EPFL
Laboratory of Cryospheric Sciences

UNIGE RES

UNIVERSITÉ DE GENÈVE
FACULTÉ DES SCIENCES

SWEET-EDGE 2021-2027

“Enabling Decentralized renewable GEneration in the Swiss cities, midlands, and the Alps”

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SWEET-EDGE team

15 research teams

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Prof. Bjarne Steffen

Prof. Isabelle Stadelmann-Steffen

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Prof. Merla Kubli

Dr. Oliver Kröcher

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Dr. Vanessa Burg
Dr. Janine Schweier

Dr. Annelen Kahl

Prof. Christof Bucher

Mr. Peter Toggweiler

20 implementation partners

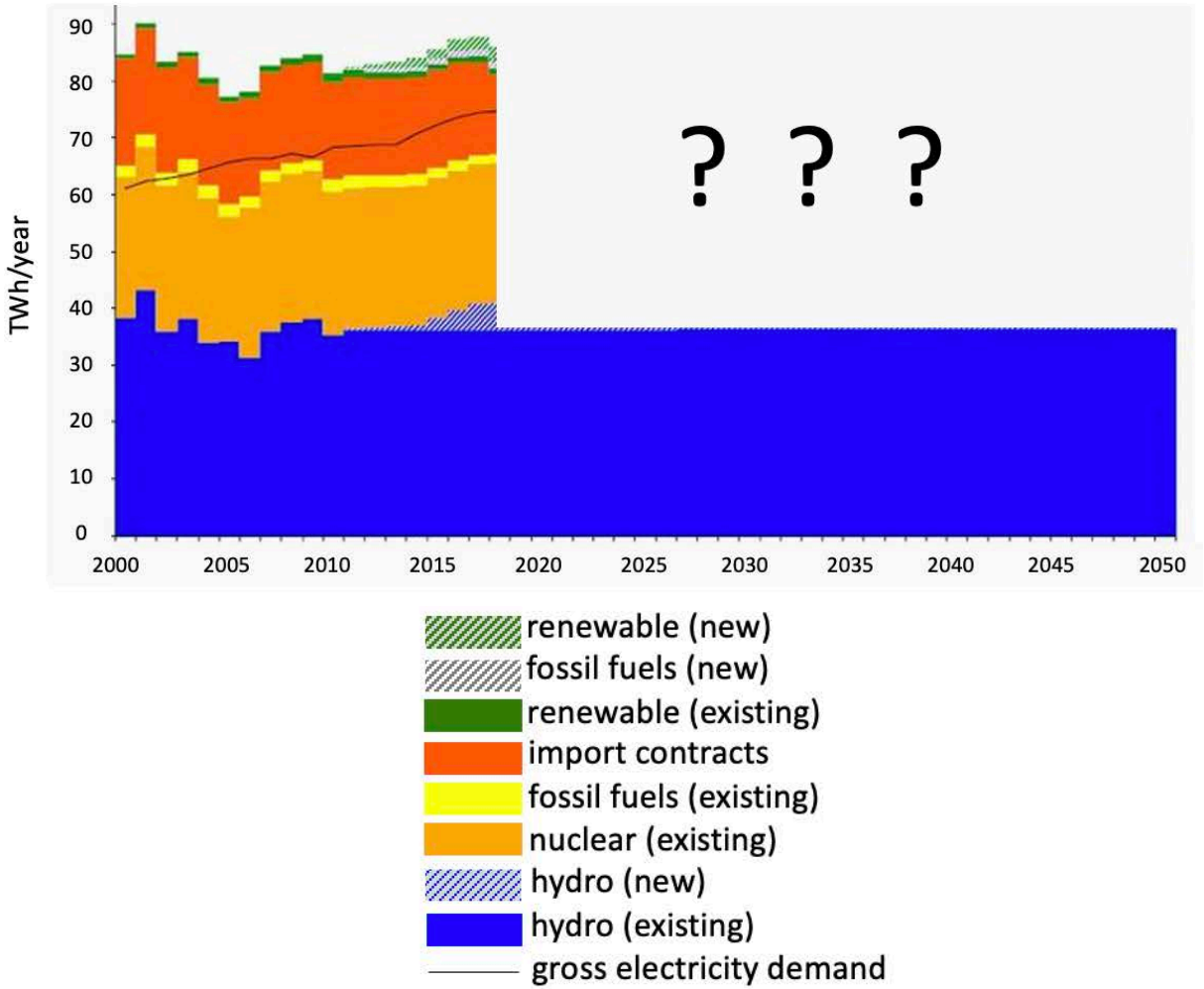
+ 42 support partners

SWEET-EDGE objective

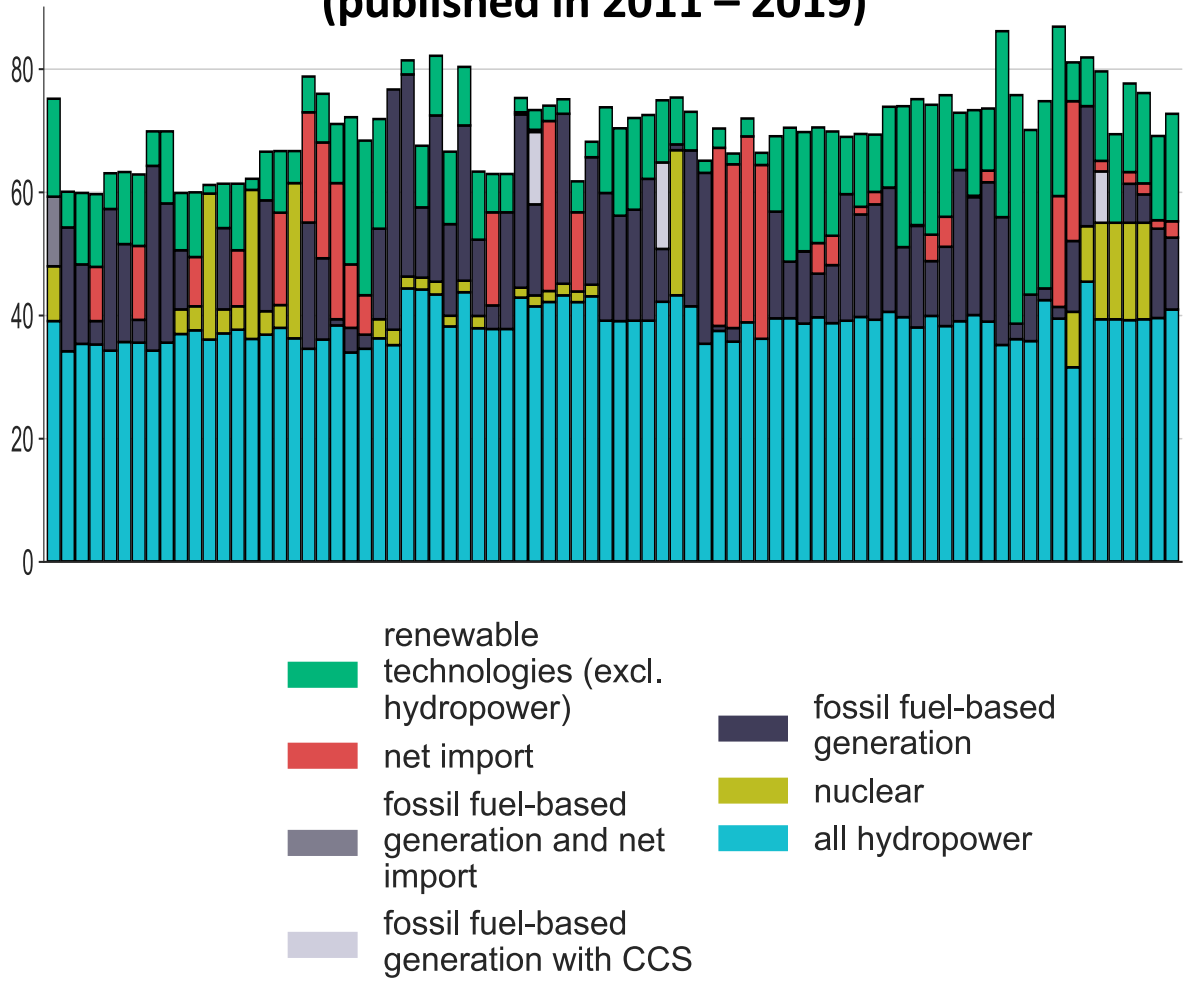
VISION: fast-track the growth of locally-sourced decentralized renewable energy in Switzerland

