

---

# Organizing Scientific Knowledge From Energy System Research Using the Open Research Knowledge Graph

**Oliver Karras**, Jan Göpfert, Patrick Kuckertz, Tristan Pelser, and Sören Auer

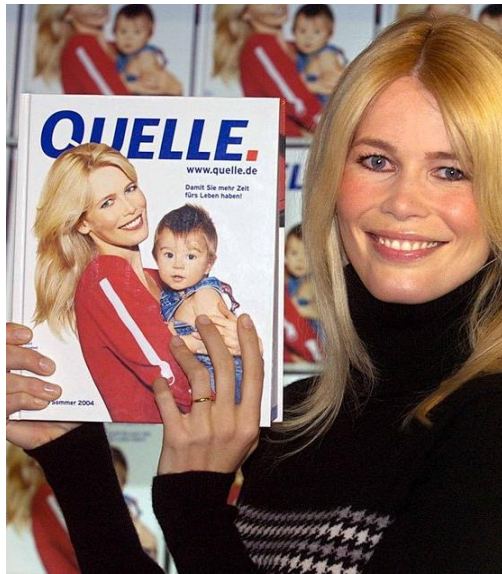
[oliver.karras@tib.eu](mailto:oliver.karras@tib.eu)

1st NFDI4Energy Conference – Bringing the Community of Energy System Data Management Together

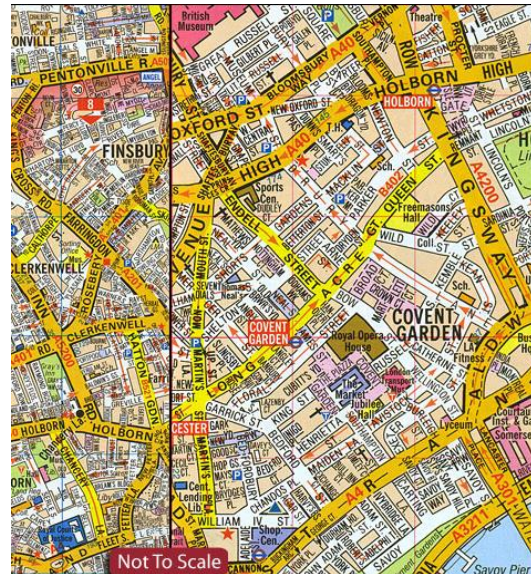
20. – 21.02.2024, Leibnizhaus, Hannover, Germany

# Once Upon a Time, we Communicated with Paper...

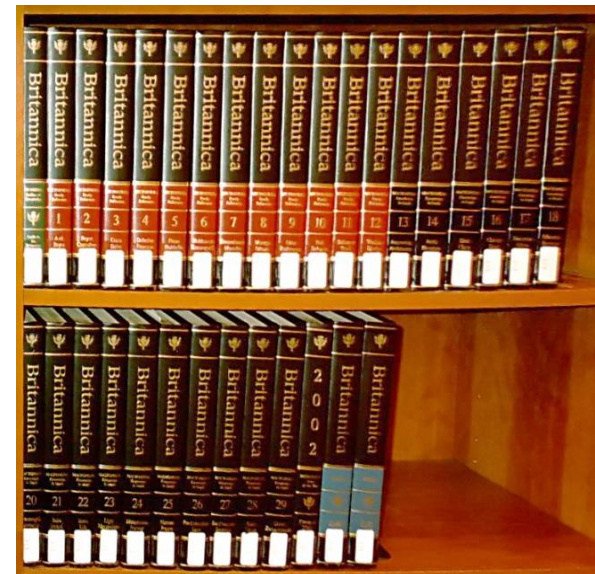
Who still remembers?



Mail order catalogs



Maps

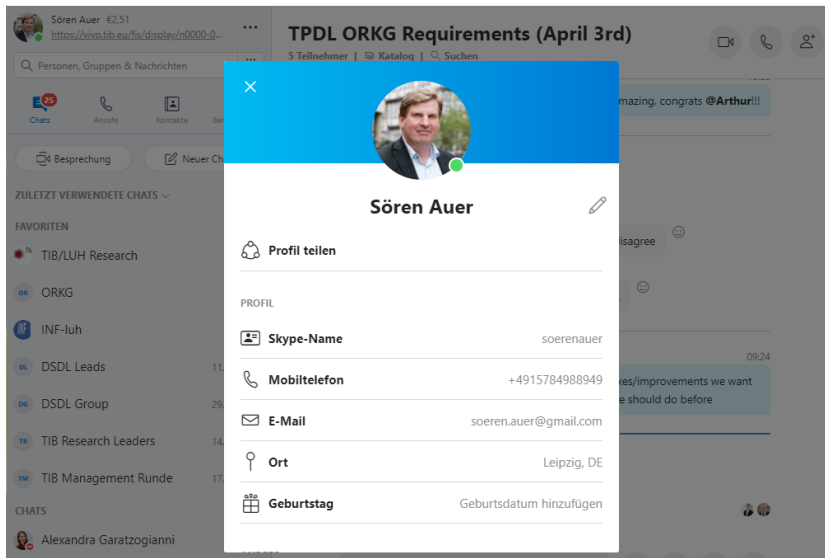
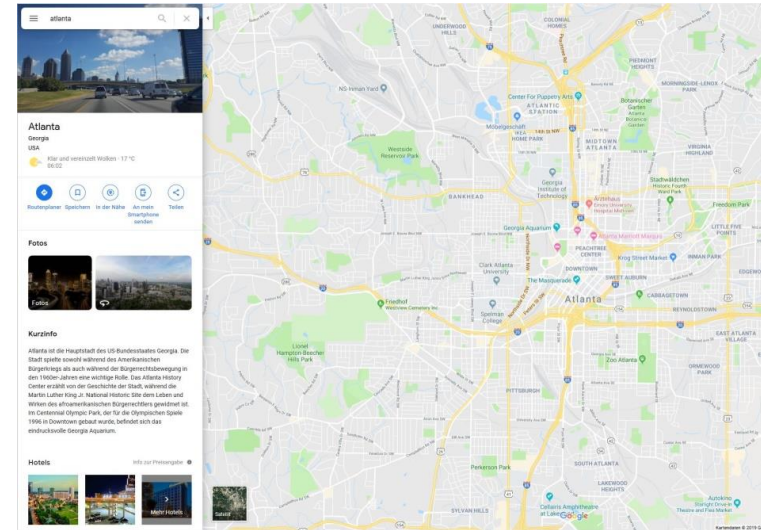
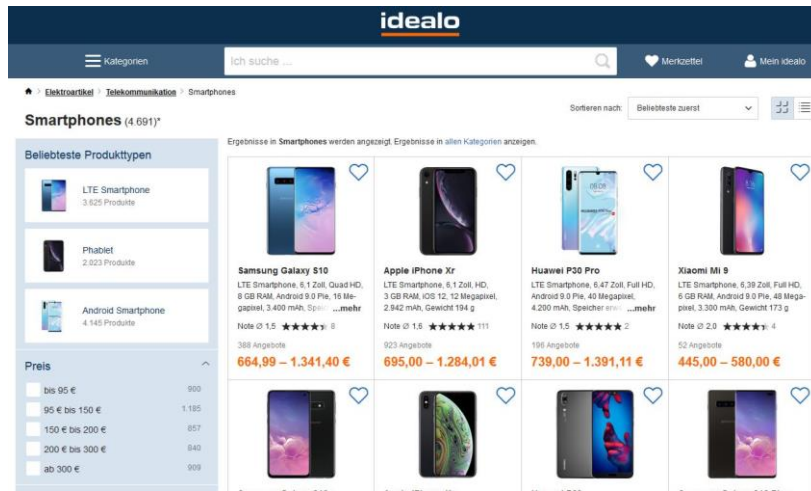


Encyclopedia



Phone books

# ... until Digital Transformation (Digitalization)!



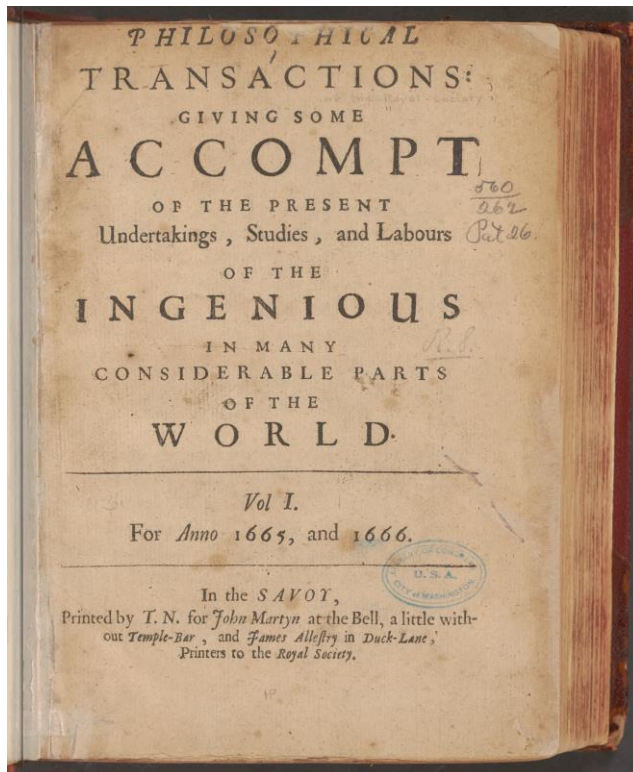
## The World of Publishing & Communication has Profoundly Changed!

