

Selected highlights of year 2+

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Project coordinator

(on behalf of the SURE team)

SWEET Conference, 6.9.2023, Eventforum, Bern

- Background: Fundamental transformation of the energy system and partly of industrial production while avoiding greenhouse gases and achieving long-term energy policy goals.

- Research questions:

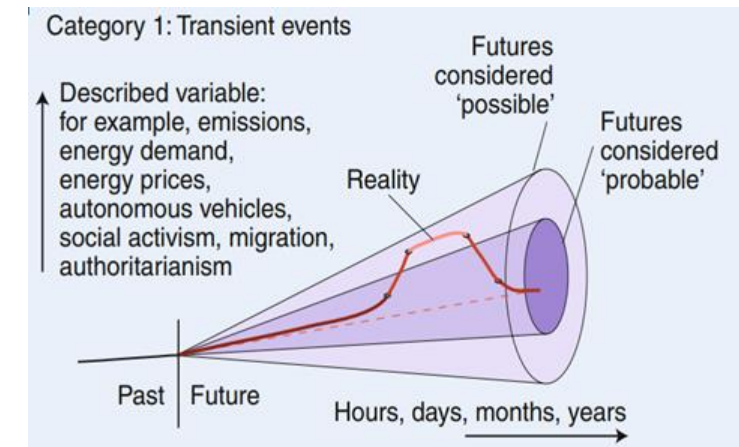
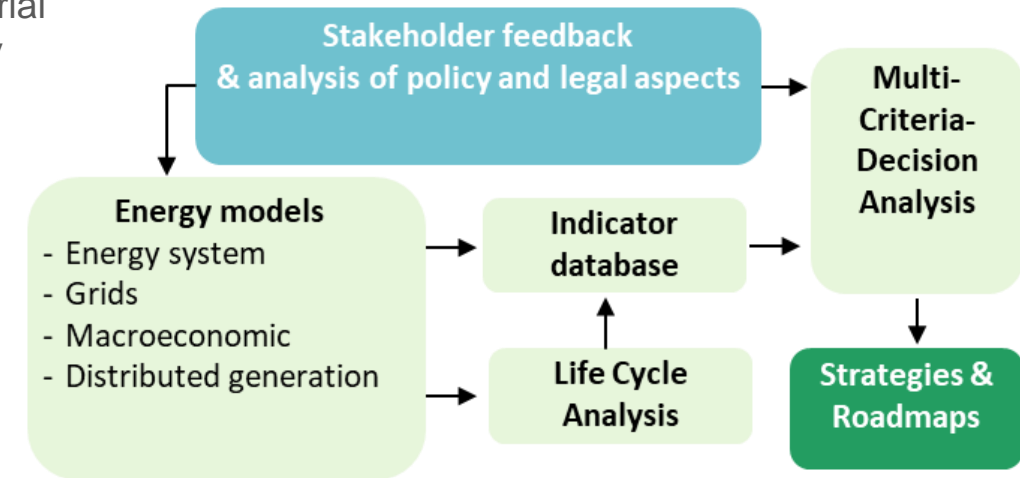
How sustainable is the future Swiss energy system?

How resilient is it to possible disruptive events?

- 10 research partners under the lead of PSI / 2021-2027



- Integrated and holistic assessment framework
- Quantitative and qualitative analysis tools
- Engagement of stakeholders (e.g. associations)
- Investigation of long-term transformation pathways and in particular of possible future shock events for the energy system (shock dimensions: economy, environment, technosphere, society, politics); such as energy supply interruptions.
- Scenarios for Switzerland and selected case studies



Source: McCollum et al. 2020,
<https://doi.org/10.1038/s41560-020-0555-3>

Highlights of the last year (+)

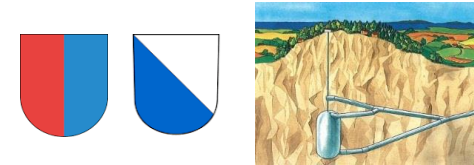
SURE stakeholder forum facilitating the project's quantitative analytical approach



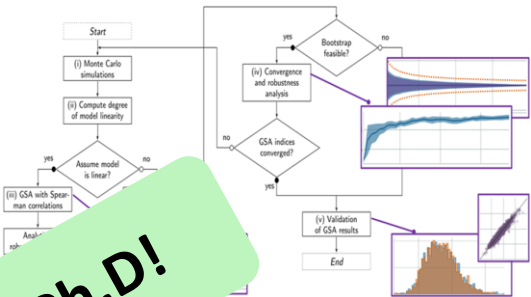
Specification of the analytical framework



National, regional, urban, and sectorial spotlights on disruptive events to the energy system transition



Advanced Global Sensitivity Analysis for LCA



Ph.D!