- develop new national-level scenarios and implementation pathways with high shares of decentralized renewable energy by 2050, including options for nearly or fully renewable Switzerland
- ensure that by 2050, when ambitious shares of renewable energy are reached, the Swiss energy system is designed and operated in a technically and economically optimal and secure way, and that it is well positioned in the European markets
- identify tailor-made solutions for the Swiss cities, midlands, and the Alps for largely electrified and multi-carrier energy systems
- combine research with innovation in three Pilot and Demonstration project clusters (P&Ds)

A gap among existing Swiss electricity scenarios



80 Swiss electricity scenarios for 2035 (published in 2011 – 2019)



Figures: adapted from Energy Strategy 2050 (left); Xexakis et al. (2020) (right)

SWEET-EDGE concept (1)

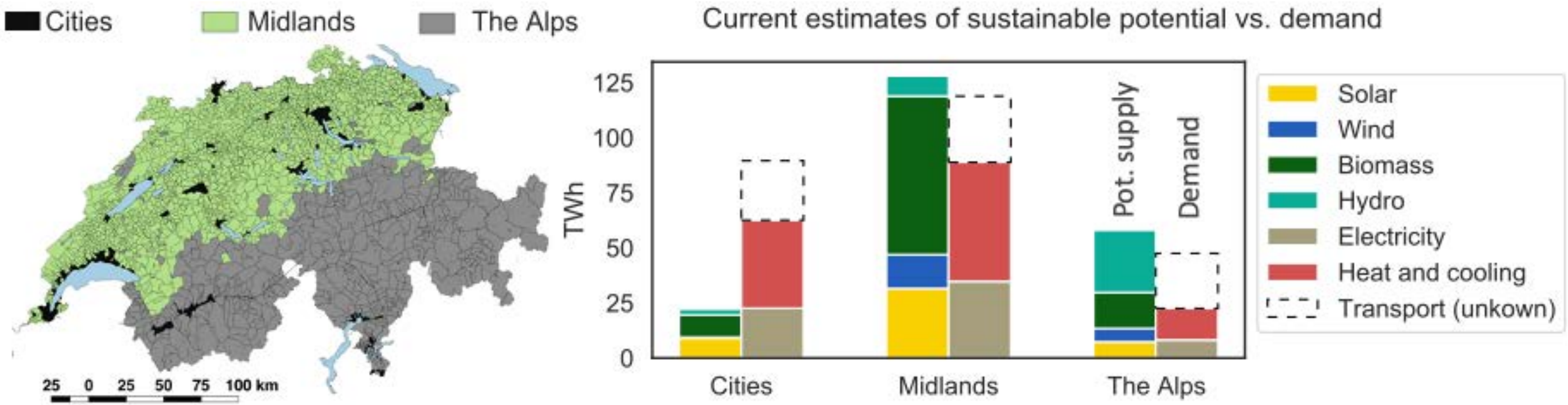


Figure: UNIGE Renewbale Energy Systems group

SWEET-EDGE concept (2)

