

Défis à relever en route vers les 50 GW de PV en Suisse

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Switzerland

PV Tagung 2021, Bern

Unimail, Solaxess, 3S Solar plus, Electrosol, Freesuns

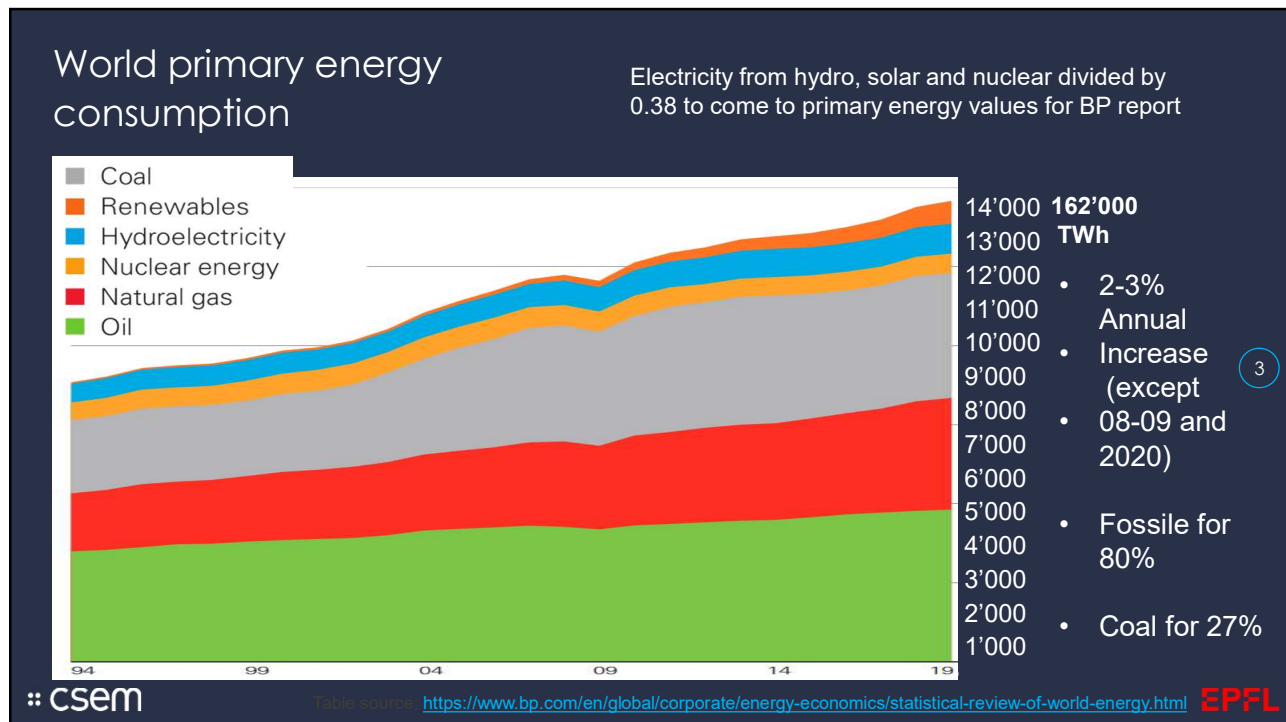


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Reminder of the general context

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Quick rule of thumbs estimations for the world:

- Assuming a 2% growth in primary energy need → 250'000 TWh in 2050 (around 1000 x CH today)
- Strong electrification of heating/mobility with a gain of 2.5 + biomass + power to gas

→ 100'000 TWh electrical production by 2050 (in 2020 hydro ~ 4300 TWh, Nuclear 2600 TWh, wind 1500 TWh, Solar 700 TWh)

4 major options →

- e.g. 40 TW of Solar and 15 TW of Wind
- 11'000 x 1 GW nuclear power plants
- Carbon sequestration
- Don't care

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**Getting fit for 55
and set for 2050**