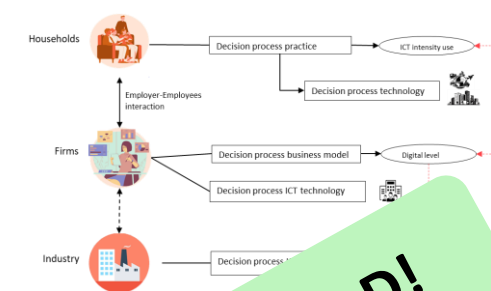
Advanced modelling of the industry sector in an energy system context



Source: Perlen Papier AG

Ph.D!

Advanced modelling of consumer effects related to digitalisation



Ph.D!

STAKEHOLDER FORUM

- 1st indicator workshop
- Case study Ticino



EDUCATIONAL ACTIVITIES

- PSI day of the open door
- Musical chairs in reverse: governance of commons - case study Energy



EVENTS

- Energy Lab Innovation Booster, Pitch&Enrich
- SCIENTIFICA



Developing the SURE Indicator Database

Successful conduction of the 1st Indicator Workshop (07.10.2022)

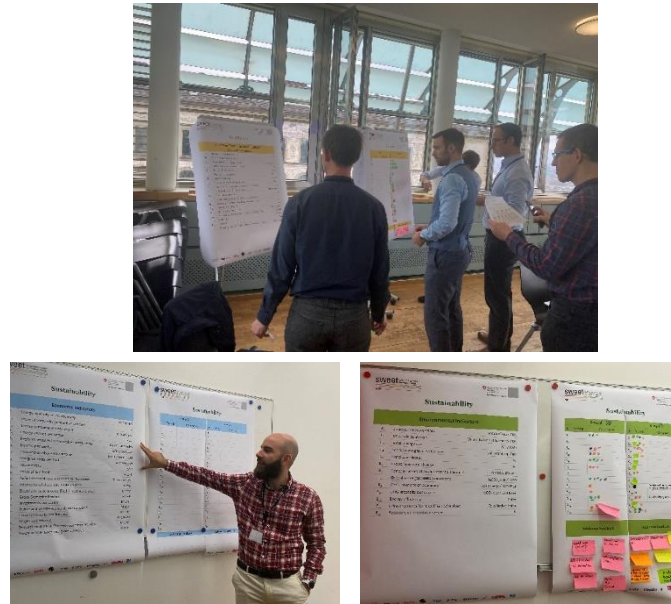
- More than 20 participants with stakeholders and partners
- 3 Informative sessions & 2 Interactive sessions

The workshop paved the way for the two upcoming SWEET-SURE Stakeholder Workshops

- ✓ Detailed description of the methodology
- ✓ Gathering input on the SWEET SURE Indicators
- ✓ Pilot implementation of the MCDA framework for the evaluation of the pathways



Introductory session



1st interactive session



2nd interactive session

The technical Perspective



Social Science Perspective

- **Purpose of the game**
 - «broadcasting a message» and «data collection»
- **Main interest:**
 - What are people's preferences regarding the future of energy?
- **Variations of interest**
 - What are the different pathways?
 - Testing the resilience of the pathways
 - What are citizens willing to trade off?
 - Reactions to shocks

A process: Bringing these perspectives together

→ Visit our “booth” here and test our prototype & let us know your feedback! ←

SURE scenario specification

Four pathway scenarios:

SPS1: Team Sprint
Focus on Sustainability

World gradually implements
High regional and energy
Social behavior and

SPS2: Mountain Hike
Focus on Energy Security

World
D
NEWS

SPS3: Single
Fragment

1st scenario protocol capturing the definition of pathway and shock
scenarios
This report defines the four identified pathway scenarios of the SURE project as well as five
scenarios representing disruptive events. The development of these scenarios is based on an
interdisciplinary and inclusive approach including in detail and corresponding information to qualify
the scenarios using energy models is provided. Beyond this, model parameters and variables
exchanged between the SURE models for the application of the analytical framework and the collaboration among
the modeling teams in SURE.

REPORT

Website!