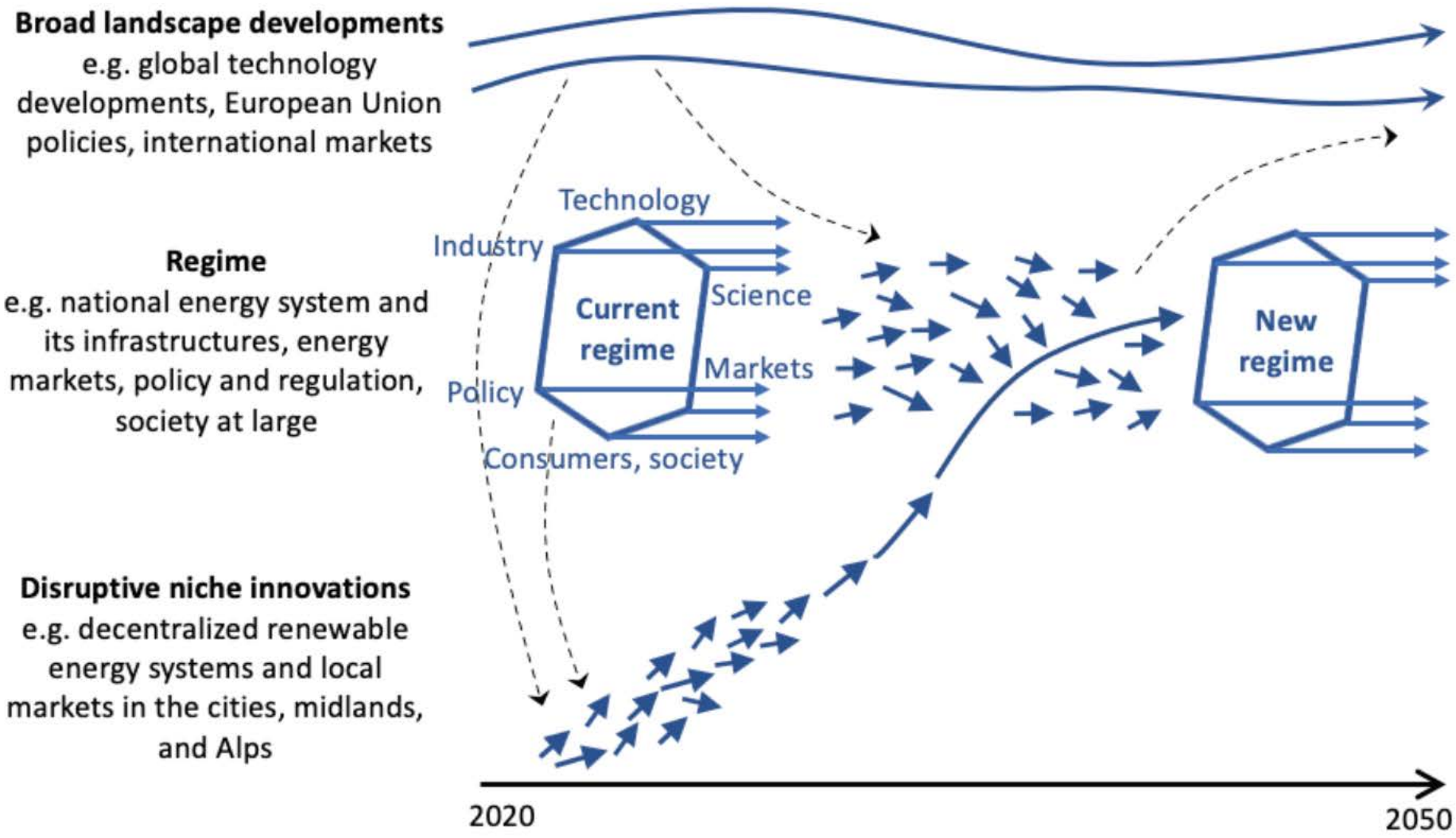
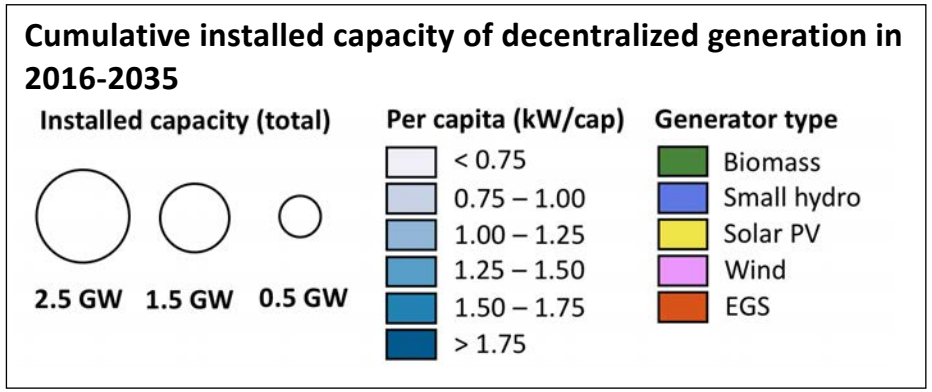
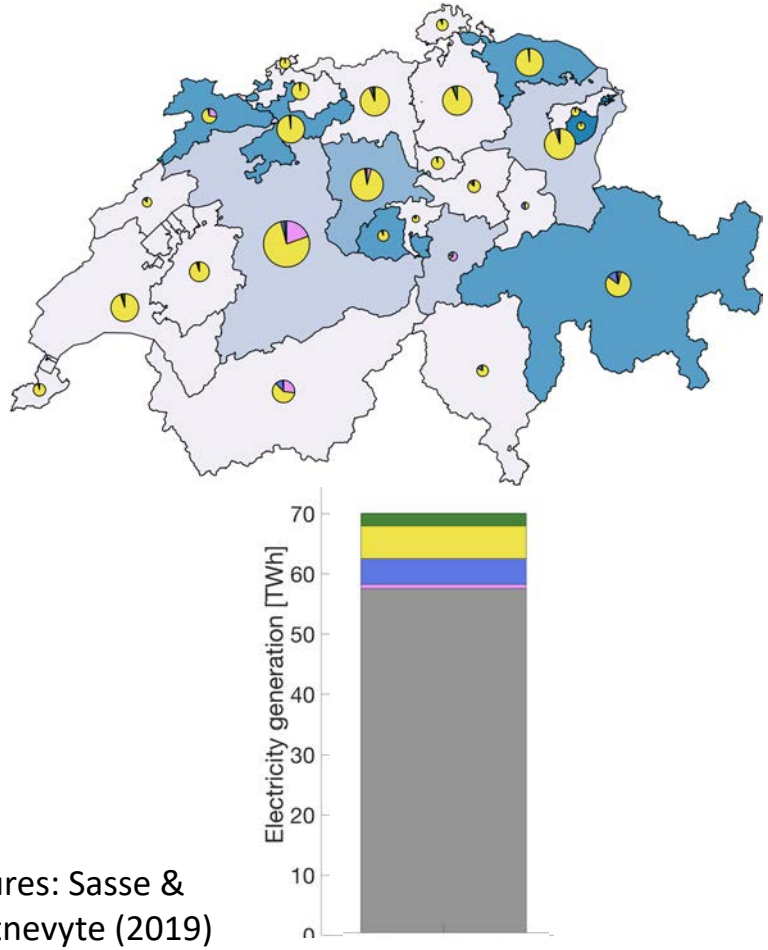