Electrifying Europe with wind energy

June 2021

etipwind.eu • windeurope.org

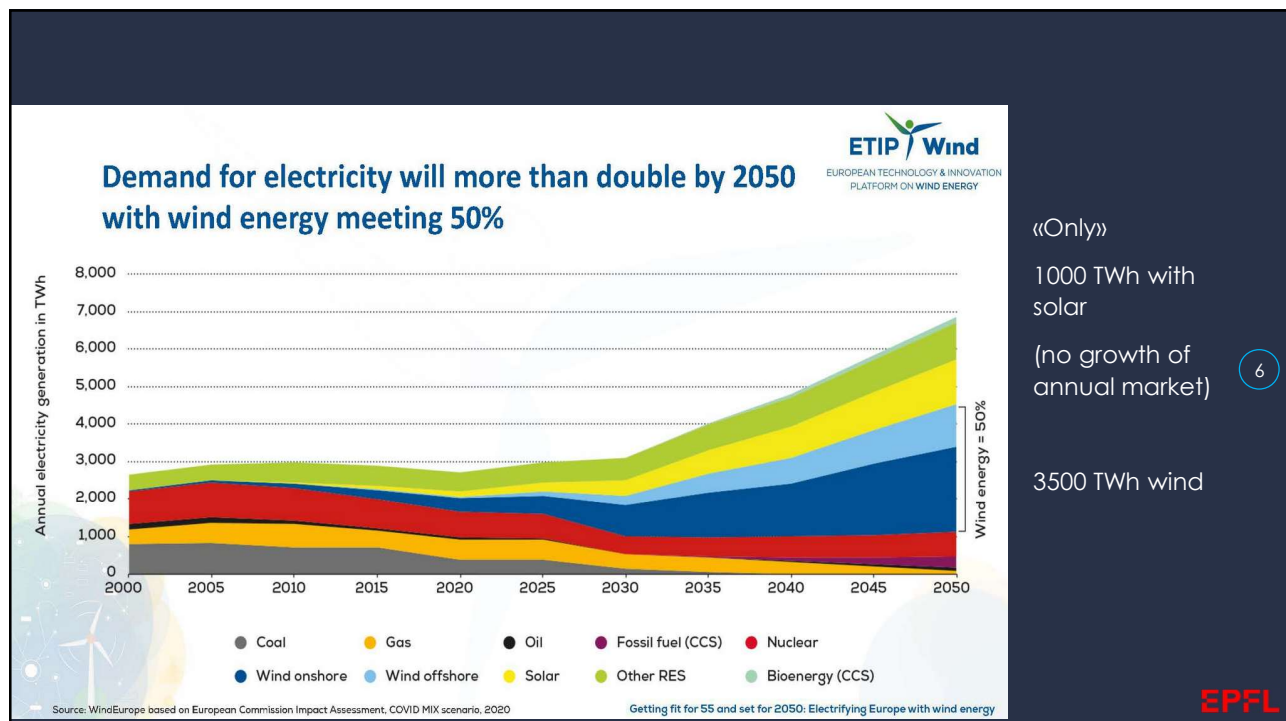
ETIP / Wind
EUROPEAN TECHNOLOGY & INNOVATION
PLATFORM ON WIND ENERGY

Wind*
EUROPE

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100%
Renewable Europe
How To Make Europe's Energy System
Climate-Neutral Before 2050