Heat wave
Cold spell
Societal change
Nuclear power re-introduction

record low precipitation
stresses the grid, disrupts hydropower
drought, 5-14 days within 2-3 weeks of heat wave

cold wave and dry fall
raises electricity and heat, disrupts energy & mobility infra
weeks of cold wave

Sudden population growth in CH due to (climate) refugees
10.4 million in 2035, high socioeconomic inequality
60-80% of the refugees in CH live in energy & mobility poverty

A political decision around 2030s to re-introduce nuclear
Variants: From not further pushing the phase-out of nuclear
power to a strong and dynamic promotion of nuclear

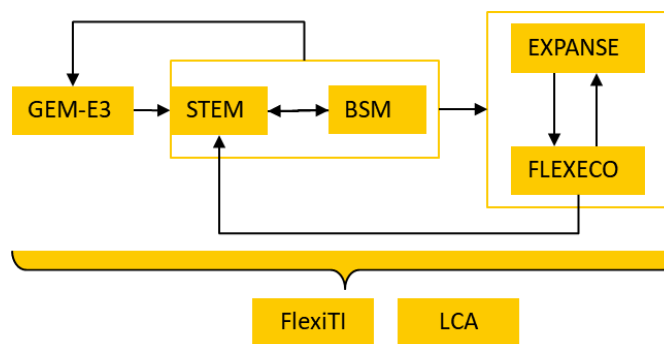
Model interfaces specification

Understanding the models:

- Workshop and bilateral meetings
- Collection of initial model outputs

Coupling the models: a Test Case to

- Identify gaps in model interactions
- Identify harmonisation needs
- Test quantification of WP1 indicators



→ Test Cases analysed

Individual model tool development

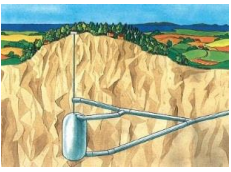
STEM: Industry and behaviour

sBSM: hybrid heating and cooling demands

Geo-spatial model for Solar, HP and BEV

FlexECO: Gasgrid & increased resolution for electricity

GemE3-CH: full CGE model for Switzerland



SURE-associated case study:

How can large-scale gas storages (TWh-scale) be integrated into the Swiss energy system taking into consideration the Swiss energy strategy and climate goals as well as the security of supply objectives?

Techno-economic characterisation of large-scale gas storages for Switzerland

- Storage abroad
- 2 LNG options
- Lined Rock Cavern (LRC) storage

Model development and enhancement (STEM of PSI and FlexECO of ETHZ-FEN)

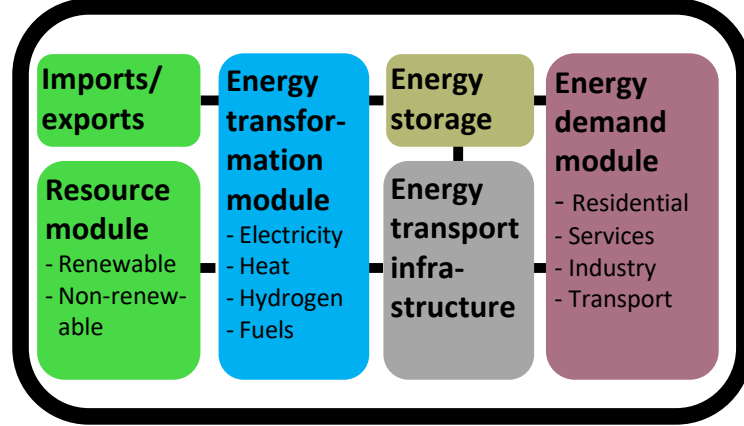
- New technologies
- Gas network (transmission level)
- Model interfaces

Joint scenario analysis

- 2 SURE Pathway scenarios
- Disruptive event
- Sensitivities on price volatility, storage availability