Figure: Adapted from Geels (2002)

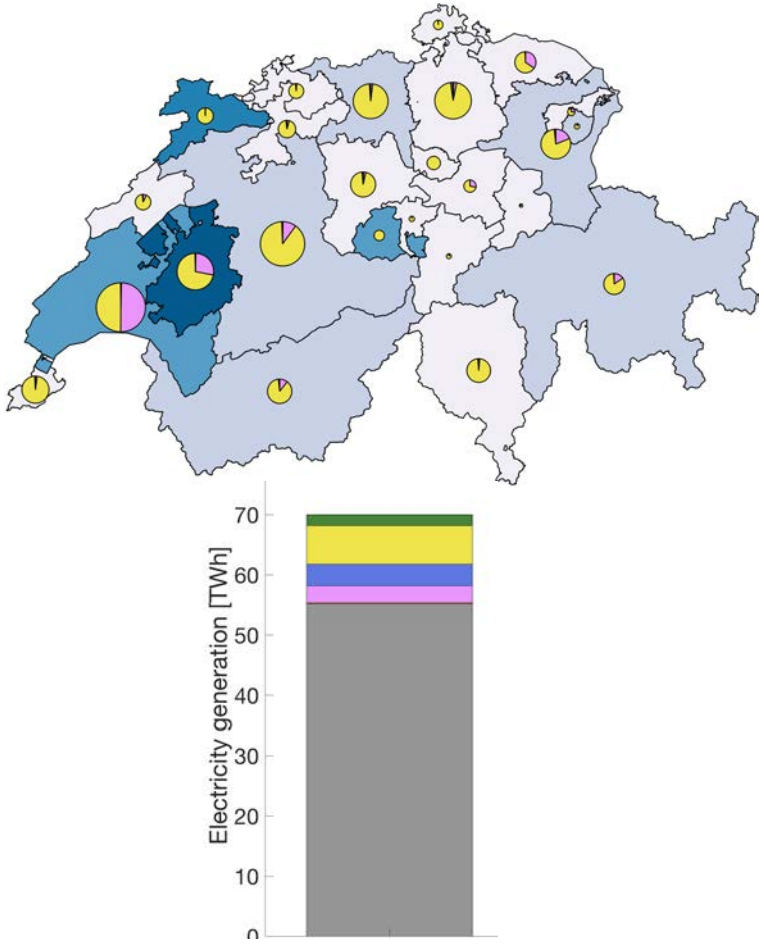
From local to national scenarios



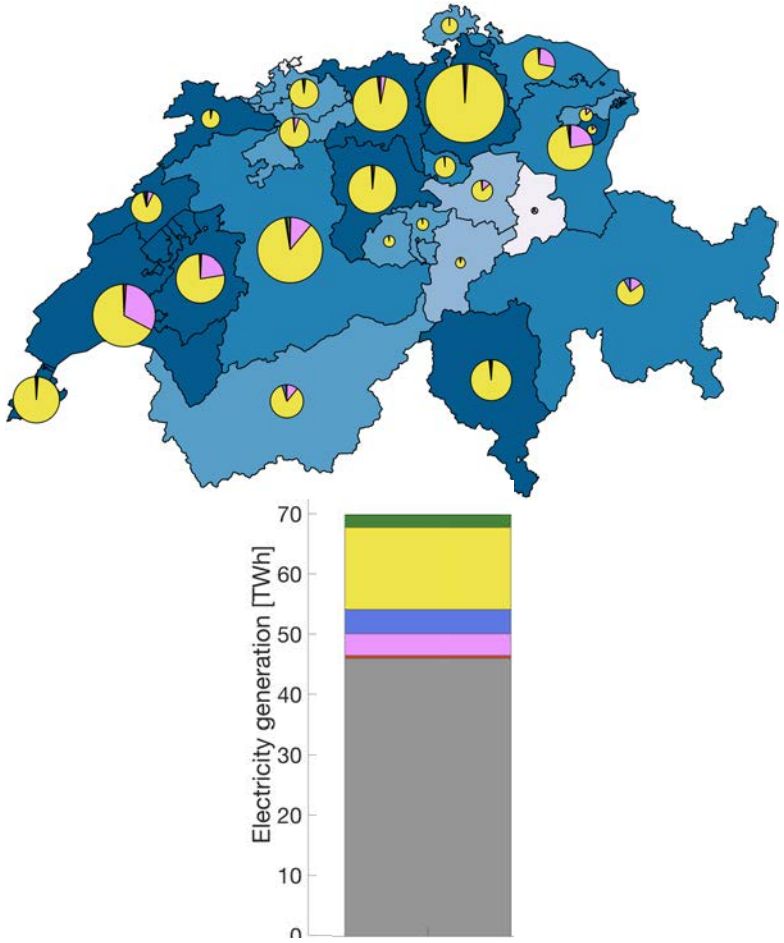
Current trend until 2035



Least-cost scenario 2035



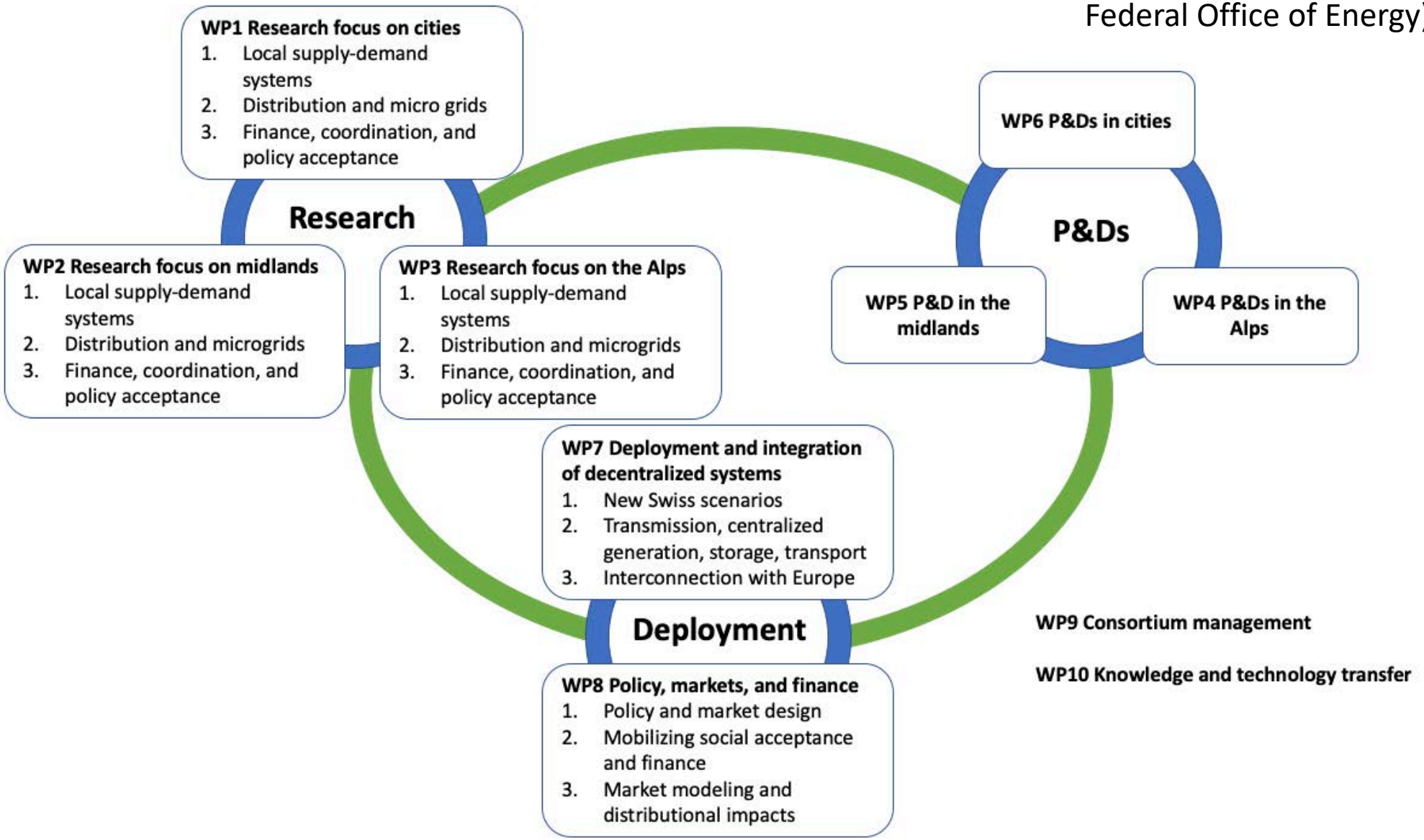
Equal regional effort scenario 2035



Figures: Sasse & Trutnevyte (2019)

SWEET-EDGE work plan

Budget: 21 mln CHF in 2021-2027
(including 8 mln CHF from the Swiss Federal Office of Energy)



SWEET-EDGE Pilot & Demonstration projects

Cities

- **Berne**
- **Lucerne**
- **Möhlin/Rheinfelden**
- **Canton of Aargau, including Aarau, Baden, and Lenzburg**
- Demonstrate EDGE solutions on different scales (district, community, group of cities) and in different development stages (concept, design, implementation, operation, optimization)

HOCHSCHULE LUZERN

Midlands

- **Waldkirch, Caton of St. Gallen**
- Extend an existing biogas plant to a fully integrated system with additional production (e.g. PV, pyrolysis) and consumers (e.g. agricultural machinery), complemented by battery storage

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The Alps

- **Bagnes-Verbier, Wallis**
- **Davos, Graubünden**
- Augment existing plans for infrastructure build-up or renewal with EDGE components, such as high-mountain PV, PV on avalanche defence structures or dams