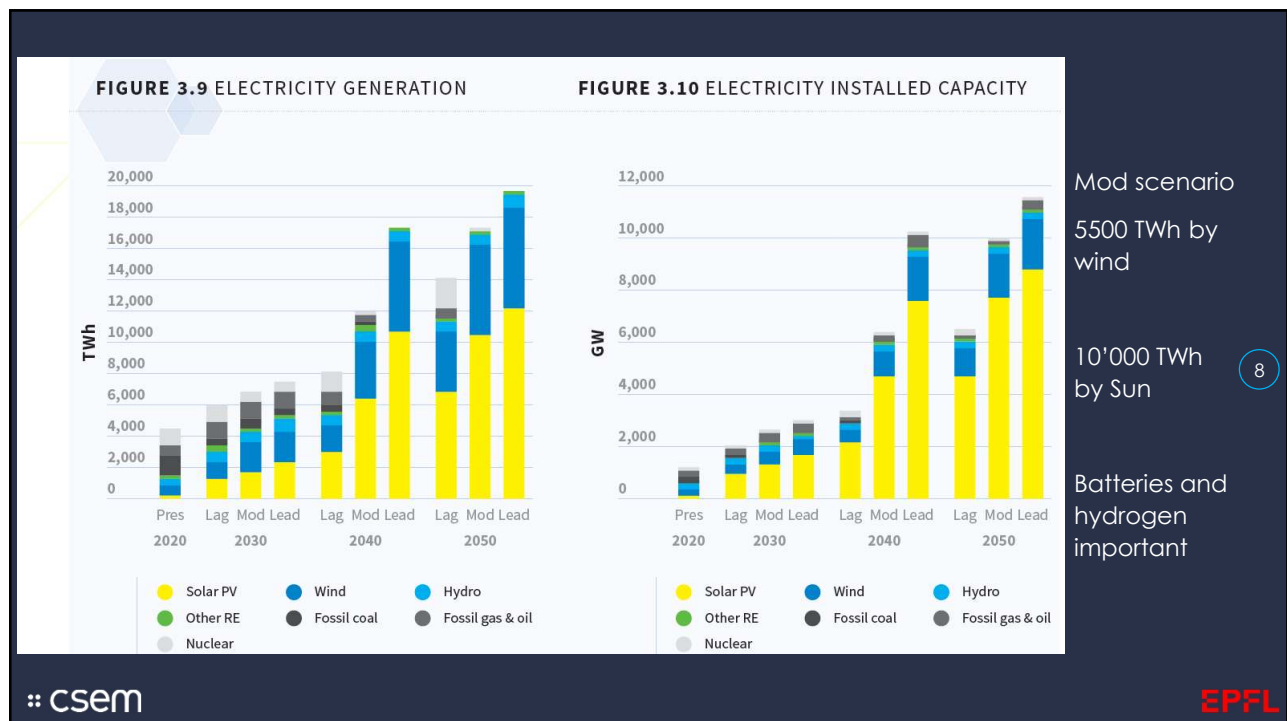



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OBJECTIF D'UNE SUISSE NEUTRE POUR LE CLIMAT EN 2050

production d'hydrogène sur le site des centrales au fil de l'eau (7 PJ)

1.5 mio. de pompes à chaleur (aujourd'hui 0.3 mio.)

valorisation des déchets avec **CCS** (3.6 Mt CO₂/a)

biomasse pour la chaleur industrielle

expansion des **réseaux de chaleur** dans les régions urbaines

cimenteries et industrie chimique avec **CCS** (2.9 Mt CO₂/a)

trafic lourd par **rail**, avec **bioénergie** et **hydrogène**

3.6 mio. de voitures électriques à batterie

technologies d'émission négative: stockage national (3 Mt CO₂/a)

45 TWh d'hydroélectricité (53% de la production)

haute efficacité dans les processus industriels

bâtiments bien **isolés** avec faible demande de chaleur

34 TWh à partir d'installations PV, 40% de la production (aujourd'hui 2 TWh)

PERSPECTIVES ÉNERGÉTIQUES 2050+
RÉSUMÉ DES PRINCIPAUX RÉSULTATS

50 to 34 GW of PV

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Main challenges to 50 GW in Switzerland

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Website of an energy provider in Romandie
(belong to public authorities)

Lobbys
And habits

CENSURÉ

**Obtenez jusqu'à
3'500 CHF de prime
en passant au gaz
naturel**

**PRIME À LA
CASSE**
SUR VOTRE ANCIENNE CHAUDIÈRE À MAZOUT

Obtenez votre
prime dès
maintenant !

Plus d'information

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Lobbys
And habits

**Coûteuse.
Inefficace.
Antisociale.** **Non**
à la loi ratée
sur le CO₂

www.loic02-ratee.ch

- Les énergies fossiles génèrent des milliards de profit pour quelques personnes en Suisse

A VOTÉ!!

**Reinforce positive communication with respect to transition.
Ban the word tax.... Use more incentives**

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Exemple: promote electric mobility without tax

- Install quickly more charging infrastructure
- Reduce electricity price for charging for remote areas
- Most parking place reserved for electric cars (increase by 10% every year)
- Speed limit at 100 km/h for fuel cars on highway (120 for electric)
- Third line in case of traffic jam only for electric/hydrogen cars
- Play on annual tax

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SDAC members (operational*)

* SEM bidding zone: operation in isolation

SDAC members (non-operational)

EU integration

Mécanisme unifié pour l'allocation des interconnexions entre zones.

