tiroler wasser kraft

The Green Battery for a Sustainable Europe

Now, 2020 and Beyond

2014

Dr. Peter Bauhofer

EUROPE 2020

Contents

tiroler wasser kraft

TIWAG Is One of the Most Important Austrian Storage Providers.

The Green Battery of TIWAG:

Storages and Pumped Storages

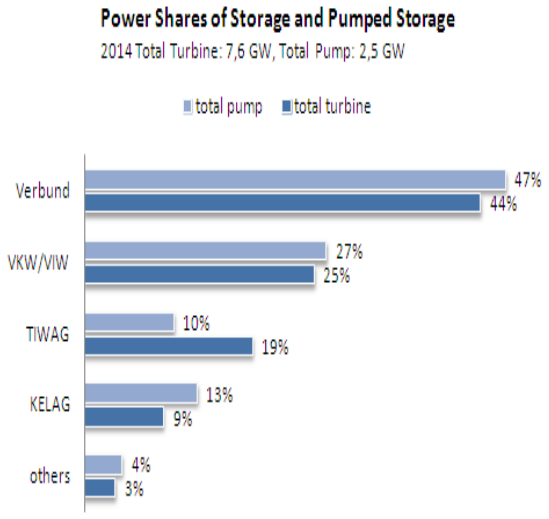
Turbine: 1.350 MW

Pumps: 250 MW

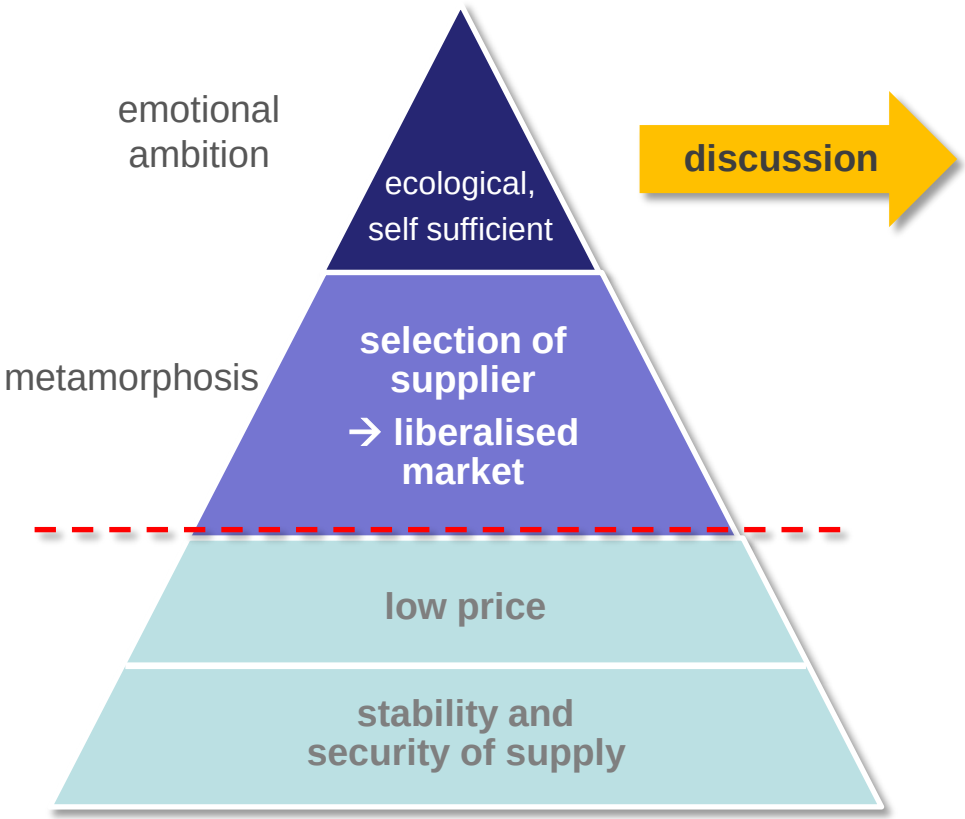
Pumped Hydro Storage Projects

Turbine: 1.050 MW

Pumps: 530 MW



The Psychology of Transition



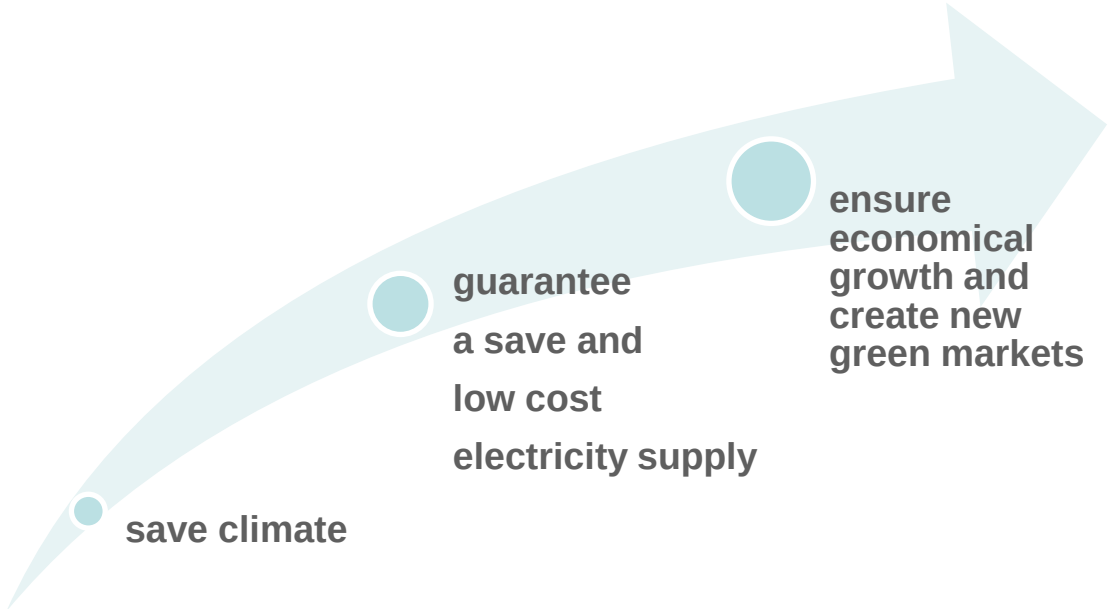
discussion

„I want to be independent of big energy companies and I want to decide wether I produce by myself, or
when, how and from whom I buy energy. „

„I want to be a creative part of the new energy system and
