



Una transizione rinnovabile in Italia e' POSSIBILE?

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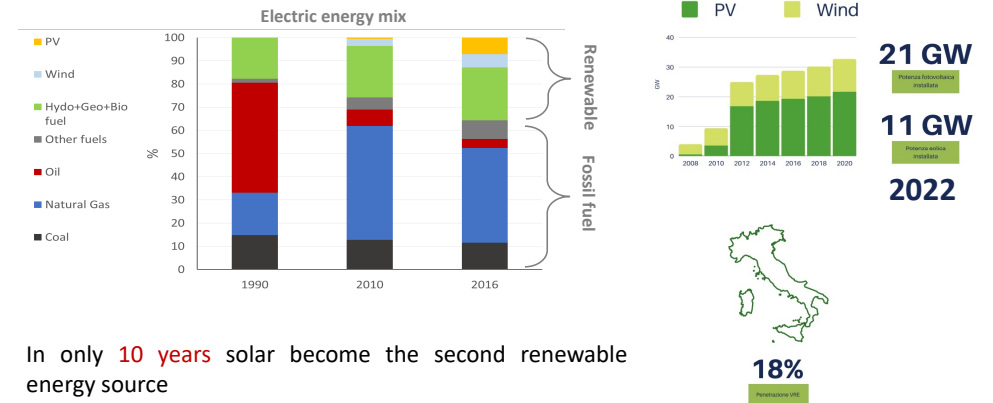
We need a communist approach to solar!

#ARipetizione. La scuola di Politica di Possibile

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In Italy, the electric mix in **20 years** moved towards renewable energy sources (**40%**) and Oil products consumption for thermoelectric generation almost disappear

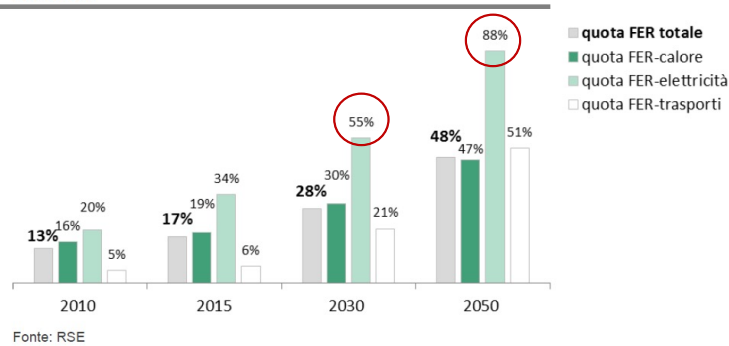


In only **10 years** solar become the second renewable energy source

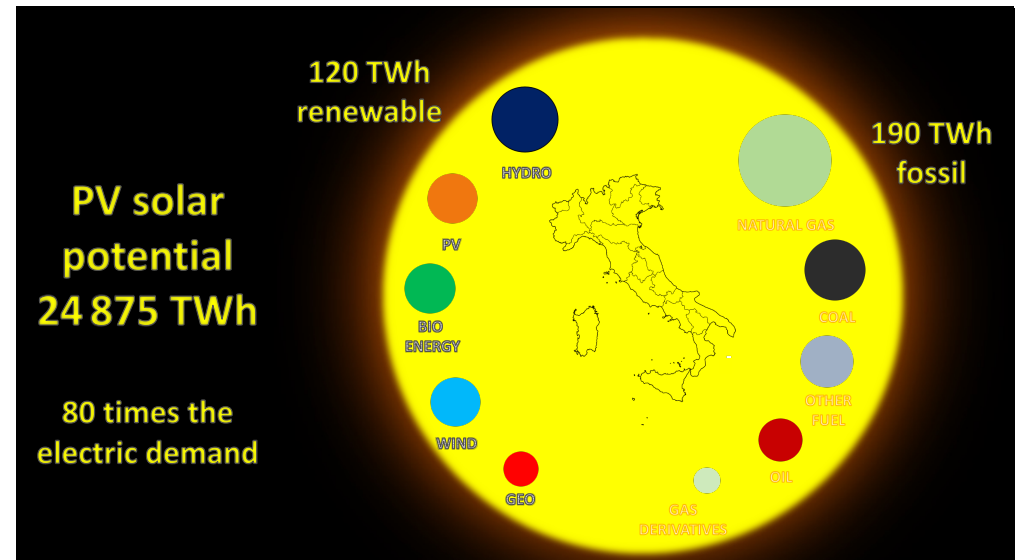
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Figura 13 Proiezione dello scenario SEN al 2050: quota FER secondo direttiva 28/2009/CE