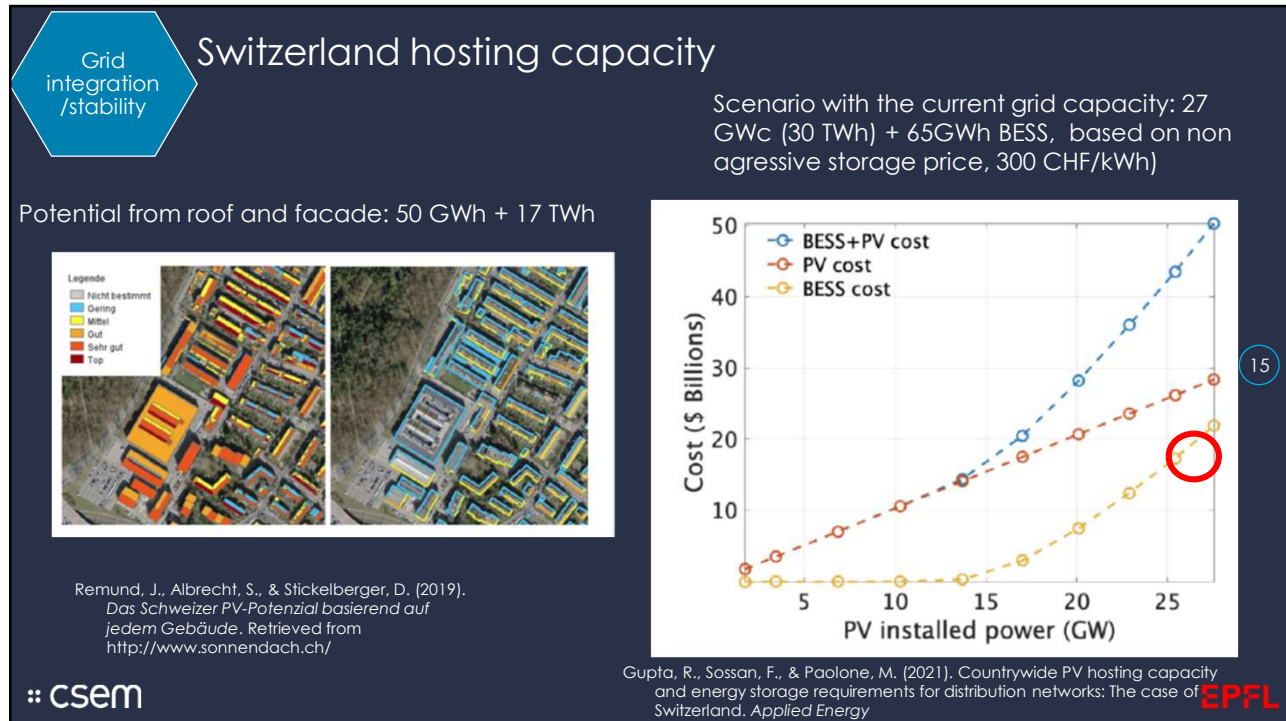
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interconnexions polonaises, tchèques et bulgares intégrées en juin 2021

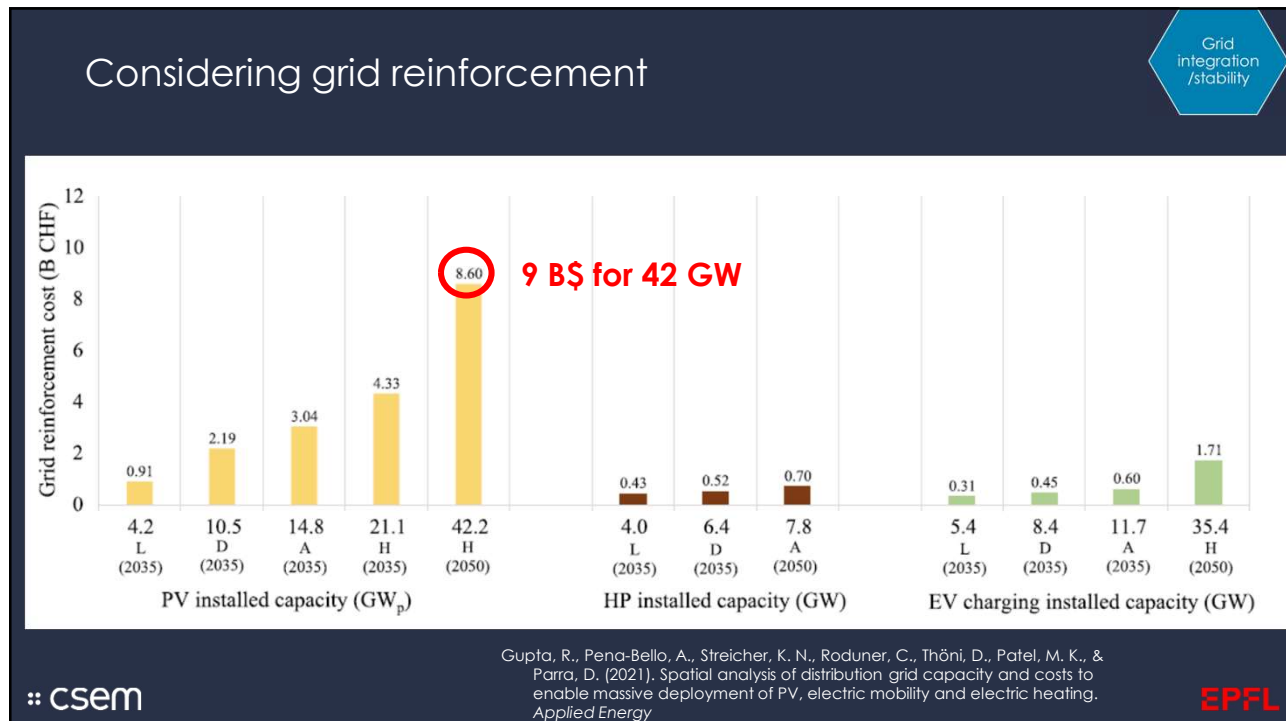
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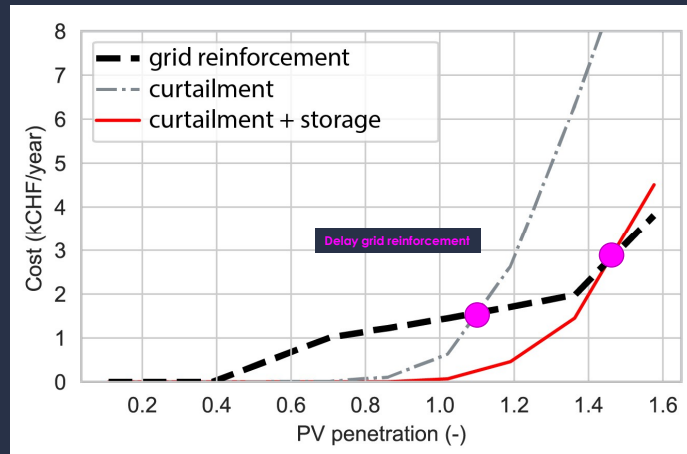
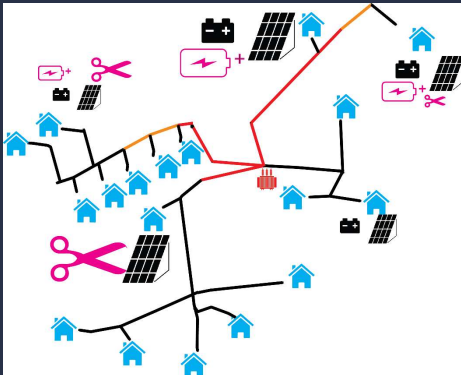