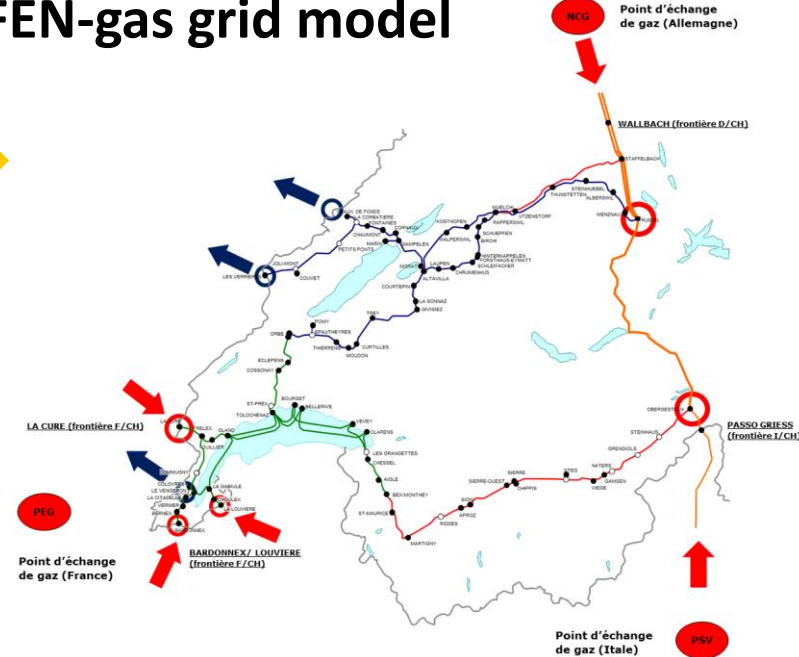
Swiss TIMES Energy systems Model



-Future gas supply and consumption patterns
-Seasonal storage needs

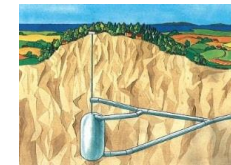
-Operational electricity & gas network & storage constraints
-Infrastructure (dis)investments

FEN-gas grid model



Insights on:

- Different possible market configurations under the energy transition
- Analysis of resilience / supply security
- Demand and supply for natural gas, synthetic CH₄
- Techno-economic optimisation of different options



SURE Pathway scenarios:

SPS₁: Team Sprint
Focus on Sustainability

World gradually implements green strategies
High regional and energy market integration
Social behavior and lifestyles supporting sustainability actions

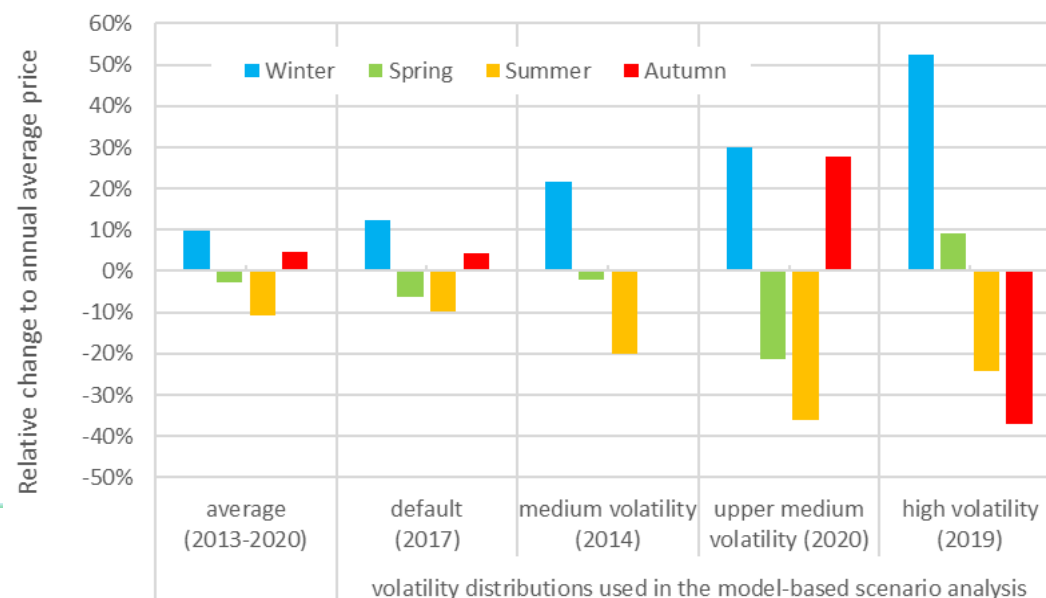
SPS₄: Walk & Talk
Current Trends and Policies

World follows a path not markedly different from today
Geopolitical situation as of today
Social behaviour and lifestyles in favor of proven options and norms

Disruptive event: gas supply interruption for about one week in winter but also a severe situation on the gas demand side with the operation of a gas CC reserve power plant due to unavailability of electricity imports in the same week

Sensitivities:

1. Availability of storage option abroad (FR and DE)
2. Gas price volatility



Results of the model-based analysis shown at the SWEET conference 2023 represent work-in-progress.

The publication of the results is expected for autumn 2023 on the SURE project website: www.sweet-sure.ch.

In case you wish a notification of the publication of this report, please send a message to info@sweet-sure.ch or sign up here: <https://sweet-sure.ch/stakeholder-forum/>.

Domestic large-scale gas storage connected to the Transitgas pipeline and hydrogen-ready to enhance supply security

Visit our website and explore the output along diverse themes and case studies

Visit our booth and test the game prototype

Stay tuned for... **SURE**

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