I want to understand it.“

?

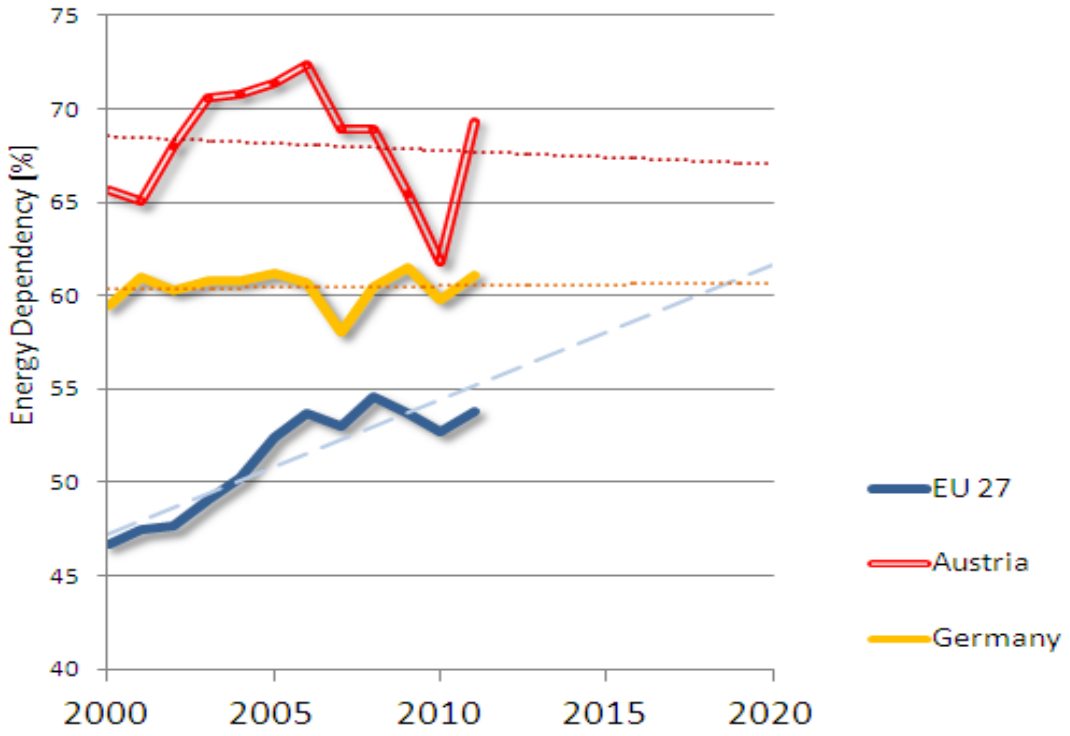
202020 Strategy and Beyond



2020 Strategy is the ignition for large scale RES integration being continued by the 2030 greenbook and the 2050 Roadmap:

- ❖ reduce emissions by at least 20 % until 2020,
- ❖ 20 % more efficiency by 2020, 50 % more efficiency by 2050,
- ❖ 20 $\%_{tot}$ RES share by 2020 = > 32 $\%_{el}$, 80 $\%_{el}$ in some countries by 2050,
- ❖ enforce sustainable ressource management,
- ❖ reduce external energy dependency significantly.

Energy Dependency Causes Geostrategic Weakness [Ref. EUROSTAT 2013].



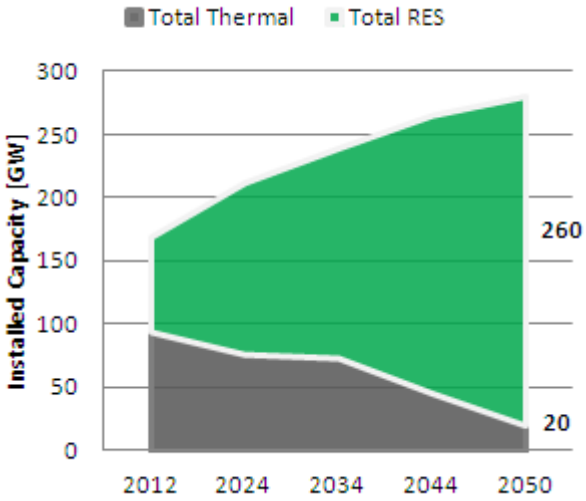
202020 strategy → EU 2030 framework → low carbon economy.