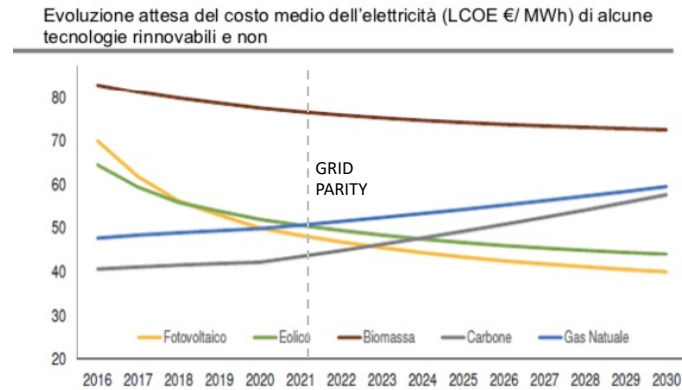
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Variable Renewable Energy (solar and wind) are the cheapest sources of electricity after carbon



Fonte: Assoelettrica – aprile 2017

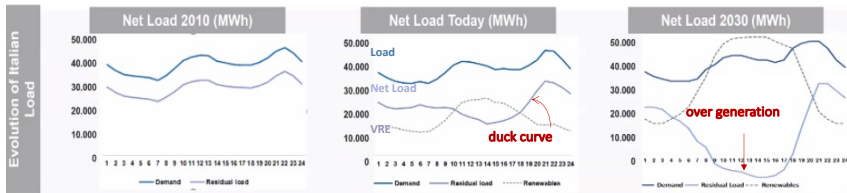
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Intermittency of solar resource implies:

1. Increasing steepness of residual load ramps ("duck curve")
2. Growing periods of overgeneration at noon hours

In the next years we will observe a completely different net load and during the central part of the day a **RES overgeneration**. Instead during the peak evening we will observe a huge ramp of the net load. The electric system needs a different mix of generation plants with more flexibility (OCGT, storage, demand respond).



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For these reasons **Variable Renewable Energy** (solar and wind) will get the lion's share of the CO2 reduction targets and carbon phase-out.

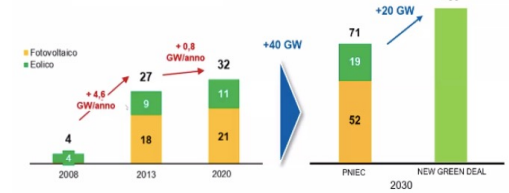
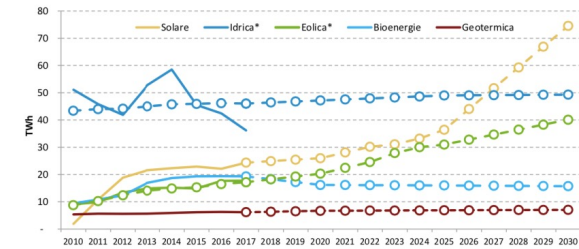


Figura 11 – Traiettorie di crescita dell'energia elettrica da fonti rinnovabili al 2030 [Fonte: GSE e RSE]



* Per la produzione da fonte idrica ed eolica si riporta, per gli anni 2010 -2017, sia il dato effettivo (riga continua), sia il dato normalizzato, secondo le regole fissate dalla Direttiva 2009/28/CE. Per i bioliquidi (inclusi nelle bioenergie insieme alle biomasse solide e al biogas) si riporta solo il contributo dei bioliquidi sostenibili.

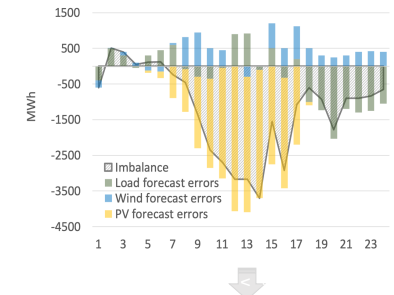
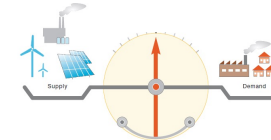
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Variability of wind/solar resource implies:

Residual electric demand becomes dependent on the solar/wind **stochastic variability**, thus it is more difficult to predict

the **imbalance** between residual demand and predicted dispatchable generation (Net-load forecast) and its related cost will grow