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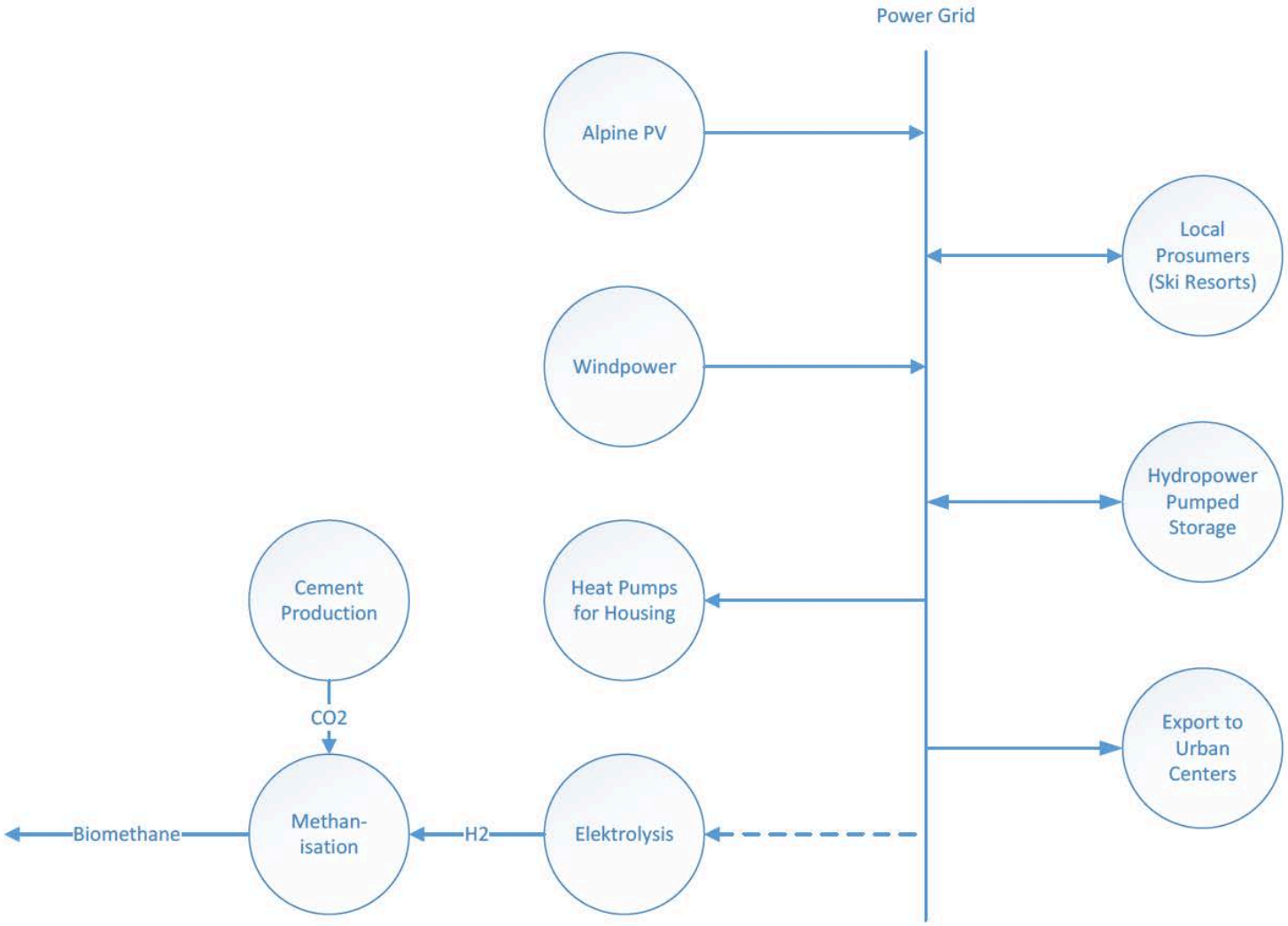
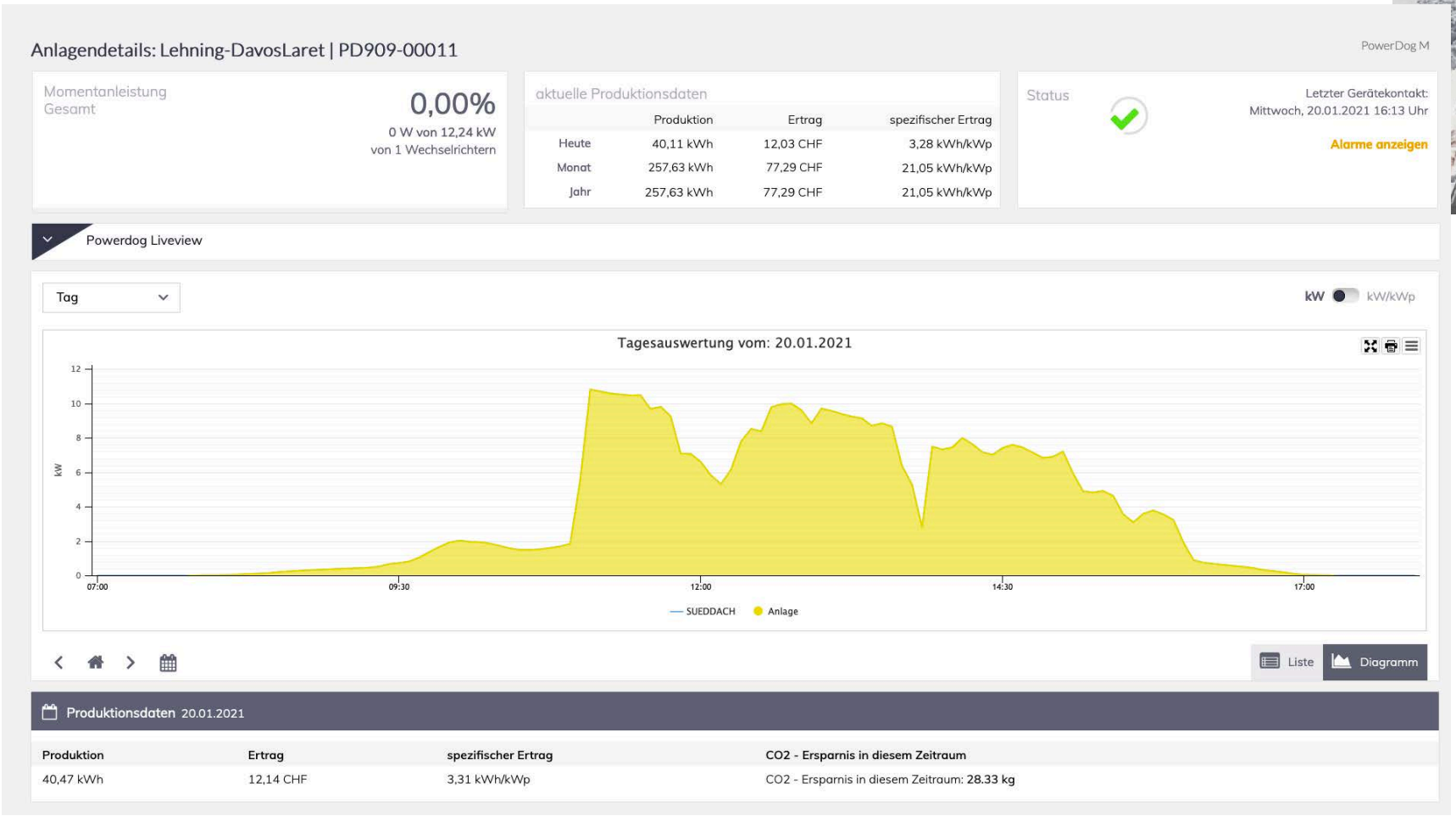
The Alpine P&D Project

Backbone Production:

- Hydro
- PV
- Wind



Alpine PV



January 20 2021:

- 11 kW achieved with 12 kW peak
- 35° roof slope
- snow removed
- <u>reflection from snow – bowl location</u>

Alpine Wind: La Stadera Lukmanier

Reasons for more wind than currently known:

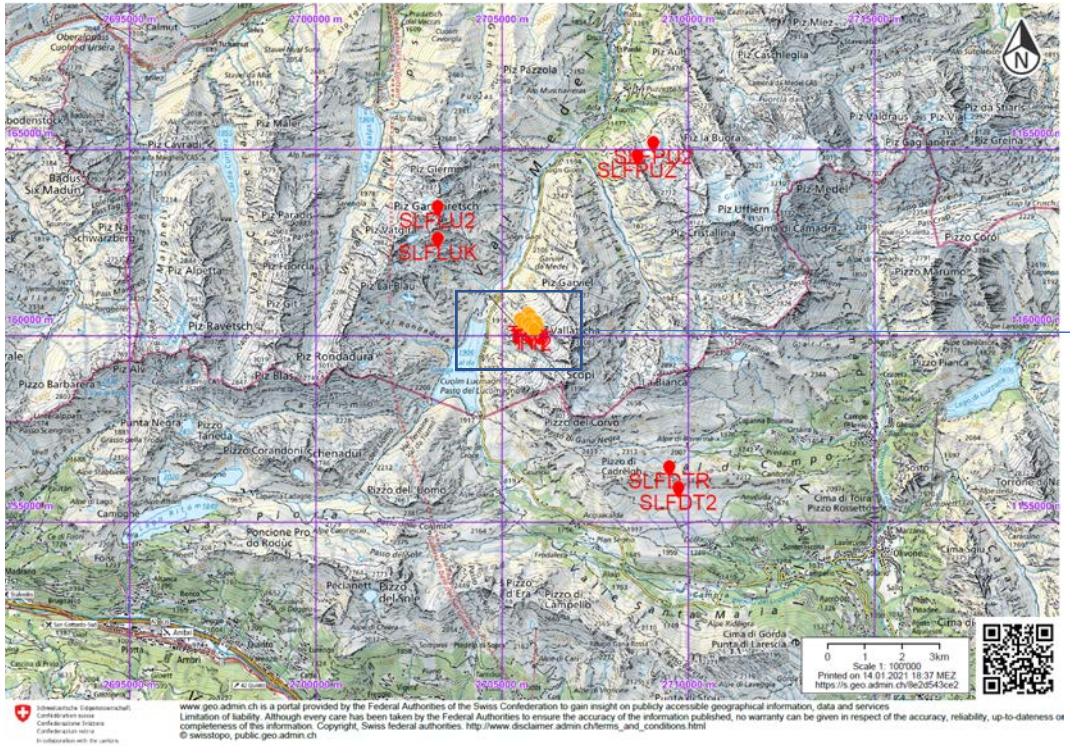
- Channeling
- Speed-up
- Mountain Waves

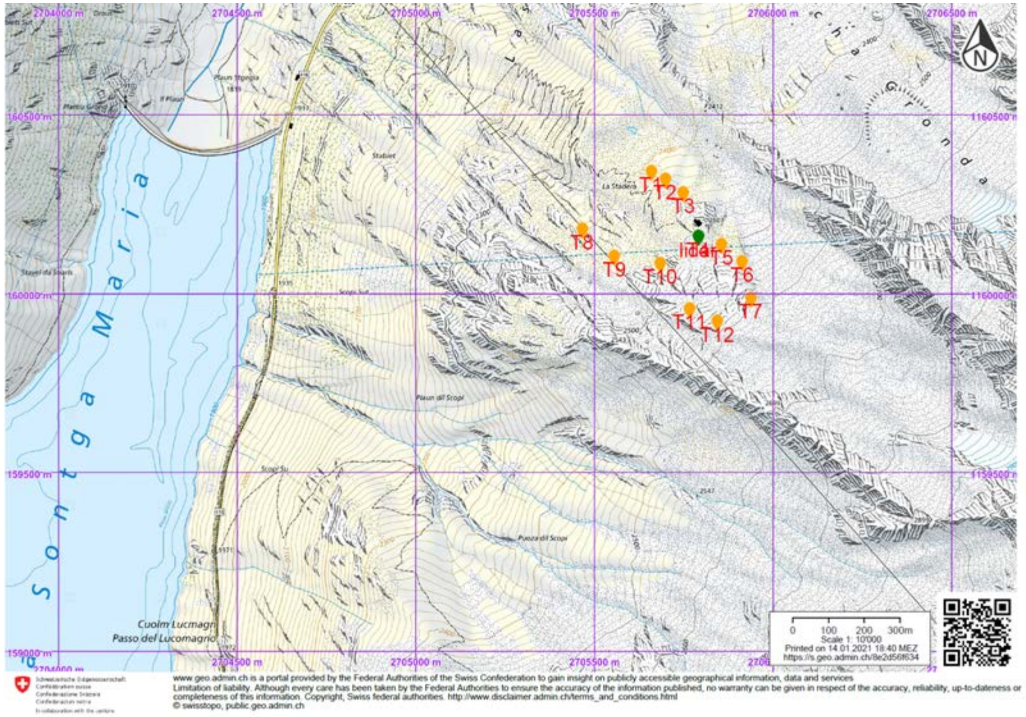
<u>How can we find the best spots?</u>

Alpine Wind: La Stadera Lukmanier

How good is this location?

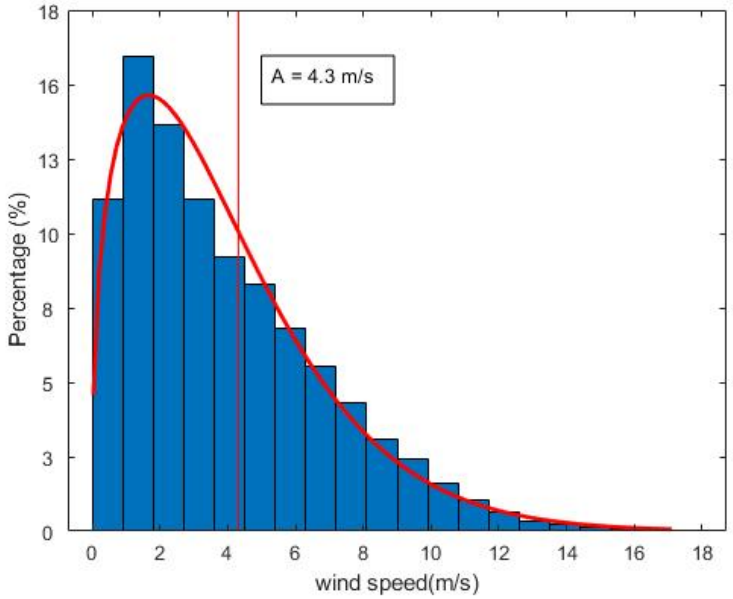
- 🔴 Weather station
- 🟡 Planned turbines location
- 🔵 Lidar location