- **New means adapted to the new possibilities, e.g., platforms**
- **Completely new business models**
- **More focus on data, interlinking, services, and search**
- **Integration, crowdsourcing, and data curation are important**

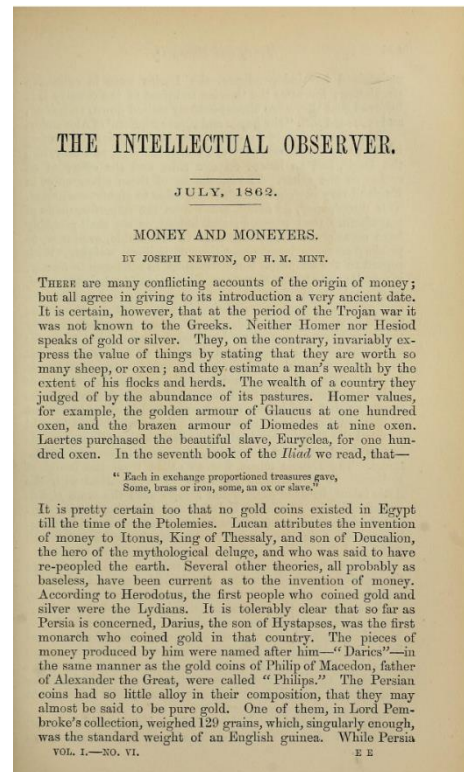
# **What has Happened in Academia in Terms of Scholarly Publishing & Communication?**

# Let's Take a Look

## 17<sup>th</sup> century



## 19<sup>th</sup> century



## 20<sup>th</sup> century

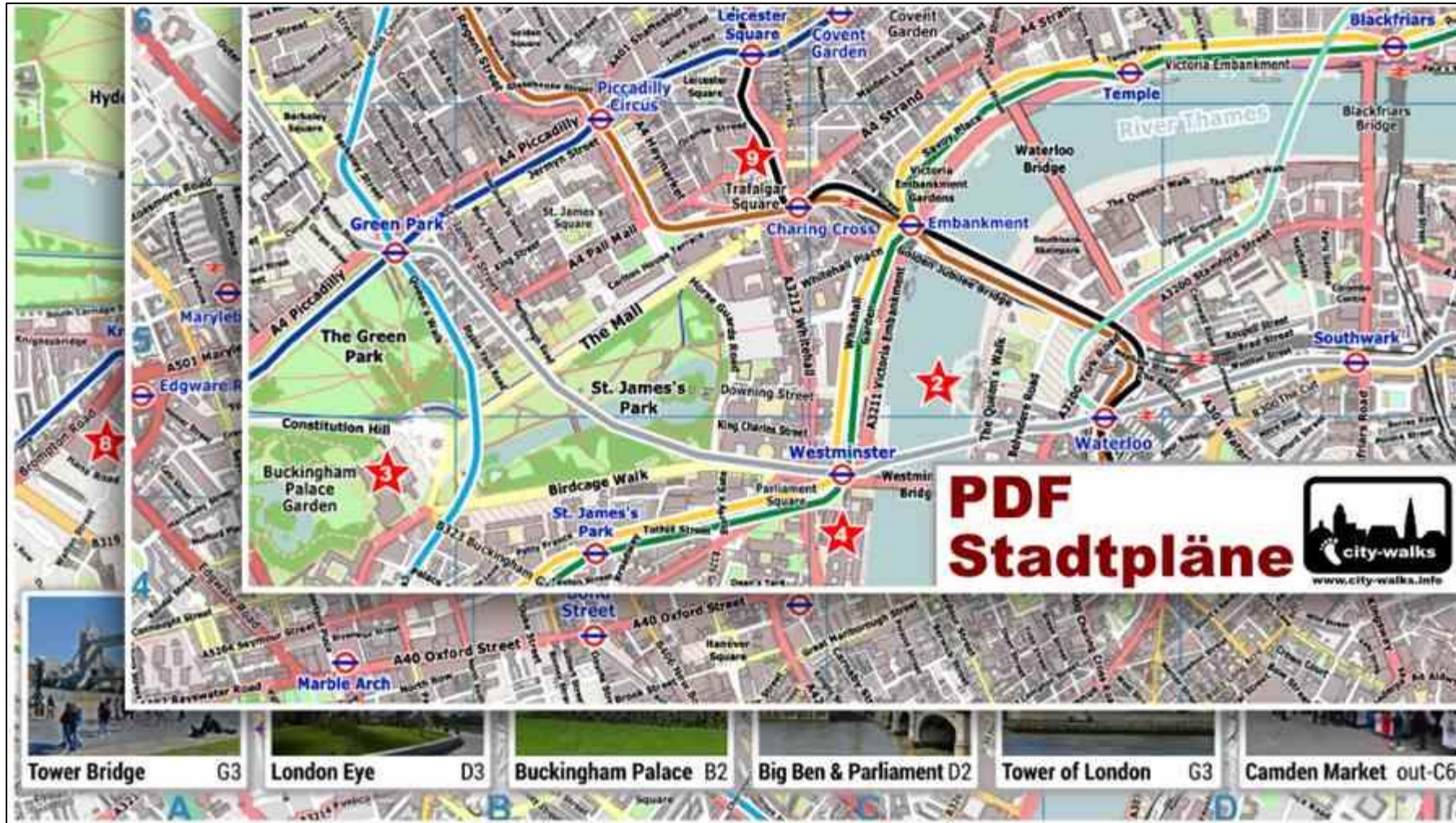


## 21<sup>st</sup> century



Scholarly Publishing & Communication has **not** changed (much)!

# Let's Take a Look



## 21<sup>st</sup> century

### AGDISTIS - Graph-Based Disambiguation of Named Entities Using Linked Data

Ricardo Usbeck<sup>1,2</sup>, Axel-Cyrille Ngonga Ngomo<sup>1</sup>, Michael Röder<sup>1,2</sup>, Daniel Gerber<sup>1</sup>, Sandro Athaide Coelho<sup>3</sup>, Sören Auer<sup>4</sup>, and Andreas Both<sup>2</sup>

<sup>1</sup> University of Leipzig, Germany

<sup>2</sup> R&D, Unister GmbH, Germany

<sup>3</sup> Federal University of Juiz de Fora, Brazil

<sup>4</sup> University of Bonn & Fraunhofer IAIS, Germany

(usbeck,ngonga}@informatik.uni-leipzig.de

**Abstract.** Over the last decades, several billion Web pages have been made available on the Web. The ongoing transition from the current Web of unstructured data to the Web of Data yet requires scalable and accurate approaches for the extraction of structured data in RDF (Resource Description Framework) from these websites. One of the key steps towards extracting RDF from text is the disambiguation of named entities. While several approaches aim to tackle this problem, they still achieve poor accuracy. We address this drawback by presenting AGDISTIS, a novel knowledge-base-agnostic approach for named entity disambiguation. Our approach combines the Hypertext-Induced Topic Search (HITS) algorithm with label expansion strategies and string similarity measures. Based on this combination, AGDISTIS can efficiently detect the correct URIs for a given set of named entities within an input text. We evaluate our approach on eight different datasets against state-of-the-art named entity disambiguation frameworks. Our results indicate that we outperform the state-of-the-art approach by up to 29% F-measure.

### 1 Introduction

The vision behind the Web of Data is to provide a new machine-readable layer to the Web where the content of Web pages is annotated with structured data (e.g., RDEa [1]). However, the Web in its current form is made up of at least 15 billion Web pages.<sup>1</sup> Most of these websites are unstructured in nature. Realizing the vision of a usable and up-to-date Web of Data thus requires scalable and accurate natural-language-processing approaches that allow extracting RDF from such unstructured data. Three tasks play a central role when extracting RDF from unstructured data: named entity recognition (NER), named entity disambiguation (NED), also known as entity linking [16], and relation extraction (RE). For the first sentence of Example 1, an accurate named entity recognition approach would return the strings Barack Obama and Washington,

<sup>1</sup> Data gathered from <http://www.worldwidewebsize.com/> on January 4th, 2014.

# Let's Take a Look



# Rethink How Research is Represented and Communicated



*“The lightbulb was **not** invented by improving the candle.”*

Oren Harari

Digitalization is **more** than just Digitization!


Current and future scientific challenges can not be tackled with an outdated communication system.

---

**Digitalize Knowledge,  
Not Documents!**



# Example: Energy System Research Scenarios

Google Scholar  

Artikel Ungefähr 5.590.000 Ergebnisse (0,25 Sek.)