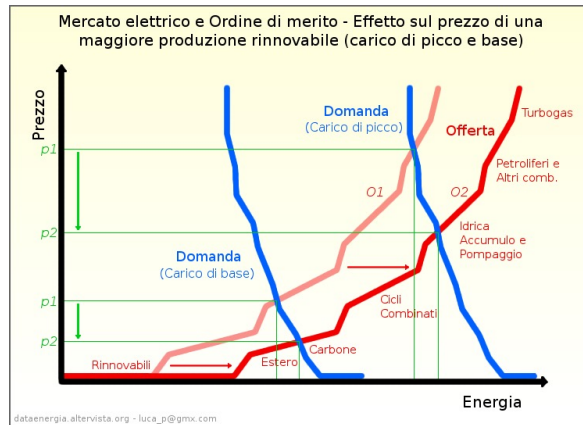
INCREASE OF REGULATION SERVICES



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RES impacts on day-ahead/intra-day energy market

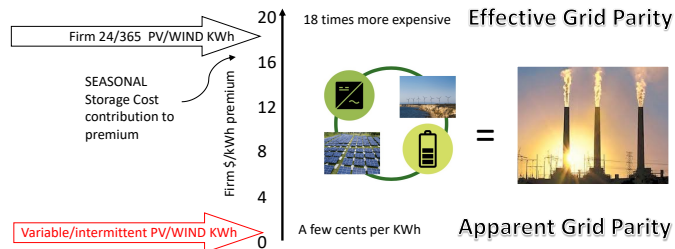
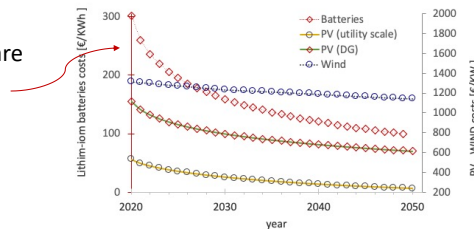
1. RES reduces the zonal DA/ID energy price. This effect is called Merit Order effect (MOE)
2. Prices of RES are linked to Natural Gas price (marginal price).
3. Overgeneration produces zero or negative energy prices



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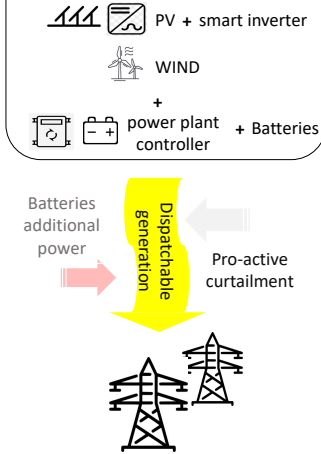
It seems simple
but the cost of the batteries are
very high even with in future



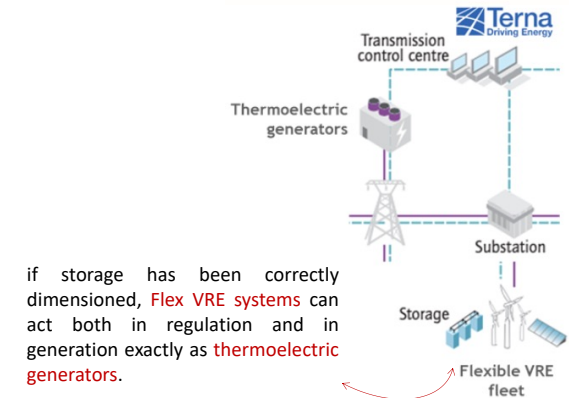
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FLEXIBLE VRE SYSTEMS



The **solution** is turn VRE systems into **FLEXIBLE** plants
able to provide **dispatchable** generation



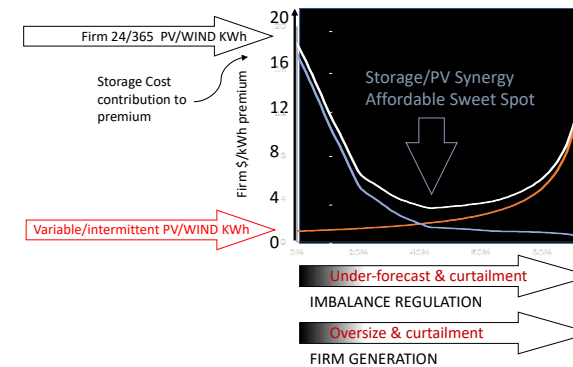
if storage has been correctly
dimensioned, **Flex VRE systems** can
act both in regulation and in
generation exactly as **thermoelectric
generators**.

