFDI4Health

Join us: 2nd NFDI4Energy Conference

- 2nd NFDI4Energy Conference - Bringing the community of energy research data management together
- Location: KIT, Karlsruhe, Germany
- Date: Tuesday, 25.03.25 – Thursday, 27.03.25
- Participants: Open for all, Submissions will be possible
- Limit: 150 participants

How to stay in touch

Website

All Information
on one site:
http://nfdi4energy.org

LinkedIn

Get the latest news!
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Newsletter

Stay up-to-date with
our newsletter:
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