Alpine Wind: La Stadera Lukmanier

Machine Learning Approach



Weibull distribution from 10 years trained data at lidar location

K = 1.4 , A = 4.3 m/s

Conventional Measurements

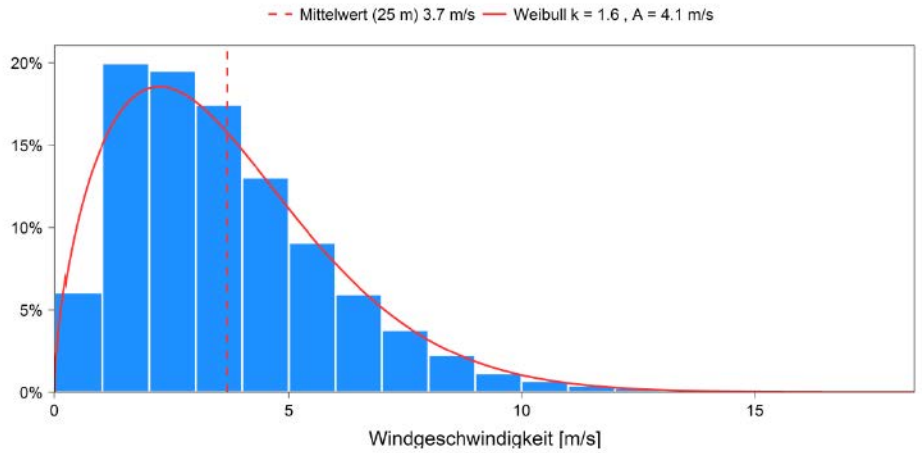


Abbildung 4: Häufigkeitsverteilung der Windgeschwindigkeit auf 25 m mit der entsprechenden approximierten Weibull-Verteilung.

Weibull distribution from meteotest

K = 1.6, A=4.1 m/s

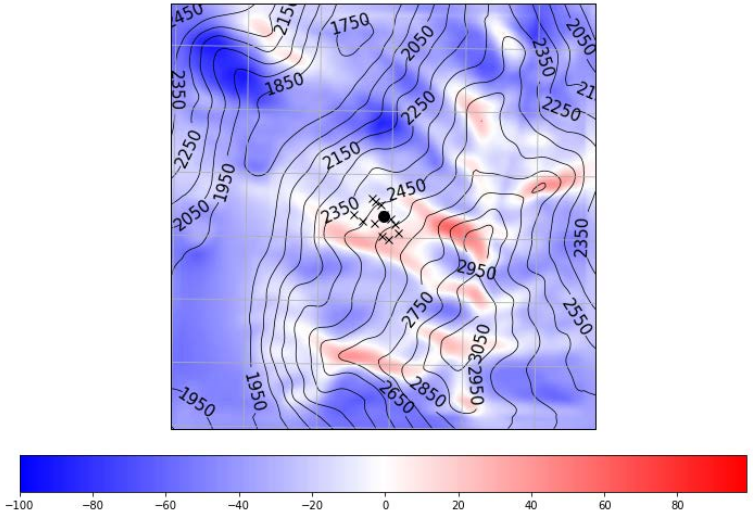
Alpine Wind: La Stadera Lukmanier

Using a numerical model at very high resolution to:

- Find the interesting features
- Assess local variability
- Know about wind shear and turbulence

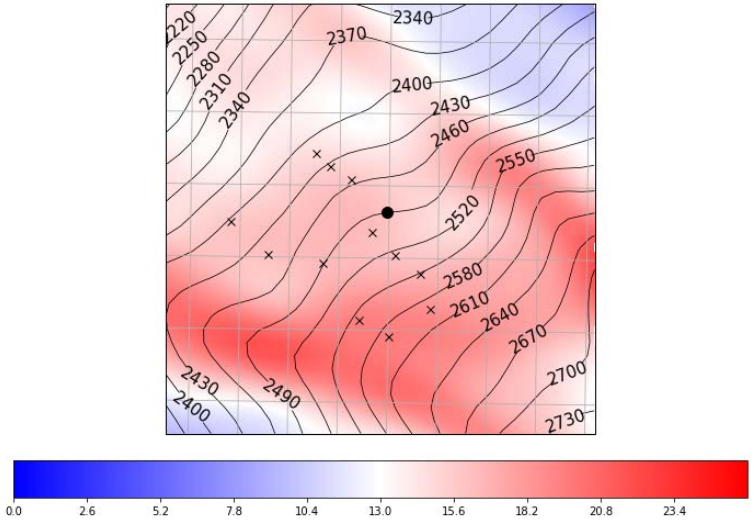
Spatial variability color index in percentage
White = same windspeed as lidar location
Red = Higher wind speed compared to the lidar location
Blue = lower wind speed compare dot the lidar location

%



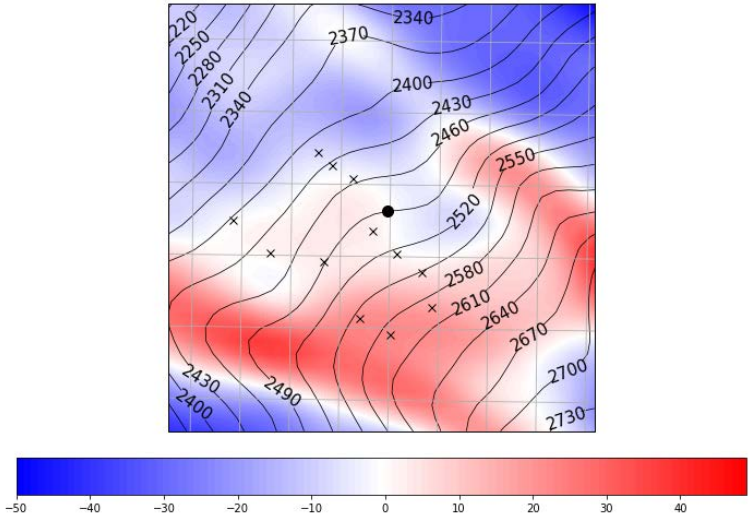
Spatial variability from WRF-COSMO1 simulation (21/10/2020)

m/s



Detailed wind speed 23.5m agl

Zoom: %



Detailed spatial variability 23.5m agl

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Please get in touch with questions and comments!

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