The significant role of flexibility

Grid integration /stability

Batteries owned by small to large customers (energy communities, public building, etc....)

Active distribution network, can remotely **control BESS and curtailment**



Holweger, J. (2021). Flexibility for large-scale deployment of PV systems in low-voltage grids. Ecole Polytechnique Fédérale de Lausanne.

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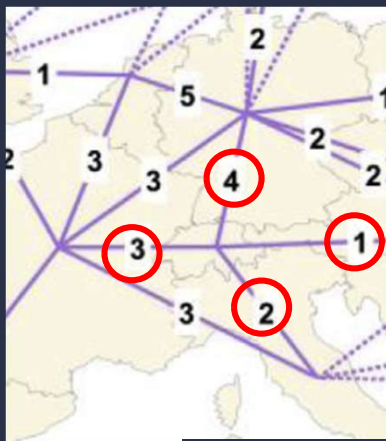
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Transmission network interconnections

Grid integration /stability

Transmission network capacity (GW)

2015



2050



Child, M., Kemfert, C., Bogdanov, D., & Breyer, C. (2019). Flexible electricity generation, grid exchange and storage for the transition to a 100% renewable energy system in Europe. *Renewable Energy*

Pessimistic assumption:
41% of
imported
energy

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Role of electrochemical storage

- In most scenarios batteries will play a significant roles (either at home, the grids, or with cars)
 - Cost affordable thanks to input thanks to automotive development
- a «future» 100\$/kWh battery system with 5000 cycles could store electricity for 2cts/kWh. At 300\$/kWh for 6 cts/kWh

Grid
integration
/stability

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→ Batteries will support most of the **energy reserve** in the grid (minutes to days) and electronics will support **the inertia** of the grid (replacing the diminution of rotating masses)... Still we should value hydro-assets...

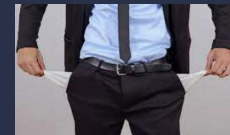
Batteries/curtailment/Flexibility/grid upgrade will ensure a stable systems...

