

STRATEGIC PLANNING SUMMIT 2022



MAXIMILIAN PARZEN
Introduction. | 4.05.2022





You are a hero!



Part 1. REVIEW OF OUR INITIATIVE

Goal: Learn what works & what not. Define/redefine the vision

Part 2. LONG-TERM PLANNING

Goal: Define technology roadmap to accomplish the vision

Part 3. RESOURCE PLANNING

Goal: Define how to execute the roadmap

You are a hero!

***But what is
PyPSA?***



WHAT IS PyPSA?

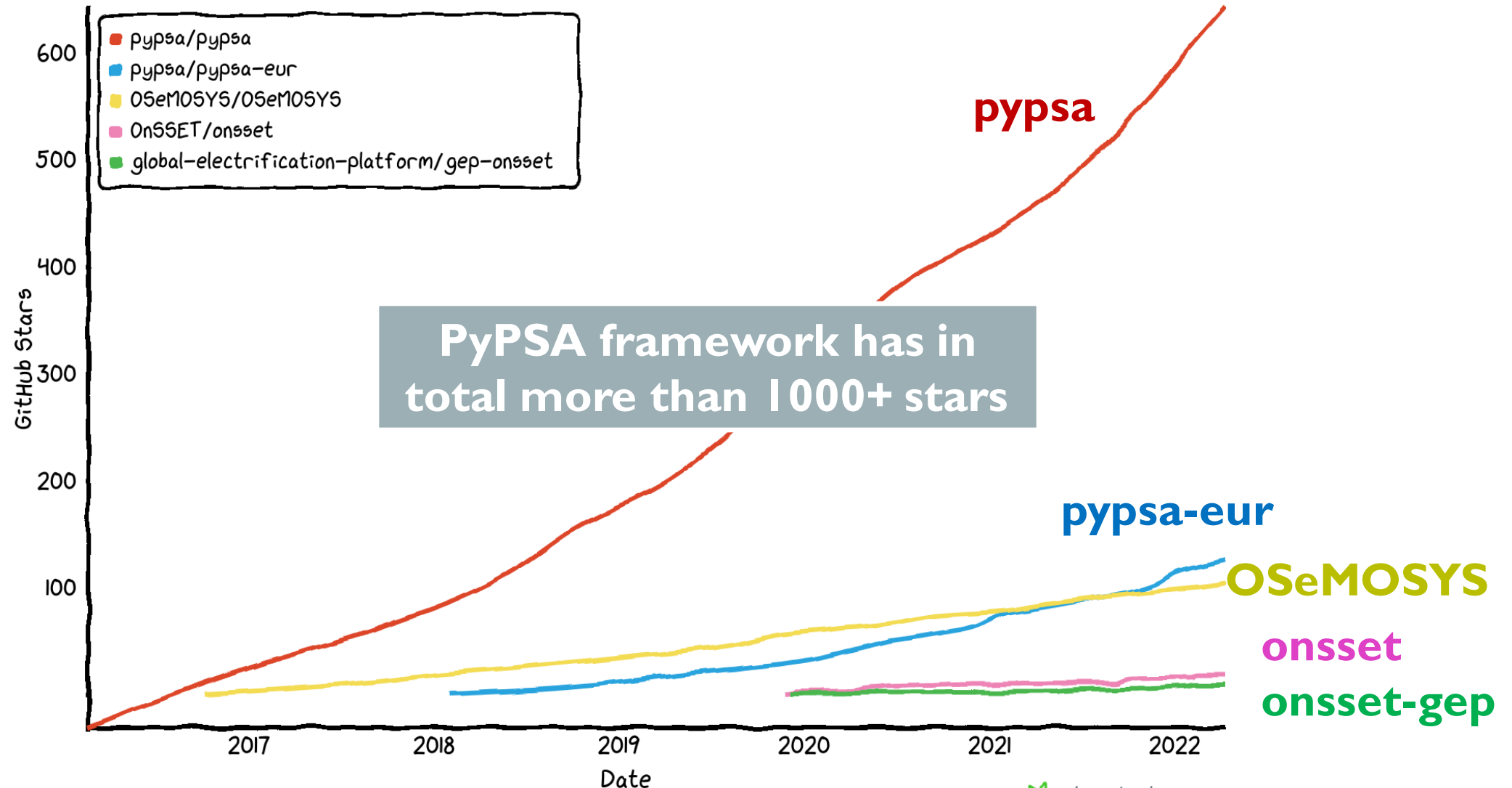
Purpose:

- A framework that can do both **economic analysis** and **grid analysis (load flow studies)**
- Developed for **large scale optimization** and
- Studies in **high spatial resolution**