	2020	2030
GHG	-20 %	-40 %
RES_{tot}	20 %	27%
RES_{el}	32 %	45%

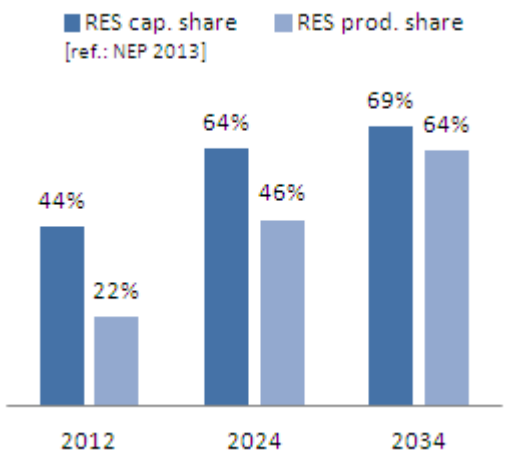
7 % Biomass, 7 % Hydro, 31% Wind/PV

Step 1:	**22 Jan 2014: Commission proposals on goals**.
Step 2:	March 2014: European Council political decision on goals (or June 2014).
Step 3:	2015: Commission drafts legislation to implement goals, spread burdens.
Step 4:	2016-17: Parliament and Council Co-Decision on legislation.
Step 5:	2018-19: National transposition where necessary.

More than 30 $\%_{el}$ RES-prod.-share long for additional flexibility steps.



Must Run > 10 GW of thermal units



Thermal production capacity to be reduced.

Must run capacity 10 – 20 GW.

Thermal flexibility to be improved.

Existing thermal plants are optimised for huge full load hours and full load operation while turndown reduces energy efficiency and drives costs.

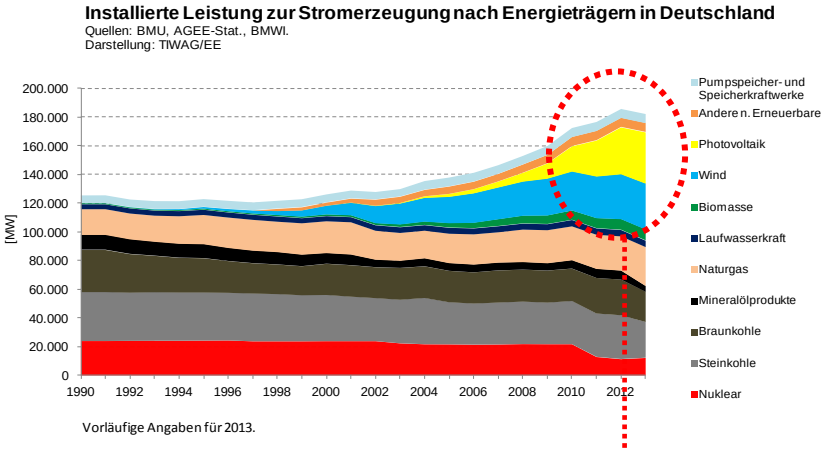
Retrofit measures will increase operational flexibility only to a certain extent.

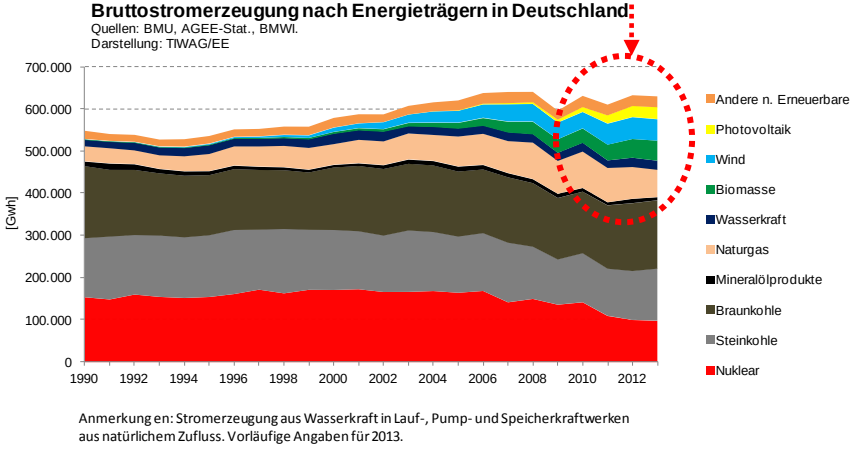
New thermal and RES plants will have more flexibility by improved technologies.

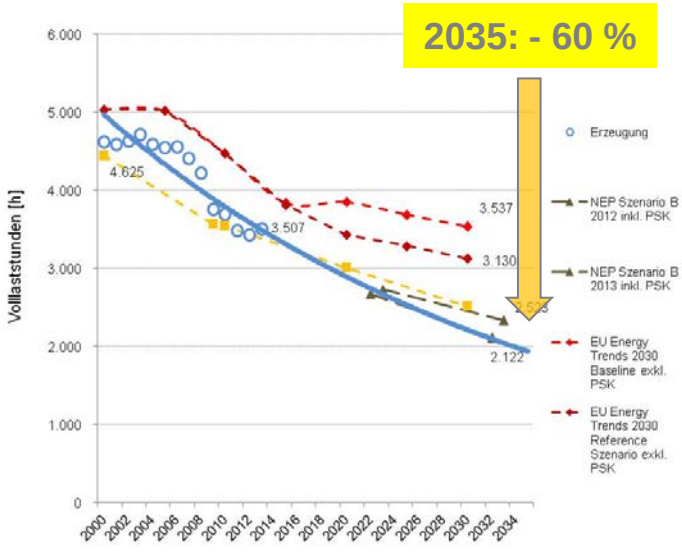
Gas power plants are expected to be the thermal backbone until 2050 and beyond.