---

**Beliebige Zeit**  
Seit 2024  
Seit 2023  
Seit 2020  
Zeitraum wählen...

---

**Nach Relevanz sortieren**  
Nach Datum sortieren

---

**Beliebige Sprache**  
Seiten auf Deutsch

---


**Alle Typen**  
Übersichtsarbeiten


---


Patente einschließen  
 Zitate einschließen

---

Alert erstellen

[\[HTML\] Comparison of 100% renewable energy system scenarios with a focus on flexibility and cost](#) [\[HTML\] sciencedirect.com](#)  
[W Deason](#) - Renewable and Sustainable Energy Reviews, 2018 - Elsevier  
... **energy system scenarios** assuming 100% renewable **energy** (RE) are selected and compared. The purpose is to compare the relative characteristics of the **scenarios**... multiple **scenarios**) ...  
☆ Speichern  Zitieren Zitiert von: 90 Ähnliche Artikel Alle 3 Versionen

[\[HTML\] Comparison methods of energy system frameworks, models and scenario results](#) [\[HTML\] sciencedirect.com](#)  
[MG Prina, B Nastasi, D Groppi, S Misconel...](#) - ... and Sustainable Energy ..., 2022 - Elsevier  
... of the comparison techniques for **energy system scenario** results and its ... **energy system scenario** results classified by publication year, case study, number of **scenarios** analyzed, **energy** ...  
☆ Speichern  Zitieren Zitiert von: 9 Ähnliche Artikel Alle 7 Versionen

[\[HTML\] Combining scenario planning, energy system analysis, and multi-criteria analysis to develop and evaluate energy scenarios](#) [\[HTML\] sciencedirect.com](#)  
[T Witt, M Dumeier, J Geldermann](#) - Journal of Cleaner Production, 2020 - Elsevier  
... **scenario** planning (SP), **energy system** analysis (ESA), and multi-criteria analysis (MCA) for the evaluation of future **energy systems** in ... **energy scenarios** in a transparent and **systematic** ...  
☆ Speichern  Zitieren Zitiert von: 69 Ähnliche Artikel Alle 4 Versionen

# Example: Energy System Research Scenarios

The image shows a Google Scholar search interface. At the top, the search bar contains the text "Energy system research scenarios" and a magnifying glass icon. Below the search bar, it indicates "Ungefähr 5.590.000 Ergebnisse (0,25 Sek.)". On the left side, there are several filter options: "Artikel" (selected), "Beliebige Zeit" (with sub-options "Seit 2024", "Seit 2023", "Seit 2020", and "Zeitraum wählen..."), "Nach Relevanz sortieren" (with "Nach Datum sortieren" below it), "Beliebige Sprache" (with "Seiten auf Deutsch" below it), "Alle Typen" (with "Übersichtsarbeiten" below it), and checkboxes for "Patente einschließen" (unchecked) and "Zitate einschließen" (checked). At the bottom left, there is a button for "Alert erstellen".

**What is the average assumed emission reduction of the scenarios?**

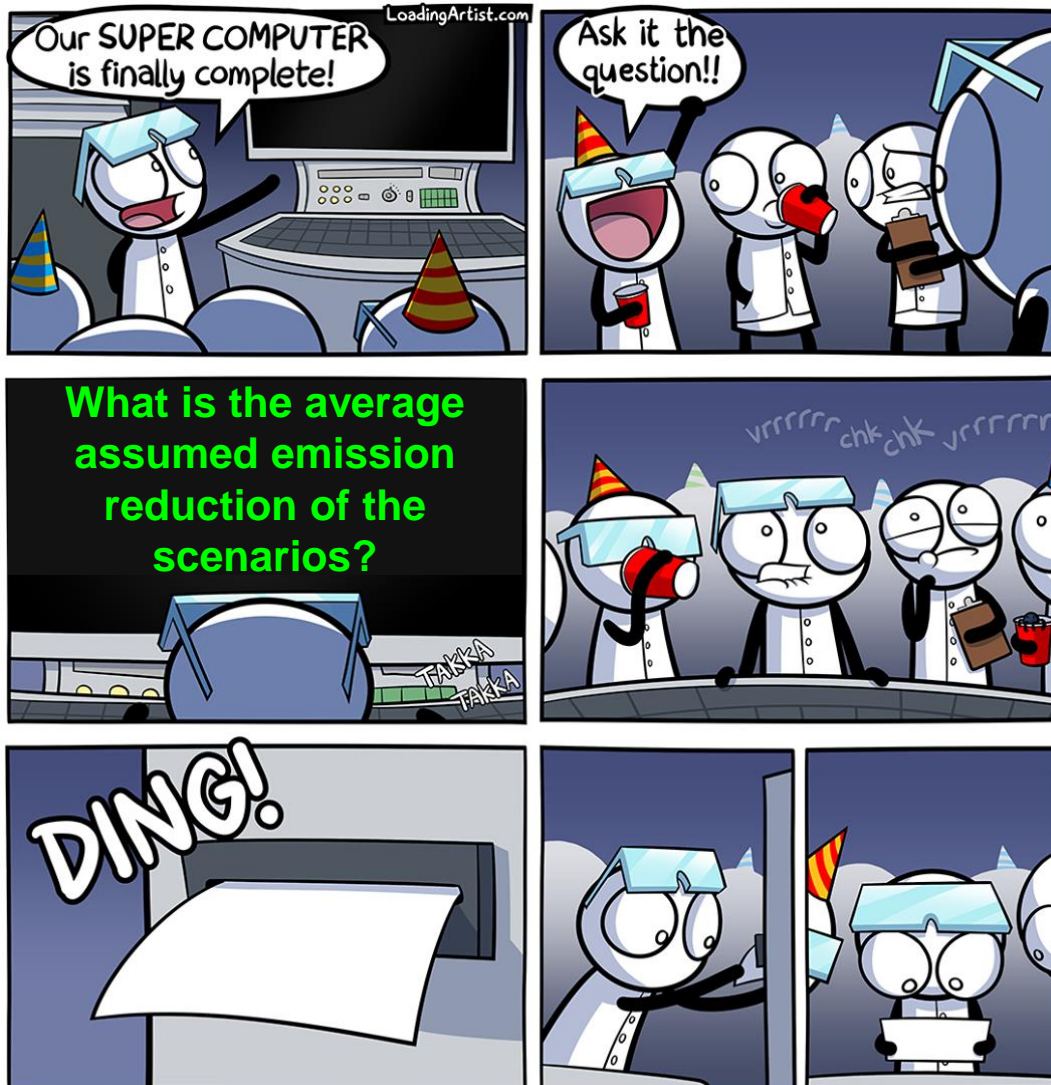
**What software can use these scenarios as input for simulations?**

**Where do I find the implementation of the software for simulating the scenarios?**

# How do we answer these questions so far?



# Wouldn't it be Great if we could ask the Computer?



How can we achieve this goal?

# Open Research Knowledge Graph (ORKG)

## Scholarly Knowledge. Comparable.

The Open Research Knowledge Graph (ORKG) aims to describe research papers in a structured manner. With the ORKG, papers are easier to find and compare. [Play video](#)

☰ Browse by research field

Search for fields... | v

Arts and Humanities  
432 papers - 33 comparisons

Engineering  
3350 papers - 341 comparisons

Life Sciences  
4085 papers - 188 comparisons

Physical Sciences &  
Mathematics  
15632 papers - 720 comparisons

Social and Behavioral Sciences  
831 papers - 170 comparisons

Comparisons Papers Visualizations Reviews Lists

Top recent v

Investigating application of Web Content Accessibility Guidelines for higher institutions websites

8 Contributions 0 Visualizations 0 attachments 26-11-2023

Research based on open-access papers, indexed in Scopus, with "wcag" keyword

Computer Sciences



Plant Cultivation, PL...

Machine learning of pre-harvesting crop/fruit parameters to minimize overall losses in farming production

Load Toots

By loading the Mastodon widget, you agree with the [cookie guidelines](#)

ORKG stories

See how researchers benefit from using ORKG.

[Find out more](#)

Join ORKG!

Sign up



# Two Examples from NFDI4Ing – TA Ellen

14 Scenario Factsheets from the Open Energy Platform

25 Studies on Germany's Energy Supply in 2050

Szenariorahmen zum NEP 2035 (Szenario A 2035)
Szenariorahmen zum NEP 2035 (Szenario B 2035 und 2040)
Szenariorahmen zum NEP 2035 (Szenario C 2035)
Paris Agreement Compatible (PAC) energy scenario
Untersuchungen zur Energiestrategie Brandenburgs (appBBB_gruene2030)
Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030)
Analysis of the energy system of Brandenburg and Berlin (Szenario 2)
Analysis of the energy system of Brandenburg and Berlin (Szenario 1)
Klimaschutzszenario 80 (KS80)
Aktuelle-Maßnahmen-Szenario 2012
Germany: With additional measures scenario (WAM)
Germany: With existing measures scenario (WEM)
Klimaschutzszenario 95 (KS95)
Waste heat recovery

**95**  
SZENARIO 2050

**WEGE FÜR DIE ENERGIEWENDE**  
Kosteneffiziente und klimagerechte Transformationsstrategien für das deutsche Energiesystem bis zum Jahr 2050

M. Robinius, P. Markewitz, P. Lopian, F. Kullmann, P.-M. Heuser, K. Syranidis, S. Cerniauskas, T. Schöb, M. Reuß, S. Ryberg, L. Kutzur, D. Caglayan, L. Welder, J. Linßen, T. Grube, H. Heinrichs, P. Stenzel und D. Stolten

Energie & Umwelt / Energy & Environment  
Band / Volume 499  
ISBN 978-3-95806-483-6

Mitglied der Helmholtz-Gemeinschaft

**JÜLICH**  
Forschungszentrum

# Example 1: Scenario Factsheets form OEP

Study	
Empirical Data	
Assumptions	
<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated
<b>Share RE (mobility sector)</b>	not estimated
<b>Share RE (power sector)</b>	not estimated
<b>Share RE (total energy supply)</b>	not estimated
<b>Cost development</b>	capex, opex, constant
<b>Technological innovations ?</b>	spread of electromobility, heat pumps and solar thermal heat;
<b>Potential wind</b>	other, potential wind other text
<b>Potential solar electric</b>	goal of "Energiesstrategie 2030"
<b>Potential solar thermal</b>	goal of "Energiesstrategie 2030"
<b>Potential biomass</b>	goal of "Energiesstrategie 2030"
<b>Potential geothermal</b>	other, potential geothermal othertext
<b>Potential hydro power</b>	-
<b>Social development ?</b>	-
<b>Economic development ?</b>	42 TWh export
<b>Development of environmental aspects ?</b>	-
<b>Post-processing ?</b>	✓
<b>Further assumptions for post-processing ?</b>	✗
Results	