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But there is a solution: **CURTAILMENT** VRE GENERATION IS MUCH **CHEAPER** THAN **STORAGE**
therefore

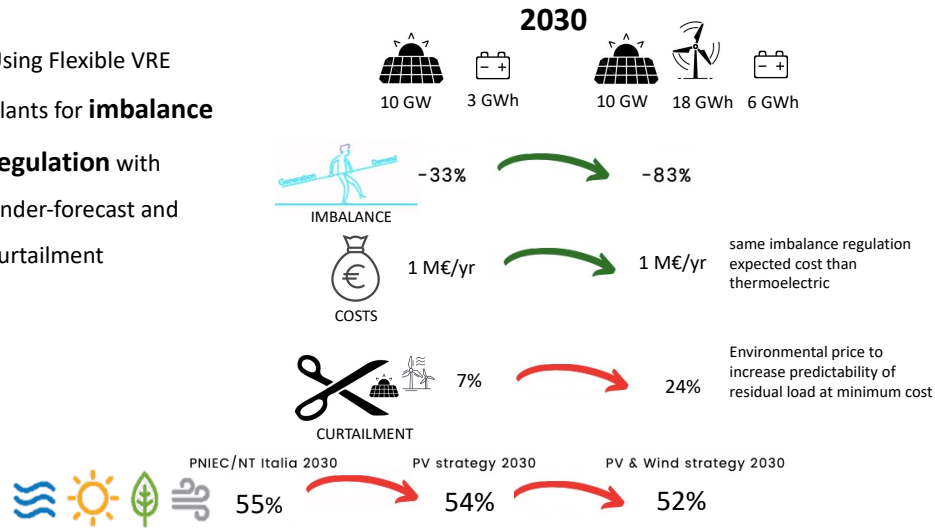
1. For **regulation**, Terna can under-forecast the VRE generation and then curtail the production to meet the forecast
2. For **Firm VRE generation** it is possible to oversize VRE and then Terna can curtail the production to meet the demand





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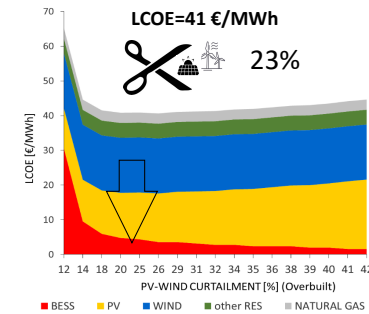
Using Flexible VRE
plants for **imbalance**
regulation with
under-forecast and
curtailment



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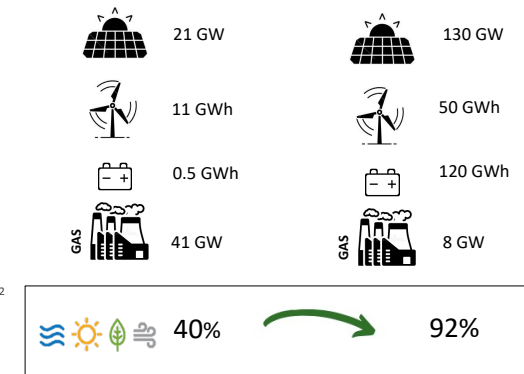
By **2050**, turnkey **utility-scale PV** costs are expected to be at **€ 350** and **batteries** at **€ 90 per kWh**. At this point, applying flexible PV and wind plants for firm 24/365 power generation will be economically feasible.

Firm VRE generation 24/365
(remove the intermittency)



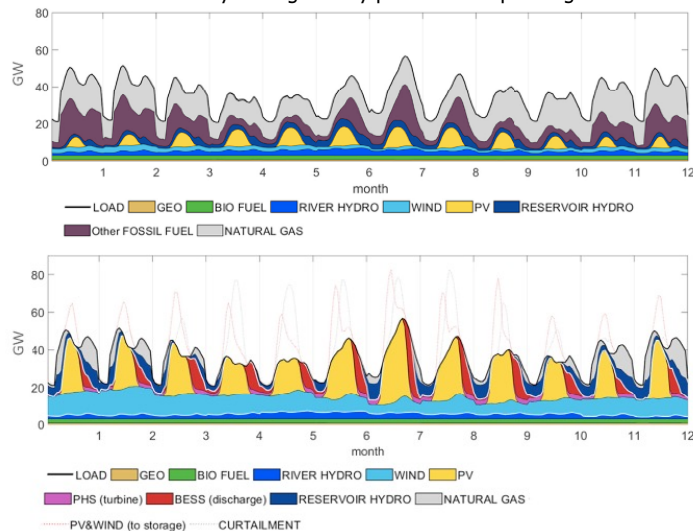
2020

2050



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Monthly averaged daily profile of the power generation



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it seems too much the solar and wind power that will have to be installed?