Increasing Capacity Produces Less Electricity. Efficiency Sinking.

tiroler wasser kraft







Austria and Germany consequently follow their NREAP-path and even exceed it. Up to now national goals are met. Restrictions of thermal plants, wind and photovoltaics more and more long for flexibility measures to stabilise the system.

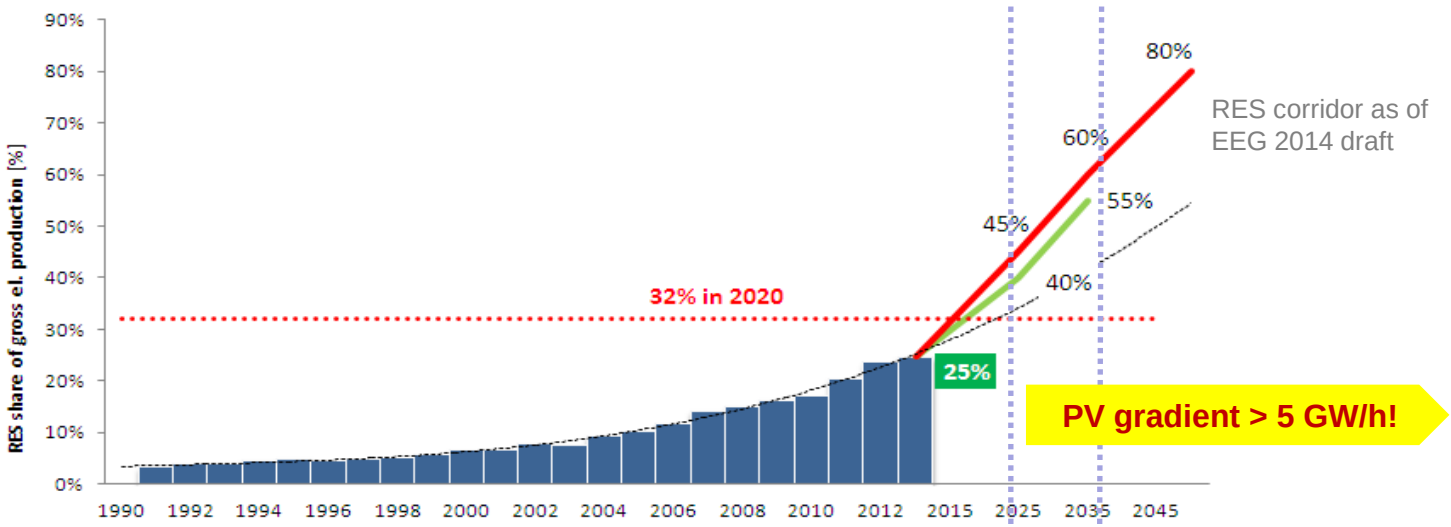
Production efficiency is being reduced significantly.

Large scale storages will be missing.

Socio Economic Benefit of Pumped Hydro Storage Is Significant.

tiroler wasser kraft

system stability	system stability, efficiency	security of supply, system stab, thermal efficiency
focus on power oriented extension of existing PHS-groups	power and capacity extension, new PHS	



PHS as precondition for RES integration

Increased PHS benefit for RES integration and thermal operation efficiency

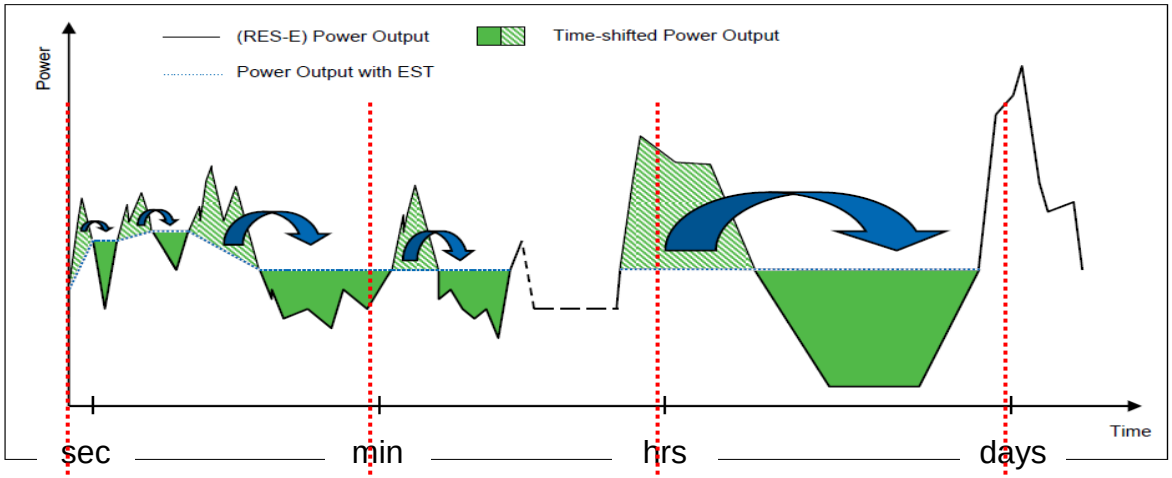
strong PHS benefit for
- RES integration,
- security of supply (long term storage),
- thermal operation efficiency

HPS is a multy utility toolbox.