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Acceptance
Cost
Regulation

Market risks at all level

- What happened when we reach 10 GW of PV in CH and 500 GW in EU?
- Which pricing and «feed-in tariffs» ?
- Who will still invest ?
- Strong limits of a self-consumption models or grid-injection models, e.g. with negative market prices



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Technically it can work, but most likely markets will need to be re-designed and roles of stakeholders clarified

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Winter storm: the bad guy

Autarchy vs
connectivity

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Use cases

Planair Reference scenarios

- Different scenarios depending on sun, wind and storage development

- A. Solar and battery
- B. Solar, battery and hydrogen storage to control imports
- C. Solar, battery, hydrogen storage and wind to control imports

[Online simulation tool](#)

	Scenario A	Scenario B	Scenario C
Final consumption	84.7 TWh (61.9 TWh in 2018)		
Installed PV power	50 GWp	67 GWp	50 GWp
Installed Wind Power	0	0	3.3 GW
Daily storage capacity (battery)	100 GWh		
Electrolyser	38 GW		
Additional seasonal storage (H ₂)	0	26 TWh	19.9 TWh
Fuel cell	8.8 GW		
Raw Energy import (7 TWh in 2018)	19.6 TWh	7 TWh	7 TWh

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<https://gridview.gridnewdeal.com/home/>

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Winterelectricity: system crashing ?

Autarcty vs
connectivity

- Winds help. We should support local wind production....
- Being better connected to Europa helps (import wind electricity. ??
Interconnections and pan-european connections)
- Increased hydrostorage
- Vertical PV (and high altitude)
- Saisonal heat storage from summer to winter
- Heat less (15°C) for one or two weeks per year....
- Possible local H2 production and storage (including in the form of liquid organic carriers... use the >> millions m3 of oil storage facilities ?

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Simple and convincing messages required, supported by understandable models.

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And it is always possible to:

- Install much more PV

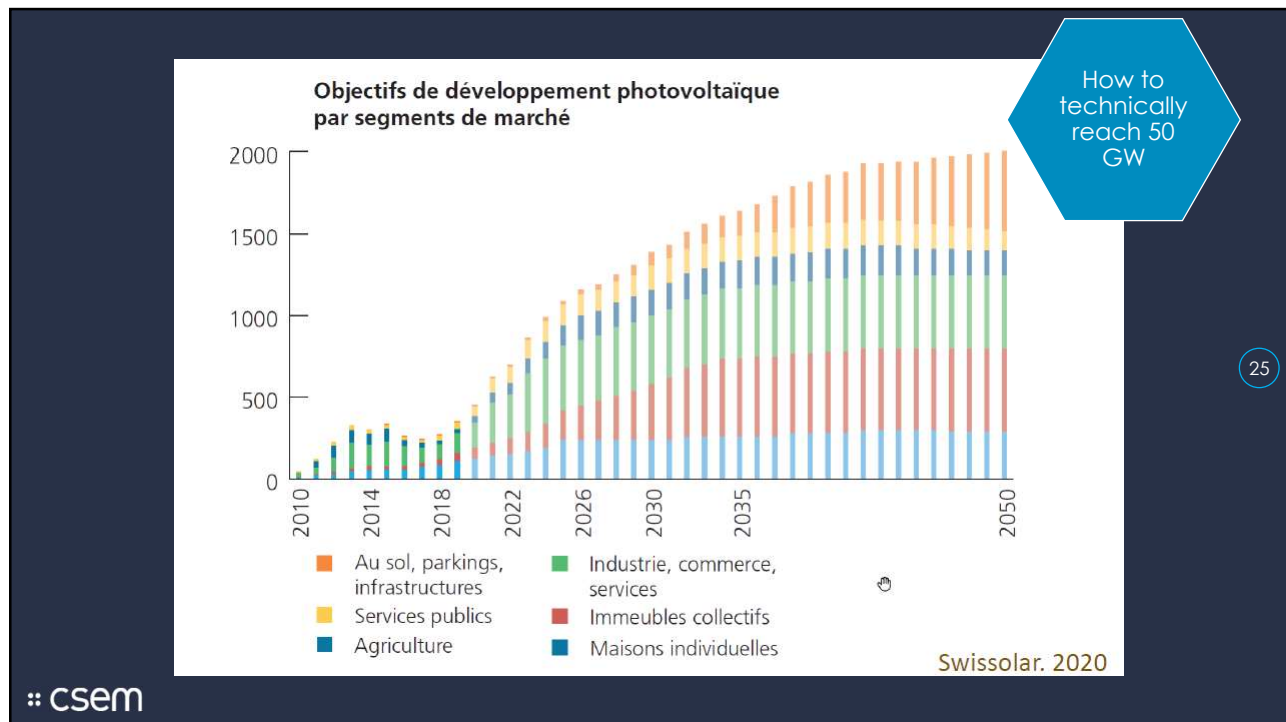
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Which space to use ?