Untersuchungen zur Energiestrategie Brandenburgs (appBBB\_ES2030)

Energy Systems Elisa Gaudchau Birgit Schachler Berit Müller

**Scenario**

Research problems  Add to comparison

Future energy and emission scenario predictions

Contribution data

← Back Scen hasF hasA Emission reduction → Emission reductions ↻

Has value	72.0	xsd:decimal
Has unit	percent	
Time frame	2030	xsd:integer
Has description	72% until 2030	xsd:string

# Example 1: Scenario Factsheets form OEP

**E. Gaudchau, B. Schachler, and B. Müller:**  
**Untersuchungen zur Energiestrategie**  
**Brandenburgs (appBBB\_ES2030)**

## Assumptions

<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated

### Untersuchungen zur Energiestrategie Brandenburgs (appBBB\_ES2030)

Energy Systems | Elisa Gaudchau | Birgit Schachler | Berit Müller

#### Scenario

Research problems  Add to comparison

Future energy and emission scenario predictions

#### Contribution data

← Back | Scen | hasF | hasA | Emission reduction → Emission reductions | ↻

Has value	72.0	xsd:decimal
Has unit	percent	
Time frame	2030	xsd:integer
Has description	72% until 2030	xsd:string



# Example 1: Scenario Factsheets form OEP

**E. Gaudchau, B. Schachler, and B. Müller:  
Untersuchungen zur Energiestrategie  
Brandenburgs (appBBB\_ES2030)**

## Assumptions

<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated

Untersuchungen zur Energiestrategie Brandenburgs (appBBB\_ES2030)

Energy Systems Elisa Gaudchau Birgit Schachler Berit Müller

Scenario

Research problems  Add to comparison

Future energy and emission scenario predictions

Contribution data

← Back Scen hasF hasA Emission reduction → Emission reductions ↻

Has value	72.0	xsd:decimal
Has unit	percent	
Time frame	2030	xsd:integer
Has description	72% until 2030	xsd:string

# Example 1: Scenario Factsheets form OEP

**E. Gaudchau, B. Schachler, and B. Müller:  
Untersuchungen zur Energiestrategie  
Brandenburgs (appBBB\_ES2030)**

## Assumptions

<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated

Untersuchungen zur Energiestrategie Brandenburgs (appBBB\_ES2030)

Energy Systems | Elisa Gaudchau | Birgit Schachler | Berit Müller

**Scenario**

Research problems  Add to comparison

Future energy and emission scenario predictions

Contribution data

← Back | Scen | hasF | hasA | Emission reduction → Emission reductions | ↻

Has value	72.0	xsd:decimal
Has unit	percent	
Time frame	2030	xsd:integer
Has description	72% until 2030	xsd:string

# Example 1: Scenario Factsheets form OEP

**E. Gaudchau, B. Schachler, and B. Müller:  
Untersuchungen zur Energiestrategie  
Brandenburgs (appBBB\_ES2030)**

## Assumptions

<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated

Untersuchungen zur Energiestrategie Brandenburgs (appBBB\_ES2030)

Energy Systems Elisa Gaudchau Birgit Schachler Berit Müller

Scenario

Research problems  Add to comparison

Future energy and emission scenario predictions

Contribution data

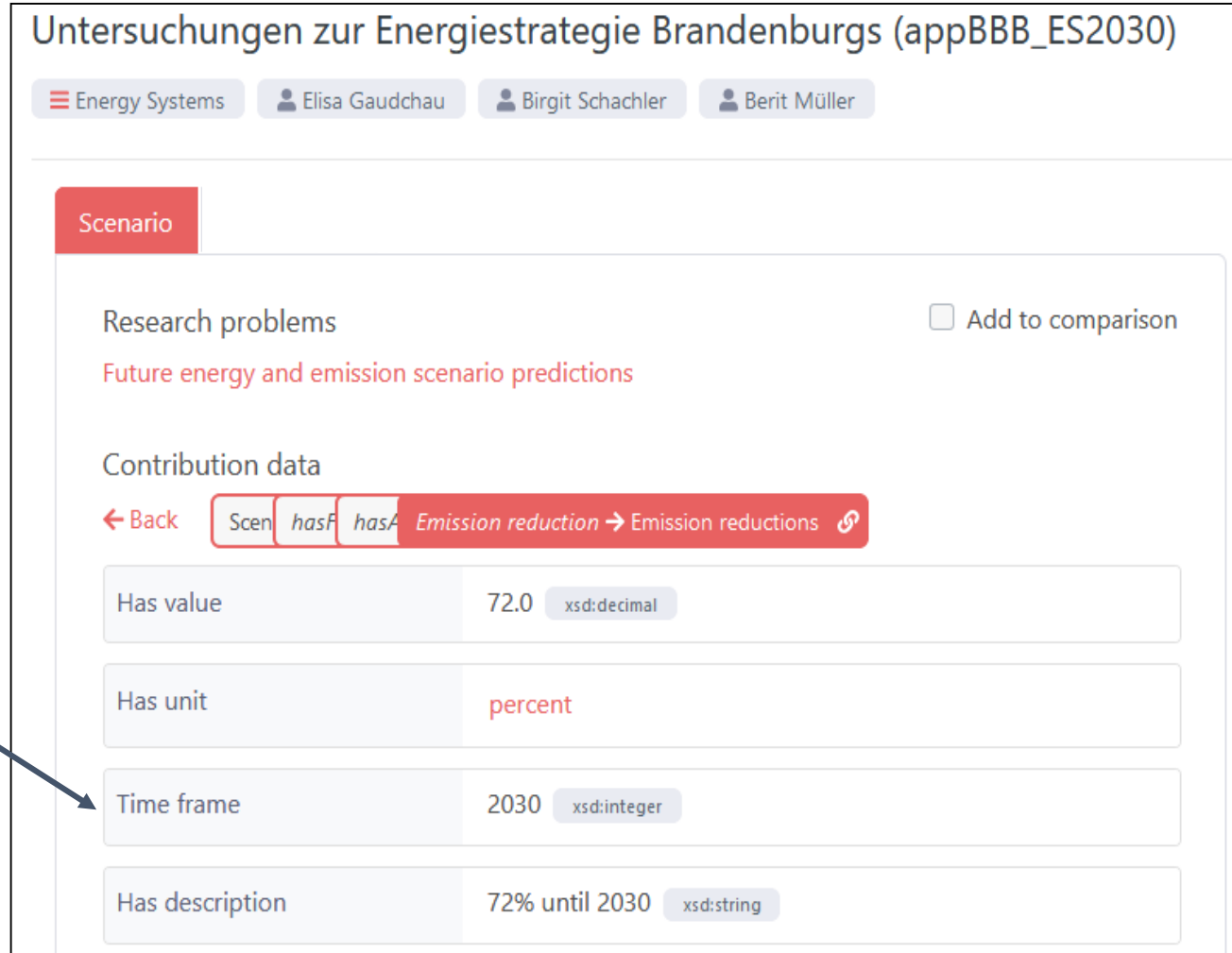
← Back Scen hasF hasA Emission reduction → Emission reductions ↻

Has value 72.0 xsd:decimal

Has unit percent

Time frame 2030 xsd:integer

Has description 72% until 2030 xsd:string



# Example 1: Scenario Factsheets form OEP

**E. Gaudchau, B. Schachler, and B. Müller:  
Untersuchungen zur Energiestrategie  
Brandenburgs (appBBB\_ES2030)**

## Assumptions

<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated

Untersuchungen zur Energiestrategie Brandenburgs (appBBB\_ES2030)

Energy Systems | Elisa Gaudchau | Birgit Schachler | Berit Müller

**Scenario**

Research problems  Add to comparison

Future energy and emission scenario predictions

Contribution data

← Back | Scen | hasF | hasA | Emission reduction → Emission reductions | ↻

Has value	72.0	xsd:decimal
Has unit	percent	
Time frame	2030	xsd:integer
Has description	72% until 2030	xsd:string

# Example 1: Open Energy Ontology & Terminology Service

Study	
Empirical Data	
Assumptions	
<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated
<b>Share RE (mobility sector)</b>	not estimated
<b>Share RE (power sector)</b>	not estimated
<b>Share RE (total energy supply)</b>	not estimated
<b>Cost development</b>	capex, opex, constant
<b>Technological innovations ?</b>	spread of electromobility, heat pumps and solar thermal heat;
<b>Potential wind</b>	other, potential wind other text
<b>Potential solar electric</b>	goal of "Energiesstrategie 2030"
<b>Potential solar thermal</b>	goal of "Energiesstrategie 2030"
<b>Potential biomass</b>	goal of "Energiesstrategie 2030"
<b>Potential geothermal</b>	other, potential geothermal othertext
<b>Potential hydro power</b>	-
<b>Social development ?</b>	-
<b>Economic development ?</b>	42 TWh export
<b>Development of environmental aspects ?</b>	-
<b>Post-processing ?</b>	✓
<b>Further assumptions for post-processing ?</b>	✗
Results	

models energy sector

**Electricity sector** C20081, C20091, C20090

**Heat sector** C20081

models demand sector

**Commercial sector** C20083, C20081, C20086

**TIB** TERMINOLOGY SERVICE

HOME COLLECTIONS **ONTOLOGIES** HELP API ABOUT

sector

Exact Match  Obsolete terms

## Repository for the Open Energy Ontology (OEO)

<http://openenergy-platform.org/ontology/o eo/>

Overview **Class Tree** Property Tree Individuals Class List

Jump to:

- entity
  - continguant
    - generically dependent continguant
      - sector**
        - agriculture, forestry and land use sector
        - energy demand sector
        - energy transformation sector
        - industry sector
        - source category
        - waste and wastewater sector

Detail **Graph View**

Legend

Relationship	Color	Visibility
Extended nodes (*)	Red	-
is a	Green	<input checked="" type="checkbox"/>
is about	Yellow	<input type="checkbox"/>
Select/DeSelect all	Blue	<input type="checkbox"/>

List of extended nodes (\*):

- sector (OEO\_0000367)

# Example 1: Behind the Scenes

Scientific knowledge becomes **machine-actionable** and **FAIR**.