	Socio Economic Welfare and RES Integration				
	System Stability			Efficiency, Security of Supply	
	redispatch	black Start	anc.Serv.: p/f- control, v/rp-control	load smoothing	seasonal energy shifting
remuneration/ market	yes	yes	yes	yes, energy only	yes, energy only
PHS	■	■	■	■	■
Power to Gas	■	■	■	■	■
CAES		■	■	■	
Batteries		■	■	■	
Flying Wheels		■	■	■	
Feed-in-Mgt.			■	■	
DSM				■	

[Ref.: TIWAG 2013]

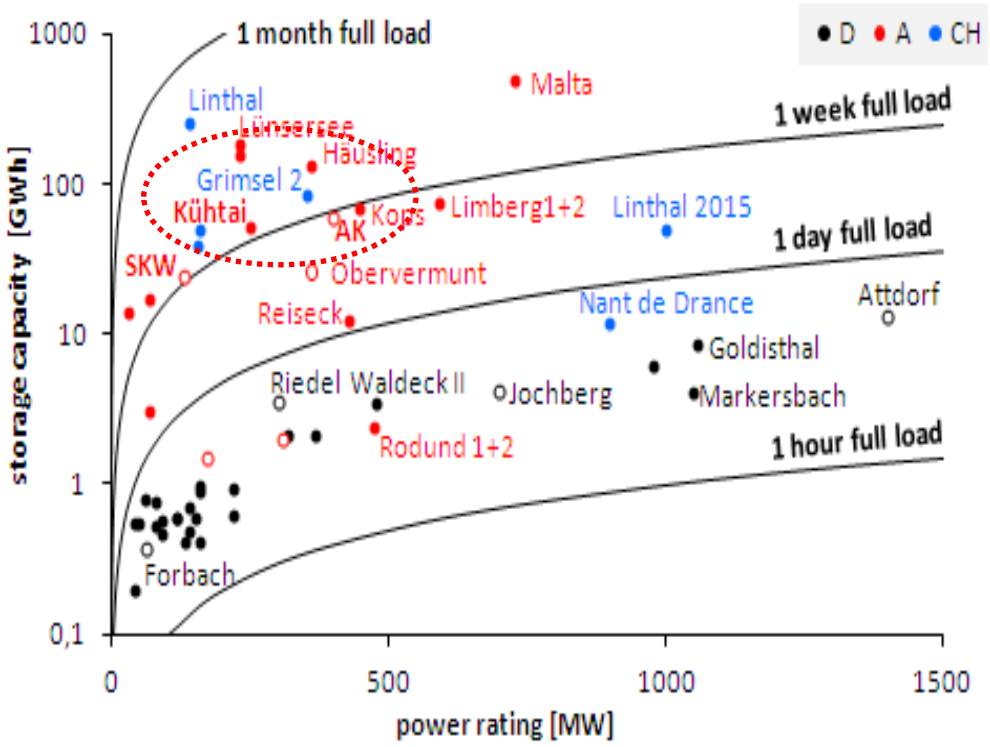
Efficient thermal production longs for efficient load smoothing.



[Ref.: www.store-project.eu, 2013]

	sec – min	min - hrs	hrs - days
pumped hydro			
power to gas			
CAES			
batteries			
flying wheels			
demand side mgt			
RES feed in mgt.			

Alpine HPS capacity to complete German daily HPS facilities.



[Ref.: EE, BES/TIWAG 2013]

The German HPS-system has short- term storage characteristics.

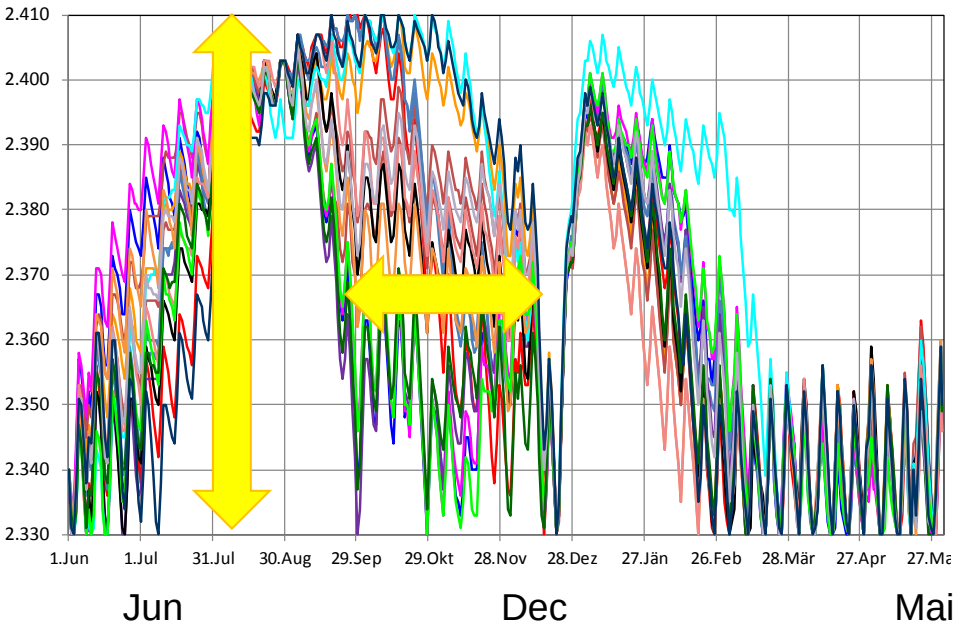
Reservoir – volumes and drop hights limit German hydro power storage facilities for short-term operation to maximum of 1 day.