How to technically reach 50 GW

- Roofs and ideally façade
- But stop with small PV systems

Many installers and companies (e.g. local utilities) propose PV systems optimised for self-consumption and shortest financial return time

«4 kW is more than enough»

Every year we waste ~ GW of rooftop potential

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Recommandation

- All installers should market the energy transition targeting the maximum installation. Make people dream !!!!
- Minimum requirements for new or renovated roofs should be increased
- Special incentive for maximum coverage (federal or local) :
+ 200 €/kWp if > 80% of surface with pot > 700 kWh/year covered

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Acceptance
Cost
Regulation

Project in Zurich by 3S, with Solaxess and CSEM support

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- Even the most beautiful projects are attacked by «heritage protectionists»
- Difficult to get a priority for renewable.

Important that the Federal Office for Culture acts and prioritise support for solar (but also small biogas, wind, ...)

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See talk by L. E. Perret on Be-smart

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Can
technology
Support ?

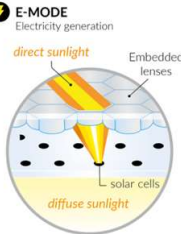

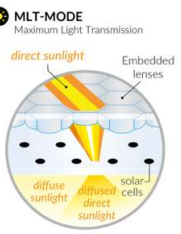

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Microtracking pour l'agriPV: select light or PV

Mode de contrôle	Photo – face arrière du module	Explication
E-MODE Electricity generation 		La lumière directe est bloquée par les cellules solaires, tandis que la lumière diffuse (ciel bleu ou nuage) passe à travers.
MLT-MODE Maximum Light Transmission 		Les lumières directe et diffuse passent à travers le module, grâce au désalignement du module, offrant plus d'intensité aux plantes pour leur photosynthèse.

Identified space for

➤ 5 GW

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DHP (CH)

Horizon

- Deployable PV systems
- Over streets, parking, water,....
- Charging EV station



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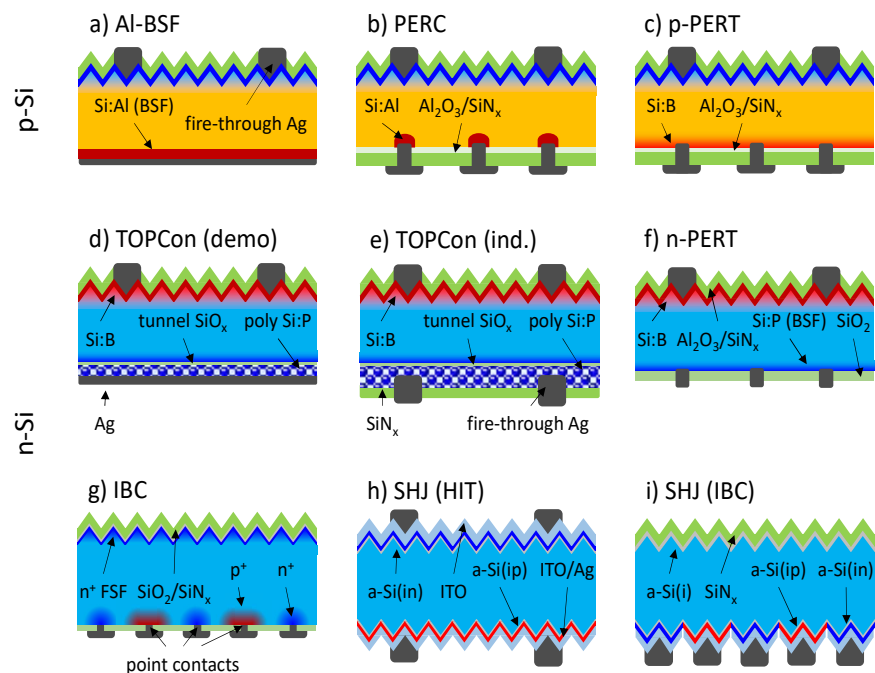
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The various types of silicon technologies

Source:
Ballif/Haug et al.
To be published

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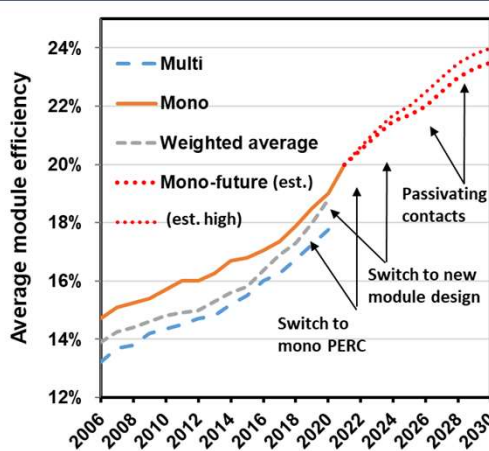
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Technology

See talk by A. Morisset et S. Nicolay

Can
technology
save the
world ?