Study	
Empirical Data	
Assumptions	
<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated
<b>Share RE (mobility sector)</b>	not estimated
<b>Share RE (power sector)</b>	not estimated
<b>Share RE (total energy supply)</b>	not estimated
<b>Cost development</b>	capex, opex, constant
<b>Technological innovations ?</b>	spread of electromobility, heat pumps and solar thermal heat;
<b>Potential wind</b>	other, potential wind other text
<b>Potential solar electric</b>	goal of "Energierstrategie 2030"
<b>Potential solar thermal</b>	goal of "Energierstrategie 2030"
<b>Potential biomass</b>	goal of "Energierstrategie 2030"
<b>Potential geothermal</b>	other, potential geothermal othertext
<b>Potential hydro power</b>	-
<b>Social development ?</b>	-
<b>Economic development ?</b>	42 TWh export
<b>Development of environmental aspects ?</b>	-
<b>Post-processing ?</b>	✓
<b>Further assumptions for post-processing ?</b>	✗
Results	



## Untersuchungen zur Energiestrategie Brandenburgs (appBBB\_ES2030)

☰ Energy Systems
👤 Elisa Gaudchau
👤 Birgit Schachler
👤 Berit Müller

Scenario

Add to comparison

Research problems

Future energy and emission scenario predictions

Contribution data

← Back
Scen
hasF
hasA
Emission reduction
→ Emission reductions
🔗

Has value
72.0 xsd:decimal

Has unit
percent

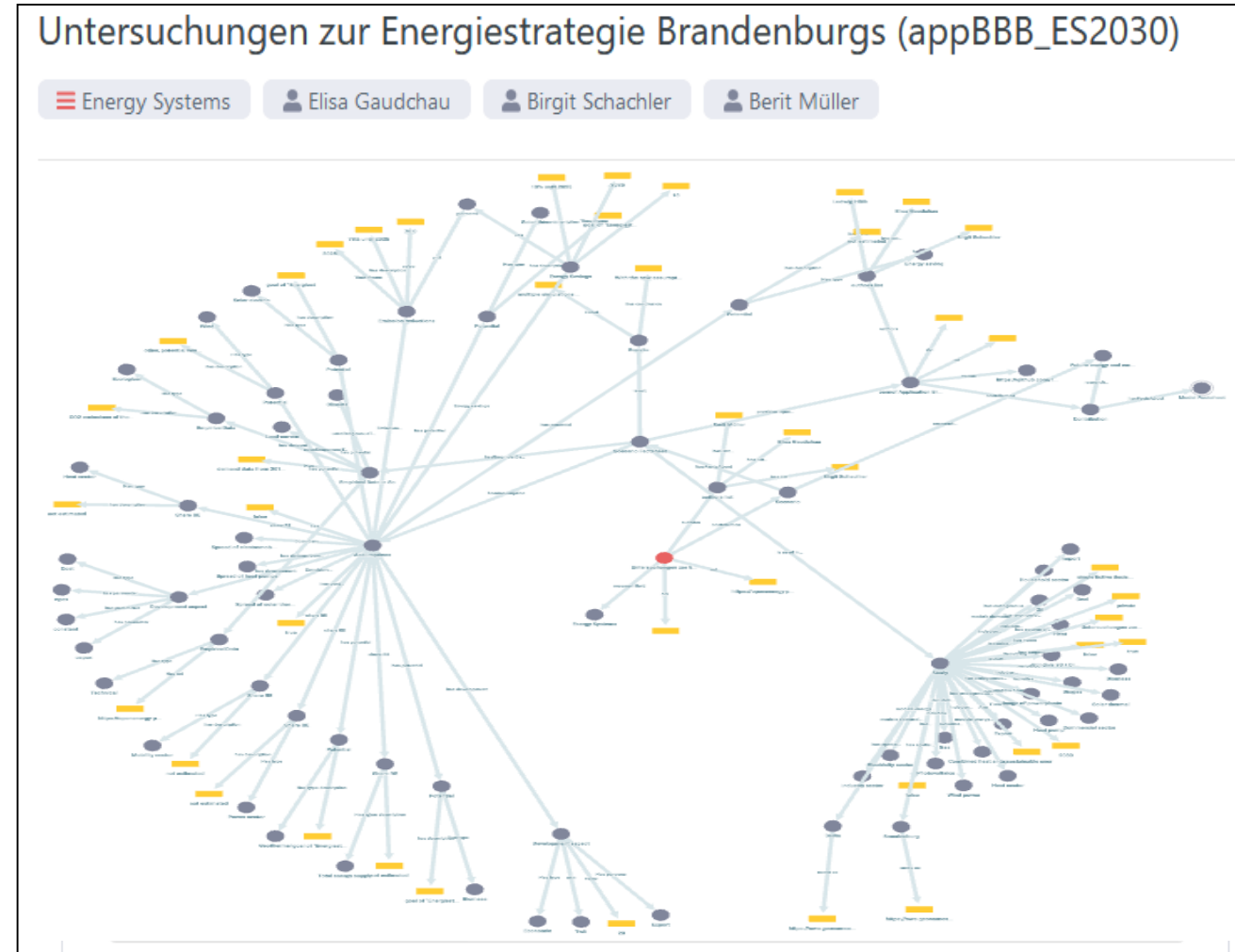
Time frame
2030 xsd:integer

Has description
72% until 2030 xsd:string

# Example 1: Behind the Scenes

Scientific knowledge becomes **machine-actionable** and **FAIR**.

Study	
Empirical Data	
Assumptions	
<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated
<b>Share RE (mobility sector)</b>	not estimated
<b>Share RE (power sector)</b>	not estimated
<b>Share RE (total energy supply)</b>	not estimated
<b>Cost development</b>	capex, opex, constant
<b>Technological innovations ?</b>	spread of electromobility, heat pumps and solar thermal heat;
<b>Potential wind</b>	other, potential wind other text
<b>Potential solar electric</b>	goal of "Energierstrategie 2030"
<b>Potential solar thermal</b>	goal of "Energierstrategie 2030"
<b>Potential biomass</b>	goal of "Energierstrategie 2030"
<b>Potential geothermal</b>	other, potential geothermal othertext
<b>Potential hydro power</b>	-
<b>Social development ?</b>	-
<b>Economic development ?</b>	42 TWh export
<b>Development of environmental aspects ?</b>	-
<b>Post-processing ?</b>	✓
<b>Further assumptions for post-processing ?</b>	✗
Results	

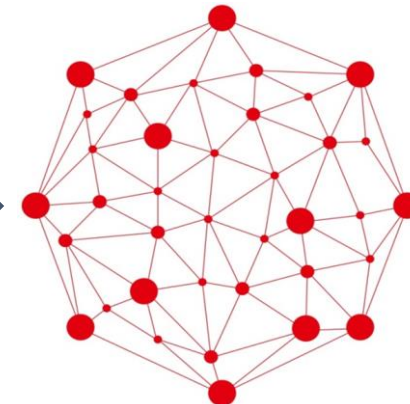


# Example 1: Using FAIR Scientific Knowledge

Study	
Empirical Data	
Assumptions	
<b>Energy savings</b>	23% until 2030
<b>Potential energy saving</b>	not estimated
<b>Emission reductions</b>	72% until 2030
<b>Share RE (heat sector)</b>	not estimated
<b>Share RE (mobility sector)</b>	not estimated
<b>Share RE (power sector)</b>	not estimated
<b>Share RE (total energy supply)</b>	not estimated
<b>Cost development</b>	capex, opex, constant
<b>Technological innovations ?</b>	spread of electromobility, heat pumps and solar thermal heat;
<b>Potential wind</b>	other, potential wind other text
<b>Potential solar electric</b>	goal of "Energiesstrategie 2030"
<b>Potential solar thermal</b>	goal of "Energiesstrategie 2030"
<b>Potential biomass</b>	goal of "Energiesstrategie 2030"
<b>Potential geothermal</b>	other, potential geothermal othertext
<b>Potential hydro power</b>	-
<b>Social development ?</b>	-
<b>Economic development ?</b>	42 TWh export
<b>Development of environmental aspects ?</b>	-
<b>Post-processing ?</b>	✓
<b>Further assumptions for post-processing ?</b>	✗
Results	

What is the avg. assumed emission reduction of the scenarios?

Natural language question



Answer



Properties	Paris Agreement Compatible (PAC) Energy Scenario	Untersuchungen zur Energiestrategie Brandenburgs (appBBB_gruene2030)
Hasfactsabout/scenario factsheet/is used in study/study/has name*	Building a Paris Agreement Compatible (PAC) energy scenario	Untersuchungen zur Energiestrategie Brandenburgs
Hasfactsabout/scenario factsheet/is used in study/study/sensitivity*	✗	✗
Hasfactsabout/scenario factsheet/is used in	✓	✓

## Visualizations





# Example 1: Publishing State-of-the-Art Comparison

## Comparison of Scenario Factsheets from the Open Energy Platform ★

November 2021
Jan Göpfert
Oliver Karras

This comparison provides an overview of the current scenario factsheets available in the Open Energy Platform. These factsheets are a standardized collection and presentation of information about scenarios used in climate and energy system modelling. The factsheets are intended to summarize the key points of the respective scenarios concisely. In studies of climate and energy system modelling domain, models simulate these scenarios with different modified input data and assumptions to calculate and compare their simulation results. The authors would like to thank the German Federal Government, the German State Governments, and the Joint Science Conference (GWK) for their funding and support as part of the NFDI4ing consortium. Funded by the German Research Foundation (DFG) - project number: 442146713. This work was also supported by the Helmholtz Association under the program "Energy System Design".