All relevant strategy studies expect from 2025 on a significant increase of medium and seasonal storage when baseload capacity reduced stepwise and renewables' share will become dominant.

The challenges until 2025 can be met mainly by increased power installation (turbines and pumps) while post 2025 power and energy storage is needed urgently.

New Alpine HPS reservoirs will meet these challenges by progressive power and capacity development.

Simultaneous short-, medium- and long-term storage with alpine HPS.



[Ref.: TIWAG 2013]

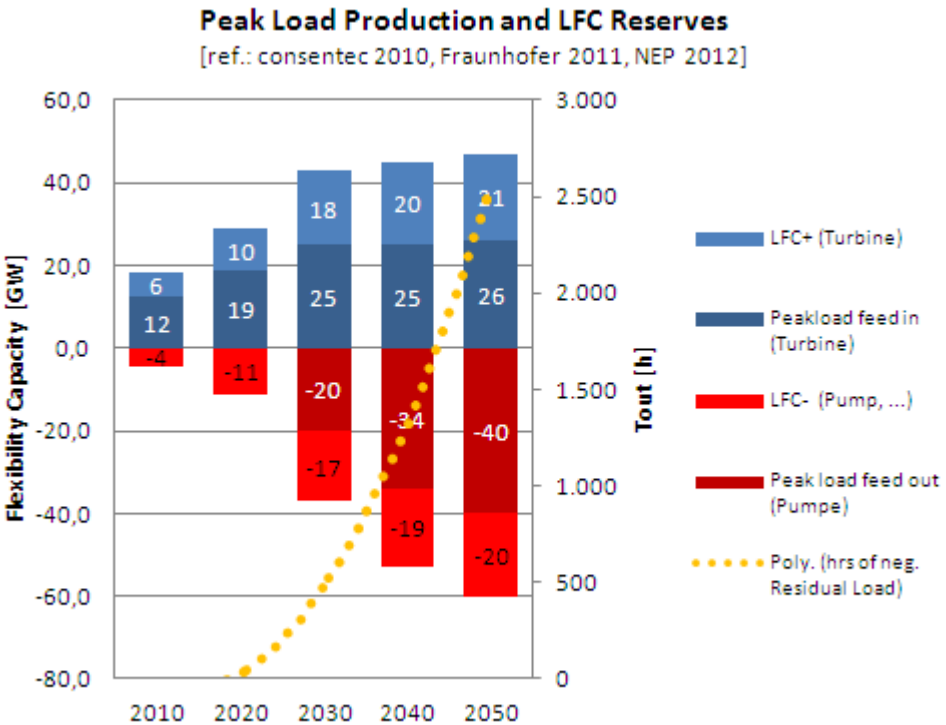
Ancillary services, residual load management and seasonal storage is the core business for HPS in the 21rst century.

- ❖ Flexible turbine and pump capacities combined with
- ❖ huge reservoir capacities/drop heights together with
- ❖ a maximum of availability

give a broadband operation-service for the entire system and thus guarantee system stability and security of supply.

Highly flexible load alternations at huge gradients meet all LFC requests simultaneously with Charging or discharging the system for short-, medium or long term shaping and seasonal energy storage.

Residual load dynamics longs for additional flexible prod. capacities.



80 % RES integration until 2050.
Significant reduction of baseload capacities.

Nuclear turn off and reduction of baseload capacities will double demand for flexible feed in capacities and multiply demand for flexible feed out capacities by factor 5.

PV gradients expected > 5 GW/h.

Offshore wind, compensation effects of geographically dispersed onshore wind and flexible RES-production may stabilise **neg. LFC** (Pumps, ...) demand at approx. – 20 GW.