105 GW

RICHIESTE DI
CONNESSIONE A
TERNA

+70 GW

FONTI
RINNOVABILI AL
2030 - PNIEC

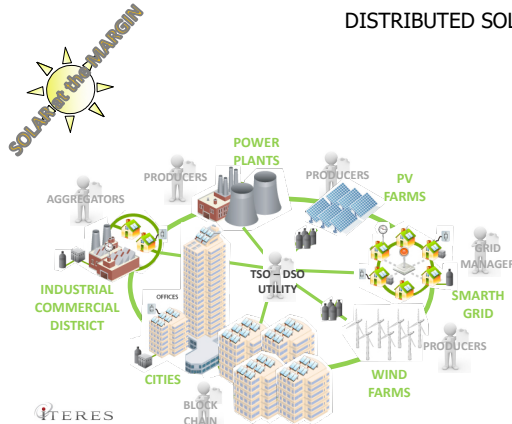
In contrast, we do not yet have
any flexible VRE facilities
that are the **backbone** of the
RE transition

New
connections
RES plant

- More than **95.000 MW** of new requests of connection of RES power plants to the transmission grid and other 10.000 MW new requests of connection to the DSOs grid
- Most of the new RES power plants (**utility scale**) are located in the South of Italy and the Islands.

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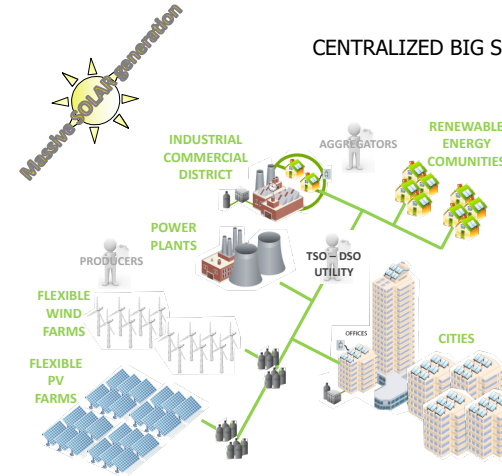
DISTRIBUTED SOLAR GRID



- ✓ High solar integration
- ✓ Low distribution loss
- ✓ Difficulties in O&M
- ✓ Complex system with many actors
- ✓ Intermit PV generation
- ✓ Grid management problems for TSO-DSO
- ✓ Not enough space for massive solar generation in cities
- ✓ High PV costs (not for all)

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CENTRALIZED BIG SOLAR/WIND GRID



- ✓ High solar visual impact
- ✓ High distribution loss
- ✓ Optimal performance and O&M
- ✓ Simple system with few actors
- ✓ Centralize TSO-DSO Grid management and no radical grid change
- ✓ Very lower PV and storage costs
- ✓ Solar availability for all

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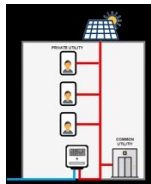


YES but

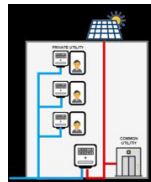
how turn all the distributed solar systems into flexible plants under the control of the TSO?

INSTRUMENTS ARE ON THE TABLE
we just have to use it in the correct way

physical connection



virtual connection

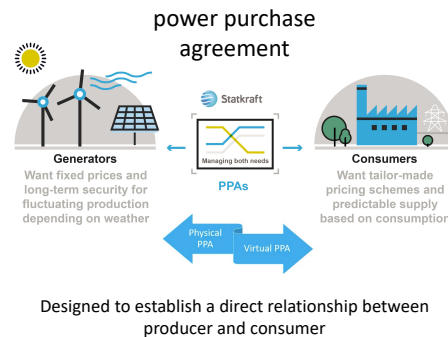


Renewable Energy
Community



Designed to maximize
community
self-consumption
and reduce energy costs

+



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1. Flexible plant could be easily large enough to provide the whole firm generation required to fulfill the entire community demand

2. Flexible plant is under control of the transmission system operator that dispatch or curtail the extra production according to the regional needed

3. Win-win economic strategy:

- The producer sells energy to the FREC at a higher price than the energy market.
- Consumers buy energy at a lower price than their billed costs.

Government should start immediately to promote **Fully RECs**