DOI: <https://doi.org/10.48366/r150337>



Energy System  
Research

Share

- 
- 
- 
-


Properties	Szenariorahmen zum NEP 2035 (Szenario A 2035) <i>Scenario - 2021</i>	Szenariorahmen zum NEP 2035 (Szenario B 2035 und 2040) <i>Scenario - 2021</i>	Szenariorahmen zum NEP 2035 (Szenario C 2035) <i>Scenario - 2021</i>	Paris Agreement Compatible (PAC) Energy Scenario <i>Scenario</i>	Untersuchungen zur Energiestrategie Brandenburgs (appBBB_gruene2030) <i>Scenario</i>	Untersuchungen zur Energiestrategie Brandenburgs (appBBB_ES2030) <i>Scenario</i>
hasfactsabout/scenario factsheet						
is used in study/study						
↳ <u>has_name*</u>	Szenariorahmen zum NEP 2035 (2021)	Szenariorahmen zum NEP 2035 (2021)	Szenariorahmen zum NEP 2035 (2021)	Building a Paris Agreement Compatible (PAC) energy scenario	Untersuchungen zur Energiestrategie Brandenburgs	Untersuchungen zur Energiestrategie Brandenburgs
↳ <u>sensitivity*</u>	✗	✗	✗	✗	✗	✗
↳ <u>has_target_year*</u>	✓	✓	✓	✓	✓	✓
↳ <u>time_frame*</u>	2035	2035	2035	2050	2030	2030






# Example 1: Visualization of Avg. Assumed Emission Reduction

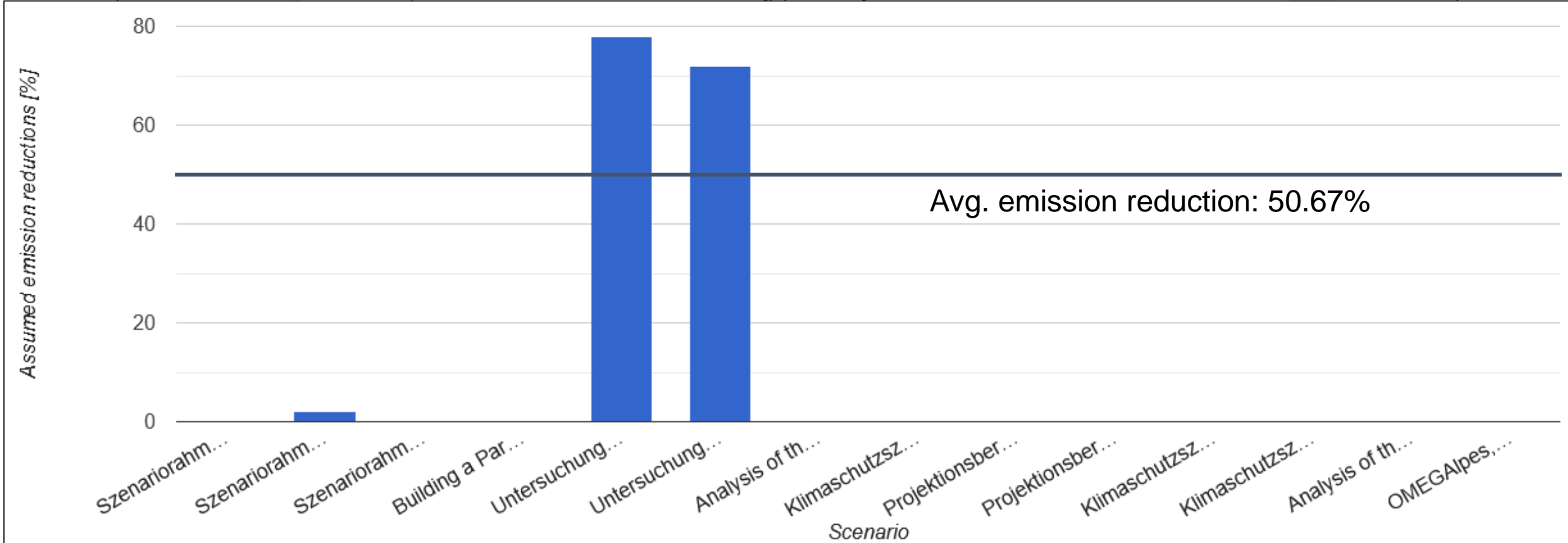
Comparison of Scenario Factsheets from the Open Energy Platform  

📅 November 2021   👤 Jan Göpfert   👤 Oliver Karras

This comparison provides an overview of the current scenario factsheets available in the Open Energy Platform. These factsheets are a standardized collection and presentation of information about scenarios used in climate and energy system modelling. The factsheets are intended to summarize the

 Energy System Research

Share     



# Example 2: Studies on Germany's Energy Supply in 2050

## Comparison of Studies on Germany's Energy Supply in 2050 ★ 🔍

📅 November 2021
👤 Felix Kullmann
👤 Jan Göpfert
👤 Oliver Karras
👤 Patrick Kuckertz
👤 Sören Auer
👤 Markus Stocker

👤 Peter Markewitz
👤 Leander Kotzur
👤 Detlef Stolten

This comparison compiles the results from various studies analyzing a future low-carbon energy system for Germany. The focus of this study comparison is electricity generation. In the future, however, other essential characteristics of the respective energy system designs in the individual studies will be listed. Installed capacity is given in GW and electricity generation is given in TWh. The authors would like to thank the German Federal Government, the German State Governments, and the Joint Science Conference (GWK) for their funding and support as part of the NFDI4ing consortium. Funded by the German Research Foundation (DFG) - project number: 442146713. This work was also supported by the Helmholtz Association under the program "Energy System Design".

DOI: <https://doi.org/10.48366/r153801>

Share

🌐
🐦
📺
🔗

Properties	Klimaneutrales Deutschland <i>Contribution - 2020</i>	Wasserstoff-Roadmap Nordrhein-Westfalen <i>Contribution - 2020</i>	Wege zu einem klimaneutralen Energiesystem <i>Contribution - 2020</i>	Wege für die Energiewende <i>Contribution - 2019</i>	Den Weg zu einem treibhausgasneutralen Deutschland ressourcenschonend gestalten <i>Contribution 1 - 2019</i>
has energy sources	<a href="#">all sources</a>	<a href="#">all sources</a>	<a href="#">all sources</a>	<a href="#">all sources</a>	<a href="#">all sources</a>
	<a href="#">bioenergy</a>	<a href="#">bioenergy</a>	<a href="#">bioenergy</a>	<a href="#">bioenergy</a>	<a href="#">bioenergy</a>
	<a href="#">geothermics</a>	<a href="#">geothermics</a>	<a href="#">geothermics</a>	<a href="#">geothermics</a>	<a href="#">geothermics</a>
	<a href="#">hydropower</a>	<a href="#">hydropower</a>	<a href="#">hydropower</a>	<a href="#">hydropower</a>	<a href="#">hydropower</a>
	<a href="#">import</a>	<a href="#">import</a>	<a href="#">import</a>	<a href="#">import</a>	<a href="#">import</a>
	<a href="#">net import</a>	<a href="#">net import</a>	<a href="#">net import</a>	<a href="#">net import</a>	<a href="#">net import</a>

# Example 2: Studies on Germany's Energy Supply in 2050



Oliver Karras

[Bearbeiten](#) [Löschen](#)

## Comparison of studies on Germany's energy supply in 2050

Autoren Felix Kullmann, Peter Markewitz, Detlef Stolten, Oliver Karras, Patrick Kuckertz, Leander Kotzur, Jan-Maris Göpfert, Sören Auer, Markus Stocker

Publikationsdatum 2021

Ausgabe FZJ-2022-00782

Verlag Technoökonomische Systemanalyse

Beschreibung This comparison compiles the results from various studies analyzing a future low-carbon energy system for Germany. The focus of this study comparison is electricity generation. In the future, however, other essential characteristics of the respective energy system designs in the individual studies will be listed. Installed capacity is given in GW and electricity generation is given in TWh.

Zitate insgesamt **Zitiert von: 1**



2023

Google Scholar-Artikel [Comparison of studies on Germany's energy supply in 2050](#)  
F Kullmann, P Markewitz, D Stolten, O Karras... - 2021  
[Zitiert von: 1](#) [Ähnliche Artikel](#)

Share

stem  
ch

u einem  
sneutralen  
d ressourcenschonend

1 - 2019

all sources  
bioenergy  
geothermics  
hydropower  
import  
net import

Properties

has energy sources

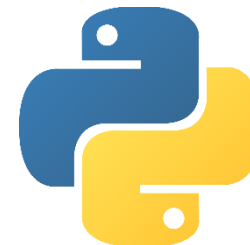
So far so good, but...

...what can we do with machine-actionable  
scientific knowledge?

Anything we want!