		Grid Analysis						Economic Analysis								
		Software	Version	Citation	Free Software	Power Flow	Continuation Power Flow	Dynamic Analysis	Transport Model	Linear OPF	SCLOPF	Nonlinear OPF	Multi-Period Optimisation	Unit Commitment	Investment Optimisation	Other Energy Sectors
Power system tools	MATPOWER	6.0	[6]	✓	✓	✓			✓	✓		✓				
	NEPLAN	5.5.8	[2]		✓			✓	✓	✓	✓	✓				✓
	pandapower	1.4.0	[9]	✓	✓				✓	✓		✓				
	PowerFactory	2017	[1]		✓			✓	✓	✓	✓	✓				
	PowerWorld	19	[3]		✓			✓	✓	✓	✓	✓				
	PSAT	2.1.10	[7]	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		
	PSS/E	33.10	[4]		✓			✓	✓	✓	✓	✓				
	PSS/SINCAL	13.5	[5]		✓			✓				✓				✓
	PYPOWER	5.1.2	[8]	✓	✓				✓	✓		✓				
	PyPSA	0.11.0		✓	✓				✓	✓	✓		✓	✓	✓	✓
Energy system tools	calliope	0.5.2	[11]	✓					✓				✓		✓	✓
	minpower	4.3.10	[12]	✓					✓	✓			✓	✓		
	MOST	6.0	[13]	✓	✓	✓			✓	✓	✓	✓	✓	✓		
	oemof	0.1.4	[14]	✓					✓				✓	✓	✓	✓
	OSeMOSYS	2017	[15]	✓					✓				✓		✓	✓
	PLEXOS	7.400	[16]						✓	✓	✓		✓	✓	✓	✓
	PowerGAMA	1.1	[17]	✓					✓	✓			✓			
	PRIMES	2017	[18]						✓	✓			✓	✓	✓	✓
	TIMES	2017	[19]						✓	✓			✓	✓	✓	✓
	urbs	0.7	[20]	✓					✓				✓	✓	✓	✓

Is PyPSA popular?

GitHub stars – indicating the user popularity



You are a hero!

**Ok, but what is
PyPSA meets
Earth?**



*“PyPSA meets Earth is an independent research initiative focusing on the global provision of **open** energy transition planning tools and data.”*

Open Energy System Modelling

Who we are

PyPSA-Earth is an independent research initiative focusing on the provision of open energy transition tools and data. While the initiative started in spring 2021 with an initial focus on Africa, the scope recently broadened to cover other continents, evolving the initiative to its current form of PyPSA-Earth.

Vision & Mission

Our vision is to create a useful alternative to closed-source energy system models for industry and research. Our mission is to build a free and open energy system model prototype based on PyPSA toolbox, create open data for the world and improve open source solvers.

Team

The continuously growing team currently includes members from 16 institutes in 11 countries and 4 continents. Our members cover a broad spectrum of expertise and have various roles in the initiative; our code team is mainly composed of young researchers and PhD candidates building the tools and data generators, our outreach team is filled with experts in the field of consulting and open energy systems modeling focusing on the growth of the community, and our advisor team includes professors, research leaders, and professionals supporting our work and creating opportunities.

What we do

Our current focus is to create a scalable open source energy system model and database that is supported by a sustainable community of users, developers and maintainers. We aim

to establish an open-source support organization which is necessary to collect and allocate funds to contributors, allowing for a continuous development of the tool. Empowering people all around the world to perform their own regional studies and improve our tools themselves is at the heart of the initiative.

USP (Unique Selling Points):

These features make the model platform special:

- Leveraging high spatially resolved data
- Including power flow physics
- Combining investment and operation optimization
- Community works on the full 'supply-chain': open solver, problem formulator, data processing and creation.
- Already trusted by industry, network operators and research institutions

Current status

PyPSA-Africa: The prototype of our PyPSA-Africa model is completed; the launch of our tool will take place on the 27th of January.

PyPSA Middle-East and North-Asia: A team formed and is actively preparing and executing a Middle-East and North-Asia prototype until mid of 2022.

PyPSA-Earth: Members of the core team generalize the PyPSA-Africa model features and make accurate modeling across Earth possible under one codebase

Detect-Energy: Ongoing Machine-Learning training of grid topology assets from satellite images and validation.

OPEN Global Independent Research Initiative



SOLVER

Help
sustaining

Support
developers

Reveal
bottlenecks

Initiate new
paths

ENERGY SYSTEM MODELS

Features

Problem
formulator

Modular

performant

High resolution

DATA

Creating open
data

Predicting
data

Data
workflow

High
resolution

USER AND DEVELOPER COMMUNITY

Open

Collaborative

Training

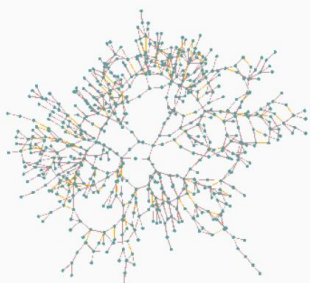
Empower

Dialogue

PyPSA is a framework. We build tools on top.