Haug, Ballif et al. Submitted

- Efficiency of PV modules will further increase (average 21.5-22.5% in 2025)
- Larger modules, new designs → acceleration of efficiency learning curve
- Price higher today (temporary bottlenecks in various materials)
- PV sustainable, no fundamental material limits
- **Minor invests worldwide to go to 1 TW PV panels production capacity (18 billions per year, with standard equipement, see P. Altermat)**

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Optimal systems:

Strong impact from costs (wind – solar – storage -hydrogen- long terme storage)

→ Ratio wind to solar electricity and share of stored energy

**Mores studies/demo and research on optimal path.
Strongly depends on each cost roadmas ! (at EU or world level).**

In CH simple: install as much Wind as we can....

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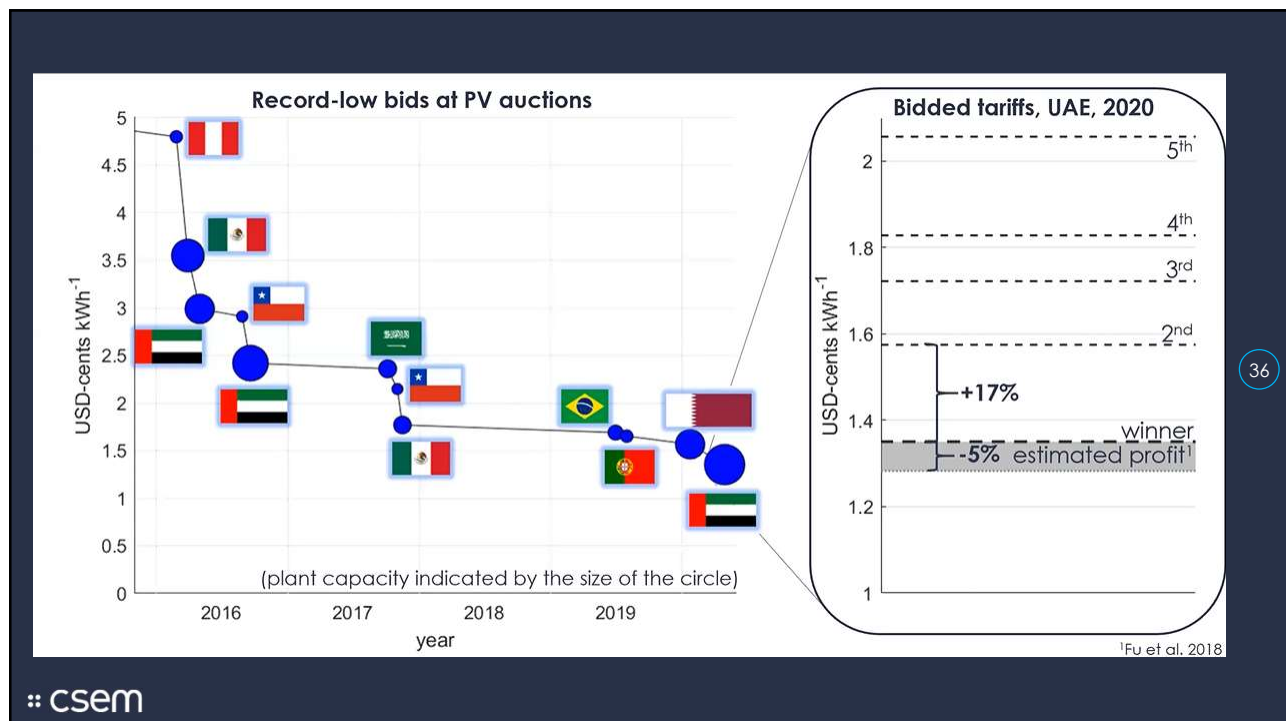
Large solar park to come down to 0.3-0.4 \$/W by 2030

Will create the cheapest electricity

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Favor the renewal of a large PV industry in Europe ??

Can
technology
save the
world ?



MEYER BURGER

Ready to pay more for a product with local content, less CO2 from polysilicon ?

No controversial human rights practice ?

Revive a European Industry ?

Reduce independancy to Asia ?

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Invitation to all installers: promote EU products, with EU cells even if more expensive...

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Many technology innovations/products in CH



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Conclusion

- Technology still needs support but will solve key technological issues
- Technology will not solve legal/market issues without political support and adapted regulation
- Wintergap manageable, but a multi-level approach is required....
- Installers of PV, heat pumps, renovations firms, need all to increase efficiency !
- 35-50 GW PV in Switzerland is doable, manageable

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"We need many more E. Becquerel's Children"
Unknown source

CSEM - Maestro

PVLIVE

www.csem.ch/page.aspx?pid=126438

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