1. Papers, contributions, comparisons, and visualizations in the ORKG are **available for (re-)use and extension to anyone**
2. The ORKG provides several **access points** for processing all data, e.g., to develop novel search, retrieval, mining, and assistance applications

{ REST : API }



# ORKG Observatory on Energy System Research

ORKG View Tools About NFDI4DataScience Search... + Add new Sign

Engineering » Mechanical Engineering » Energy Systems

Energy System Research | Observatory

observatory aims at organizing key research questions, research problems, publications, software, and data sets related to the research field of Energy System Research.

Research problems  
Future energy and emission scenario predictions

Organizations

- TIB LEIBNIZ INFORMATION CENTRE FOR SCIENCE AND TECHNOLOGY UNIVERSITY LIBRARY
- NFDI4Ing
- JÜLICH

Members

- Rodrigo Pueblos Forschungszentrum Jülich
- Felix Engel National Research Data Infrastructure for Engineering Sciences (NFDI4Ing)
- Patrick Kuckertz Forschungszentrum Jülich

View more

ent | 32 items Show:  Paper  Comparison  Visualization Top recent

Comparison of Studies on Germany's Energy Supply in 2050 Comparison

25 Contributions 18 Visualizations 23-11-2021

This comparison compiles the results from various studies analyzing a future low-carbon energy system for Germany. The focus of this study comparison is electricity generation. In the future, however...

Versions: Version 23-11-2021 • View history

- **Central access point** to all related curated papers, contributions, comparisons, and visualizations
- **Collaboration** between NFDI4Ing and NFDI4Energy in the future
- **(RE-)use** by others

## (Re-)use by Auer et al. [1]

How has the **average energy supply** (in TWh) **per energy source** changed in **5-year intervals** in the comparison “Comparison of studies on Germany’s energy supply in 2050”?

# (Re-)use by Auer et al. [1]

How has the **average energy supply** (in TWh) **per energy source** changed in **5-year intervals** in the comparison “Comparison of studies on Germany’s energy supply in 2050”?

```
1 PREFIX orkgr: <http://orkg.org/orkg/resource/>
2 PREFIX orkgc: <http://orkg.org/orkg/class/>
3 PREFIX orkgp: <http://orkg.org/orkg/predicate/>
4 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
5 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
6 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
7
8 #defaultView:BarChart
9 SELECT (SAMPLE(?rangeId) AS ?interval)
10        (AVG(?value) AS ?average_energy_generation)
11        (STR(SAMPLE(?energy_src_label)) AS ?legend)
12 WHERE {
13   orkgr:R153801 orkgp:compareContribution ?contrib.
14   ?paper orkgp:P31 ?contrib;
15   orkgp:P29 ?year.
16   BIND(xsd:int(?year) as ?y)
17   VALUES(?rangeId ?min ?max) {
18     ("2001-2005" 2001 2005)
19     ("2006-2010" 2006 2010)
20     ("2011-2015" 2011 2015)
21     ("2016-2020" 2016 2020)
22   }
23   FILTER(?min <= ?y && ?y <= ?max)
24   ?contrib orkgp:P43135 ?energy_src.
25   ?energy_src rdfs:label ?energy_src_label;
26   orkgp:P43134 ?energy_gen.
27   ?energy_gen orkgp:HAS_VALUE ?val.
28   BIND(xsd:decimal(?val) as ?value)
29   FILTER(str(?energy_src_label) != "all sources")
30   FILTER(str(?energy_src_label) != "net import")
31 }
32 GROUP BY ?rangeId ?energy_src_label
33 ORDER BY ?rangeId
34
```

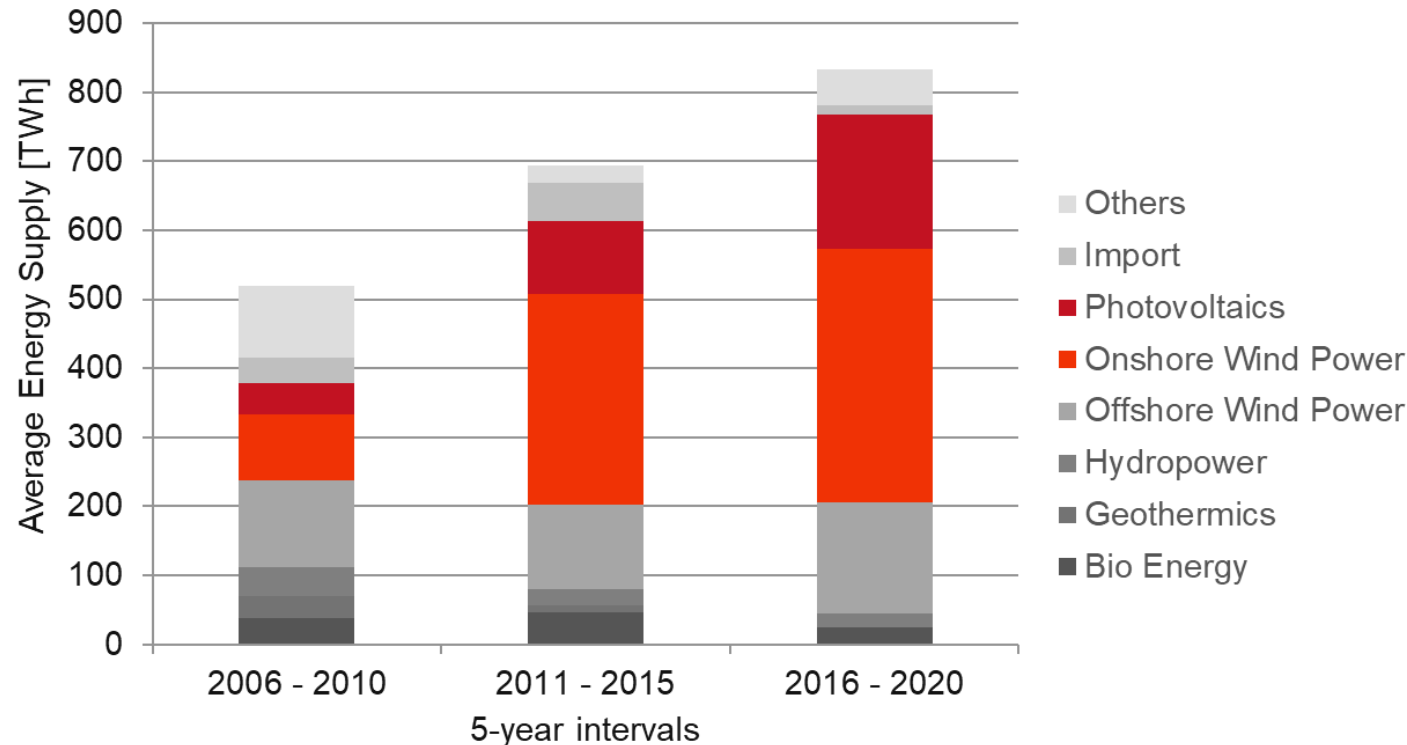


[1] S. Auer, D. A. C. Barone, C. Bartz, *et al.*, “The SciQA Scientific Question Answering Benchmark for Scholarly Knowledge”, *Nature Scientific Reports*, vol. 13, no. 7240, 2023. DOI: [10.1038/s41598-023-33607-z](https://doi.org/10.1038/s41598-023-33607-z).