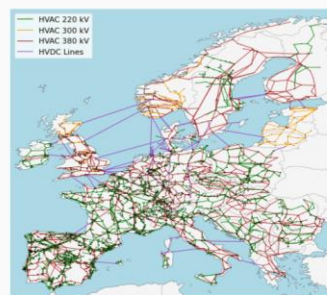


PyPSA



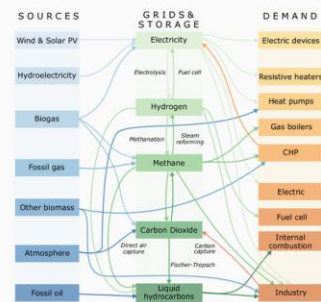
A python software toolbox for simulating and optimising modern power systems.

PyPSA-Eur



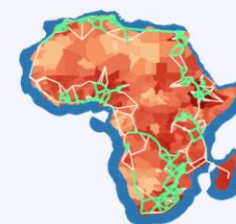
An open optimisation model of the European transmission system.

PyPSA-Eur-Sec



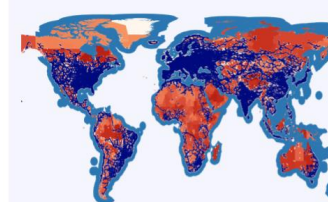
A sector-coupled open optimisation model of the European energy system.

PyPSA-Africa



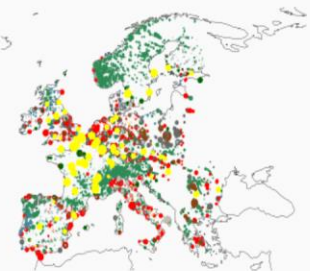
An open optimization model of the African transmission system

PyPSA-Earth



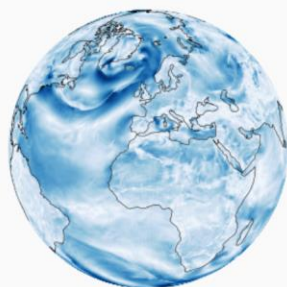
A highly flexible **sector-coupled** energy system model of the global energy system

Powerplantmatching



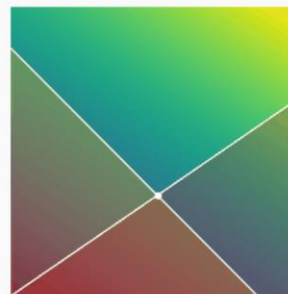
A toolset for cleaning, standardizing and combining multiple power plant databases.

Atlite



A Lightweight Python Package for Calculating Renewable Power Potentials and Time Series

Linopy



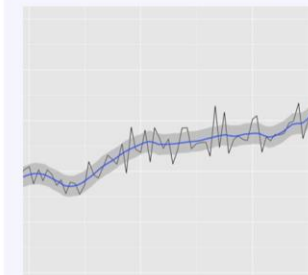
Linear optimization interface for N-D labeled variables.

Detect-Energy



A machine learning framework to detect energy assets from satellites

Demand-Creator



A general framework to create demand timeseries in subnational resolution

11.04.2021

FREEDOM VISION

Build supported and maintained OS model
which is useful for industry and research

You are a hero!

**What have we
accomplished?**



PyPSA meets Africa hackathon



Launch of Earth community



1-year of Outputs

10+ presentations. Highlights:

Initiative launch event



OPEN ENERGY SYSTEM MODELLING IN AFRICA

WEBINAR, INTRODUCING PyPSA meets Africa

THU, 29 APRIL 2021 13:00 - 14:20 BST/UTC+1

STATE OF THE ART AND FUTURE OPPORTUNITIES

STEFAN PFENNINGER, KHALED SALIM, TOM RWAHAMA, JARRAD WRIGHT, AMINU H. ISA

OPEN CODE AND DATA THOUGHT LEADER AND PROF. OF ENERGY SYSTEMS AT TU DELFT, NETHERLANDS

STRATEGIC PLANNING EXPERT AT EGYPTIAN ELECTRICITY HOLDING COMPANY, MINISTRY OF ELECTRICITY AND RENEWABLE ENERGY

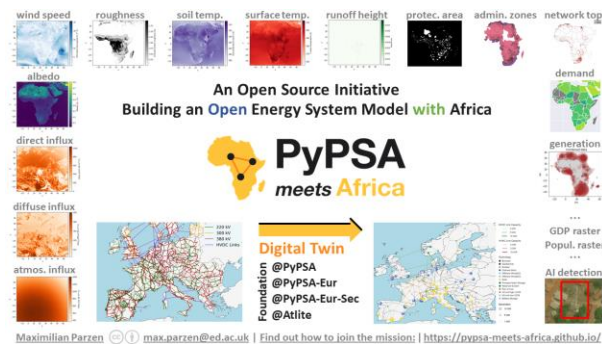
DIRECTOR OF POWER GENERATION AND O&M OF THE RWANDA ENERGY GROUP

PRINCIPAL RESPONSIBLE OF THE COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR), SOUTH AFRICA

ENERGY EXPERT AT THE ENERGY PLANNING AND POLICY DEPARTMENT AT THE ENERGY COMMISSION, NIGERIA

IEEE, THE UNIVERSITY OF EDINBURGH, IEEE PES

University of Reading workshop



An Open Source Initiative Building an Open Energy System Model with Africa

PyPSA meets Africa

Maximilian Parzen @PyPSA, @PyPSA-Eur, @PyPSA-Eur-Sec, @Atlite

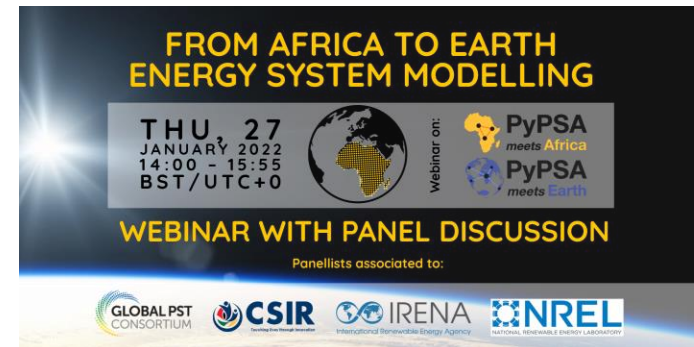
Digital Twin

Maximilian Parzen max.parzen@ed.ac.uk | Find out how to join the mission: <https://pypsa-meets-africa.github.io/>

Openmod Lightning Talk



PyPSA-Africa launch event with panel discussion



FROM AFRICA TO EARTH ENERGY SYSTEM MODELLING

THU, 27 JANUARY 2022 14:00 - 15:55 BST/UTC+0

Webinar on: PyPSA meets Africa, PyPSA meets Earth

WEBINAR WITH PANEL DISCUSSION

Panellists associated to:

GLOBAL PST CONSORTIUM, CSIR, IRENA, NREL

Linux Foundation Energy + Global Power Transformation Consortium event



World Bank event



THE WORLD BANK IBRD • IDA | WORLD BANK GROUP

WORLD RESOURCES INSTITUTE

Webinar-Series: Open-Source GIS Solutions in Energy Access

PyPSA meets Earth

12.04.2022, Maximilian Parzen

1-year of Outputs

SOLID TEAM GROWTH:

Project structure

The structure might be adjusted in future:

- Director ([Max Parzen](#))
- Co-Director ([Davide Fioriti](#))
- Data and Workflow leader (temporary Davide and Max)
- Demand leader (Pierre lead + Stephen co-lead)
- AI leader ([Lukas Franken](#))
- Outreach leader ([Stuart James](#))
- Sector-coupling lead (Hazem lead + Leon co-lead)
- Western Asia Coordinator ([Kasim Zor](#))

Meaningful code contributor (add. to 'leaders')

- Johannes Hampp
- Ekatarina Federova
- Matin Mahmood
- Cesare Caputo

Soft skill contributors and advice:

- Hana
- Irene
- Gaurav
- Fabian Neumann

Meaningful code contributor candidates:

- Emre Yorat & co. (Model Middle-East)
- Carlos (Model South-America)
- Giacomo (Load disaggregation)
- Hana
- Nse (Nigeria)
- Shari (Nigeria)
- Tom

In-active contributors:

- Koen
- Ayman
- Jarrad
- Toob Lippe

CHALLENGES OF THE INITIATIVE (miro session)

PyPSA VISION & OURS



"MAKING MACRO-ENERGY SYSTEM PLANNING BETTER WITH A FOCUS ON EUROPE!"

- Improving methods and data in Europe***
- Dealing with complexity***
- Working on Uncertainty/ Robust planning***
- Working on Sector Coupling & Pathway, Learning optimization***
- Working on Public Acceptance***
- Bringing OR research to energy system modelling***
- Solving bigger problems faster***
(decomposition/relaxation/acceleration)

***"Providing an useful, maintained and supported
open-source PyPSA model to the World for
research, industry and people"***

STRATEGIC PLANNING SUMMIT 2022



14.05.2022