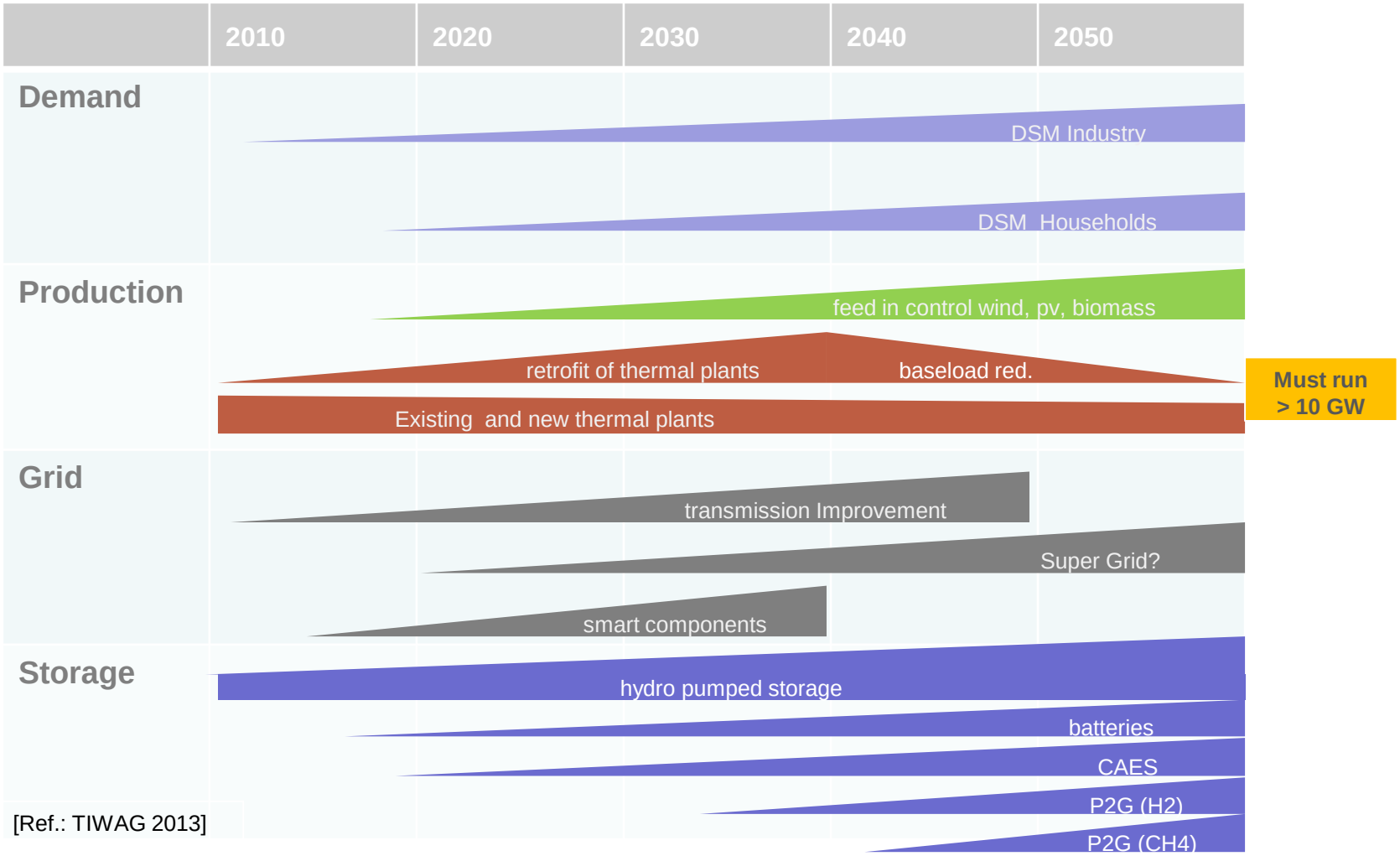
Hours with negative residual load are expected to rise from nearly 0 today to 500 in 2030 and up to 2.500 in 2050.

It will need all mature technologies in an optimised way to meet these challenges.

All technologies needed to meet the coming challenges.

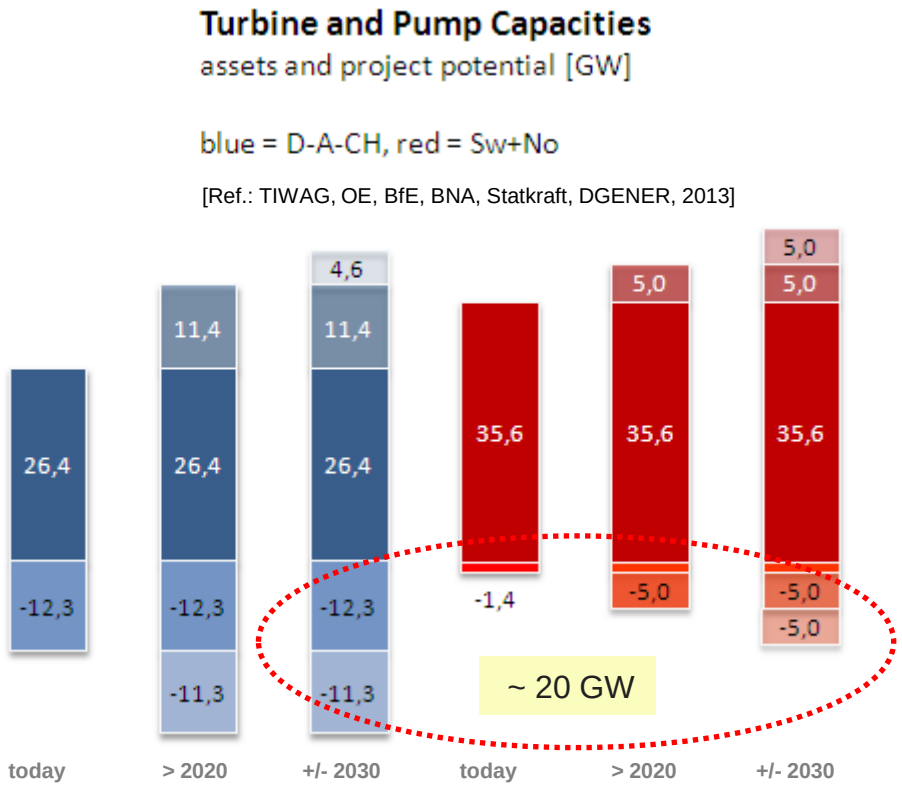
(System requirements, not technological availability)

tiroler wasser kraft



[Ref.: TIWAG 2013]

Alpine and scandinavian hydropower will meet the challenge together.