# (Re-)use by Auer et al. [1]

How has the **average energy supply** (in TWh) **per energy source** changed in **5-year intervals** in the comparison “Comparison of studies on Germany’s energy supply in 2050”?



```

1 PREFIX orkgr: <http://orkg.org/orkg/resource/>
2 PREFIX orkgc: <http://orkg.org/orkg/class/>
3 PREFIX orkgp: <http://orkg.org/orkg/predicate/>
4 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
5 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
6 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
7
8 #defaultView:BarChart
9 SELECT (SAMPLE(?rangeId) AS ?interval)
10         (AVG(?value) AS ?average_energy_generation)
11         (STR(SAMPLE(?energy_src_label)) AS ?legend)
12 WHERE {
13   orkgr:R153801 orkgp:compareContribution ?contrib.
14   ?paper orkgp:P31 ?contrib;
15   orkgp:P29 ?year.
16   BIND(xsd:int(?year) as ?y)
17   VALUES(?rangeId ?min ?max) {
18     ("2001-2005" 2001 2005)
19     ("2006-2010" 2006 2010)
20     ("2011-2015" 2011 2015)
21     ("2016-2020" 2016 2020)
22   }
23   FILTER(?min <= ?y && ?y <= ?max)
24   ?contrib orkgp:P43135 ?energy_src.
25   ?energy_src rdfs:label ?energy_src_label;
26   orkgp:P43134 ?energy_gen.
27   ?energy_gen orkgp:HAS_VALUE ?val.
28   BIND(xsd:decimal(?val) as ?value)
29   FILTER(str(?energy_src_label) != "all sources")
30   FILTER(str(?energy_src_label) != "net import")
31 }
32 GROUP BY ?rangeId ?energy_src_label
33 ORDER BY ?rangeId
34

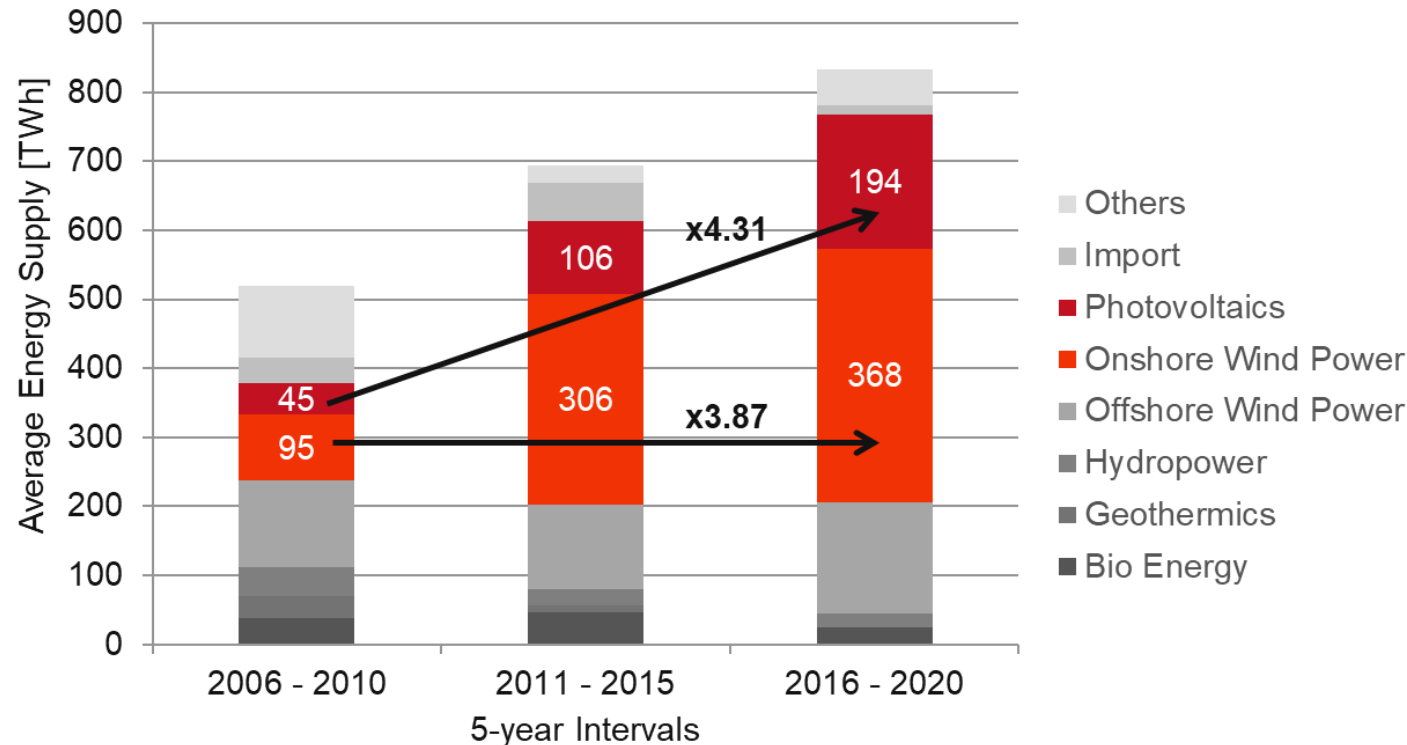
```



[1] S. Auer, D. A. C. Barone, C. Bartz, et al., “The SciQA Scientific Question Answering Benchmark for Scholarly Knowledge”, *Nature Scientific Reports*, vol. 13, no. 7240, 2023. DOI: [10.1038/s41598-023-33607-z](https://doi.org/10.1038/s41598-023-33607-z).

# (Re-)use by Auer et al. [1]

How has the **average energy supply** (in TWh) **per energy source** changed in **5-year intervals** in the comparison “Comparison of studies on Germany’s energy supply in 2050”?



```

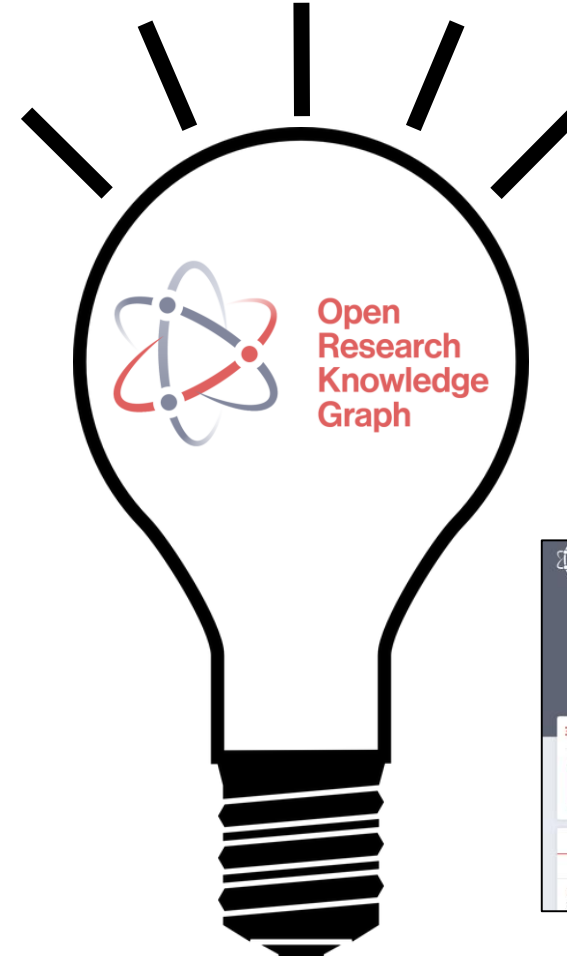
1 PREFIX orkgr: <http://orkg.org/orkg/resource/>
2 PREFIX orkgc: <http://orkg.org/orkg/class/>
3 PREFIX orkgp: <http://orkg.org/orkg/predicate/>
4 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
5 PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
6 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
7
8 #defaultView:BarChart
9 SELECT (SAMPLE(?rangeId) AS ?interval)
10         (AVG(?value) AS ?average_energy_generation)
11         (STR(SAMPLE(?energy_src_label)) AS ?legend)
12 WHERE {
13     orkgr:R153801 orkgp:compareContribution ?contrib.
14     ?paper orkgp:P31 ?contrib;
15     orkgp:P29 ?year.
16     BIND(xsd:int(?year) as ?y)
17     VALUES(?rangeId ?min ?max) {
18         ("2001-2005" 2001 2005)
19         ("2006-2010" 2006 2010)
20         ("2011-2015" 2011 2015)
21         ("2016-2020" 2016 2020)
22     }
23     FILTER(?min <= ?y && ?y <= ?max)
24     ?contrib orkgp:P43135 ?energy_src.
25     ?energy_src rdfs:label ?energy_src_label;
26     orkgp:P43134 ?energy_gen.
27     ?energy_gen orkgp:HAS_VALUE ?val.
28     BIND(xsd:decimal(?val) as ?value)
29     FILTER(str(?energy_src_label) != "all sources")
30     FILTER(str(?energy_src_label) != "net import")
31 }
32 GROUP BY ?rangeId ?energy_src_label
33 ORDER BY ?rangeId
34
    
```



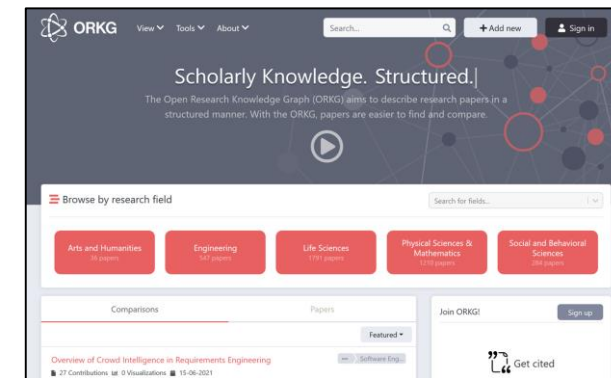
[1] S. Auer, D. A. C. Barone, C. Bartz, et al., “The SciQA Scientific Question Answering Benchmark for Scholarly Knowledge”, *Nature Scientific Reports*, vol. 13, no. 7240, 2023. DOI: [10.1038/s41598-023-33607-z](https://doi.org/10.1038/s41598-023-33607-z).

# Conclusion

Study	
Empirical Data	
Assumptions	
Energy savings	23% until 2030
Potential energy saving	not estimated
Emission reductions	72% until 2030
Share RE (heat sector)	not estimated
Share RE (mobility sector)	not estimated
Share RE (power sector)	not estimated
Share RE (total energy supply)	not estimated
Cost development	capex, opex, constant
Technological innovations ?	spread of electromobility, heat pumps and solar th
Potential wind	other, potential wind other text
Potential solar electric	goal of "Energierstrategie 2030"
Potential solar thermal	goal of "Energierstrategie 2030"
Potential biomass	goal of "Energierstrategie 2030"
Potential geothermal	other, potential geothermal othertext
Potential hydro power	-
Social development ?	-
Economic development ?	42 TWh export
Development of environmental aspects ?	-
Post-processing ?	✓
Further assumptions for post-processing ?	x
Results	

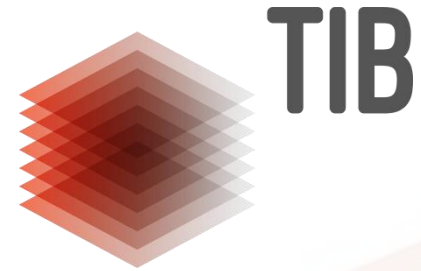


<https://orkg.org>



**Let's bring scholarly communication in engineering sciences & energy system research to the 21<sup>st</sup> century!**

LEIBNIZ INFORMATION CENTRE  
FOR SCIENCE AND TECHNOLOGY  
UNIVERSITY LIBRARY



<https://www.oliver-karras.de>



[@OliverKarras](https://twitter.com/OliverKarras)



[Google Scholar](#)



<https://www.linkedin.com/in/oliver-karras/>

## Contact

Dr. rer. nat. Oliver Karras

TIB – Leibniz Information Centre for Science and Technology

Data Science and Digital Libraries Research Group

[oliver.karras@tib.eu](mailto:oliver.karras@tib.eu)