Austria's hydraulic potential is only used by 50 %.
Appr. 13.000 GWh are expected to be developed. Tirol shares 21 %.

D-A-CH together with scandinavian storage and HPS facilities will significantly help to meet the future challanges by creating win-win opportunities within the authorized potential:

- large scale RES integration
- thermal production optimisation
- system stability
- price stabilisation
- CO_2 reduction

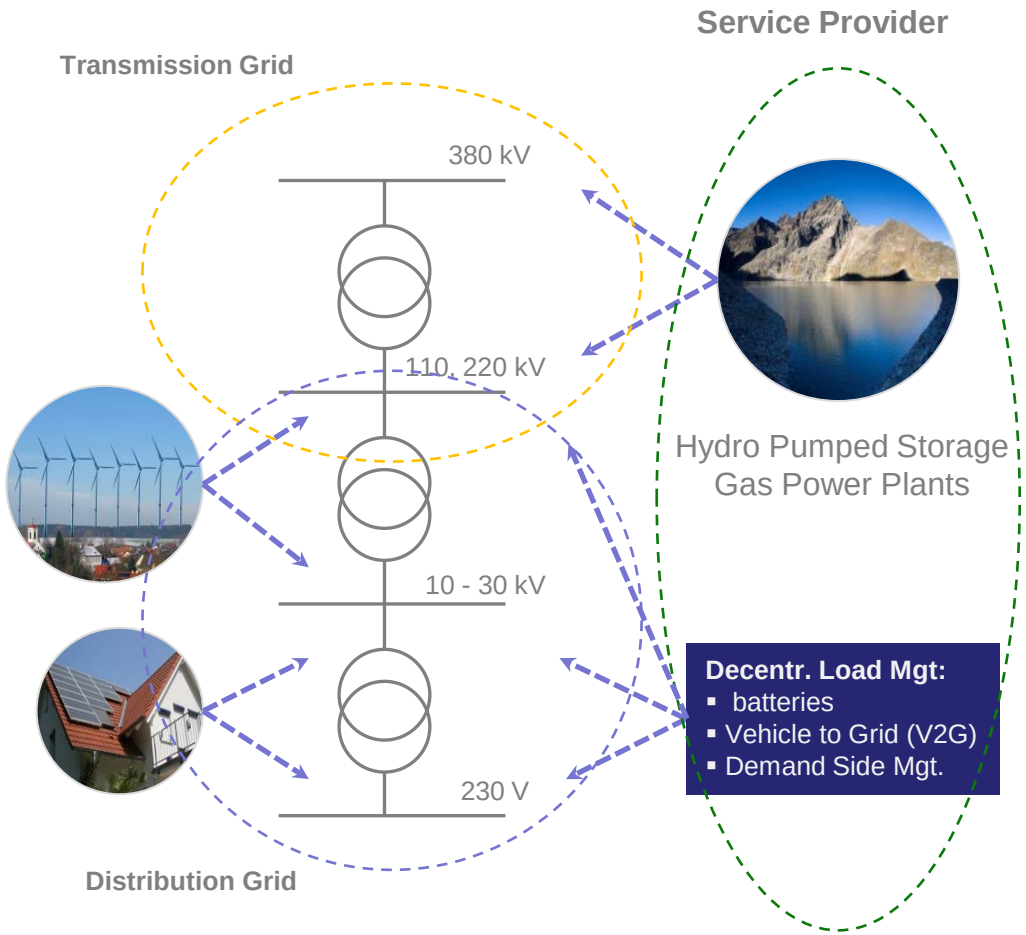
Alpine HPS benefit from strong interconnectors to the German system.

Desirable investment for European industry:

20 GW = Euro 24 billion within 15 yrs.

Individual costs depend on local conditions and operational focus.

Ancillary Services are a Market Product!



[Ref.: TIWAG 2013]

Ancillary services have to be provided market oriented also in future: independent of technology and grid-level.
Storages do not have to be part of the grid infrastructure.

Ancillary Services stabilise the system:

- voltage stabilisation
- black start ability to manage black outs
- spinning reserves
- **system balancing**
  - **load/frequency reserves**
  - long term reserves
  - backup-reserves

System flexibility issues for the 21rst century

tiroler wasser kraft

1. sufficient **power reserves** by production optimisation, weather – oriented DSM,
2. **guaranteed power availability** for defined time frames,
3. effective and efficient **RES and thermal surplus recovery,**
4. **fast power control** to meet huge residual load gradients mainly caused by PV,
5. sufficient and highly efficient **storage facilities.**

1. market oriented system services
2. power and energy oriented market design

Let’s Live a Sustainable Future!

tiroler wasser kraft

Thanks for your kind attention!

Dr. Peter Bauhofer
Leiter Abt. Energiestrategie und Energieeffizienz

++43 699 1257 2511
peter.bauhofer@tiwag.at