Solar Thermal Electricity at the heart of the energy transition
How could the Netherlands benefit?

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ANOTHER LOOK ON ENERGY TRANSITION

The first priority for all Europe is to get back to growth and jobs for Europeans.
EU-made growth is achievable to a large extent as "**green growth**", based on an energy supply model designed as the **most efficient combination of renewable sources. This will deliver reliability and affordability** of a system, in which a **centralized bulk energy supply to energy intensive industries will coexist with decentralized generation serving mostly local demand and "circular" or "participative" economy sectors**.

The energy transition towards renewables is an **irreversible** process, even if the pace of this transition will vary from country to country. It might of course also be accelerated or delayed by price swings on raw materials and fossil fuels.

ALWAYS KEEPING IN MIND…

Energy investments need time

→ from any decision to implementation,

→ effects on the system (rebalancing a generation portfolio)

→ effects on technology costs get real (effects of scale and bankability of innovation)

→ until behaviour and interest of users (prosumers/consumers), also voters .. change

The metrics is at best a decade.

- This means that longer-term planning is key.
- This means that the **value** of energy transition has several dimensions

THE VALUE OF ENERGY TRANSMISSION IS 3-FOLD

- **business** (cost/return ratio) value leading to concepts such as primary **affordability**,
- **macro-economic** value (GDP metrics, up into "social welfare" understood as the well-being of the entire society, including the quality of life, quality of the environment (air, soil, water), availability of essential social services, even religious and spiritual aspects of life.
- both together means a **political** value:
- The energy transition is already now an instrument for policy makers to offer their voters an active role in modelling their own future: the citizen has suddenly a "real say" about how and when his energy needs shall be covered

THE KEY ISSUE IS SYSTEM RESPONSIBILITY. WHICH ONE?

- Although energy policy remains across EU a national competence, progress has been made towards integration of the European power system: **the European power system is today a physical entity (more than a single market) where any structural unbalance or any abrupt supply disruption in a given country impacts all participating countries in the system. This is the story about „grid integration“ of (VARIABLE!!!) renewables**
- Countries in Europe claiming they can manage penetration levels of intermittent generation “of nearly 100%” are either exporting system stability issues to their neigh-bors or manage such situations over short periods (sunny or windy weekends).
- **This means that the reliability of the European power system can no longer be managed at national level**

THE GOOD THINGS…

- In this context, the supra regional system responsibility (i.e. the task of real-time balancing generation and demand) in todays power systems is to stay as the core task of TSOs.
- In order to manage intermittency of more generation sources, it will need to be increasingly coordinated with DSOs and new agents (independent power producers, “prosumers”, etc..).

But someone MUST take responsibility.. Both for the system operation and the market design, correcting what no market will deliver a full-value approach of investments that leads to a **better balanced ratio between generation investments in intermittent and non-intermittent sources.**

THE LESS GOOD THINGS…

- **Energy regulators** are said to defend the **interests** of consumers. Doing so, they have been following since the setup of ACER mainly a "technology-neutral", "market-fits-all-issues" policy.
- However, energy markets that are today largely financial markets cannot (by essence) and will not cover all value aspects.
- Current market mechanisms alone do not ensure that generators in the power system are remunerated for their effective contribution to system responsibility, do not take into account externalized societal costs such as industrialization effects, business opportunities, health effects, dismantling costs, etc...
- It tackles only the short-term affordability and completely misses the strategic and political values of the energy transition.

WHERE IS THE MAIN THREAT TO THE ENERGY TRANSITION

- Regarding Europe, the combined effects of the demand stagnation, the expected effects of energy efficiency targets, the “only-27%” targets for RES by 2030, the substantial current overcapacities on the European power market as well as urgently needed market design adjustments may soon put the whole energy transition at threat.
- The same market forces that have triggered and will further trigger the deployment of intermittent technologies up to current system penetration levels and brought down by effects of scale the costs of intermittent technologies) will soon find a poor return on any further RES investment – whatever the technology. There will be no more value for intermittent power injected in the same timeframes into saturated systems and also no need for non-intermittent power to facilitate on a CO2-free basis the further transition steps to decarbonization.

WE HAVE THE CHOICE AMONG 3 SCENARII

1. EU ends with a system with approx. 30% of renewables that a still fossil-fuel based system can more or less cope with, without incentive to go further. Coal, oil and gas industries will come back on stage and . . . citizens will pay also with their health

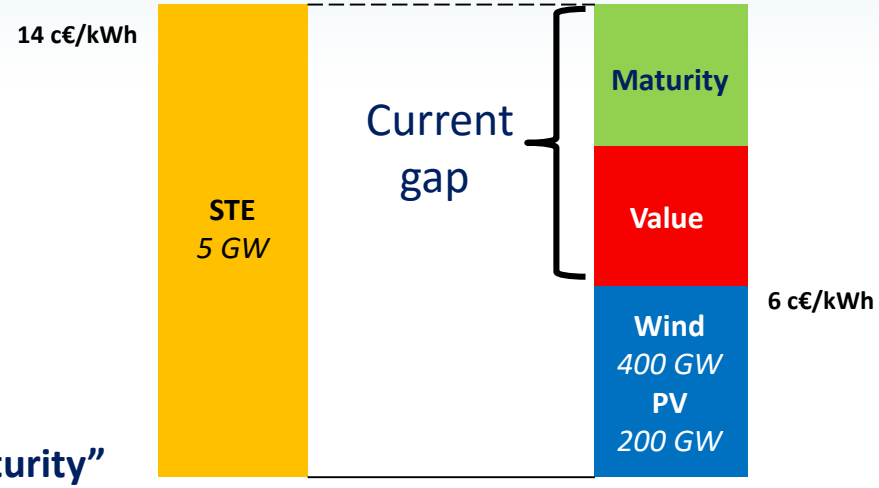
2. Both system operators and the demand side will sooner or later call for a new clean and cost efficient balance between intermittent and non-intermittent generation sources. Dispatchable generation will reach **extreme price peaks** due to not timely investments and the resulting scarcity; the energy transition will come to a hold – possibly inverting the energy transition back into fossil fuels.

THE BETTER SCENARIO

- A smooth European energy transition built on a balanced technology mix building on non-intermittent generation technologies incorporating commercially proven bulk storage solutions is of course possible
- However, these should be built now so to be available in larger volumes and at much lower costs demonstrating thus to the world the complementarity of technologies for a common objective: full decarbonization. Natural gas may be to a certain extent further used to increase firmness of deliveries.
- Last, but not least, competitors of EU industries – acting under fully different business conditions and in many cases with aggressive state-aid – are watching Europe policies and will no doubt take advantage of any hesitation or inconsistency in Europe affecting the ability of Member States to work together

THE BIG QUESTION MARK

Onshore Wind and PV have reached already competitive cost levels. Is it still worth continuing to support the STE technology?



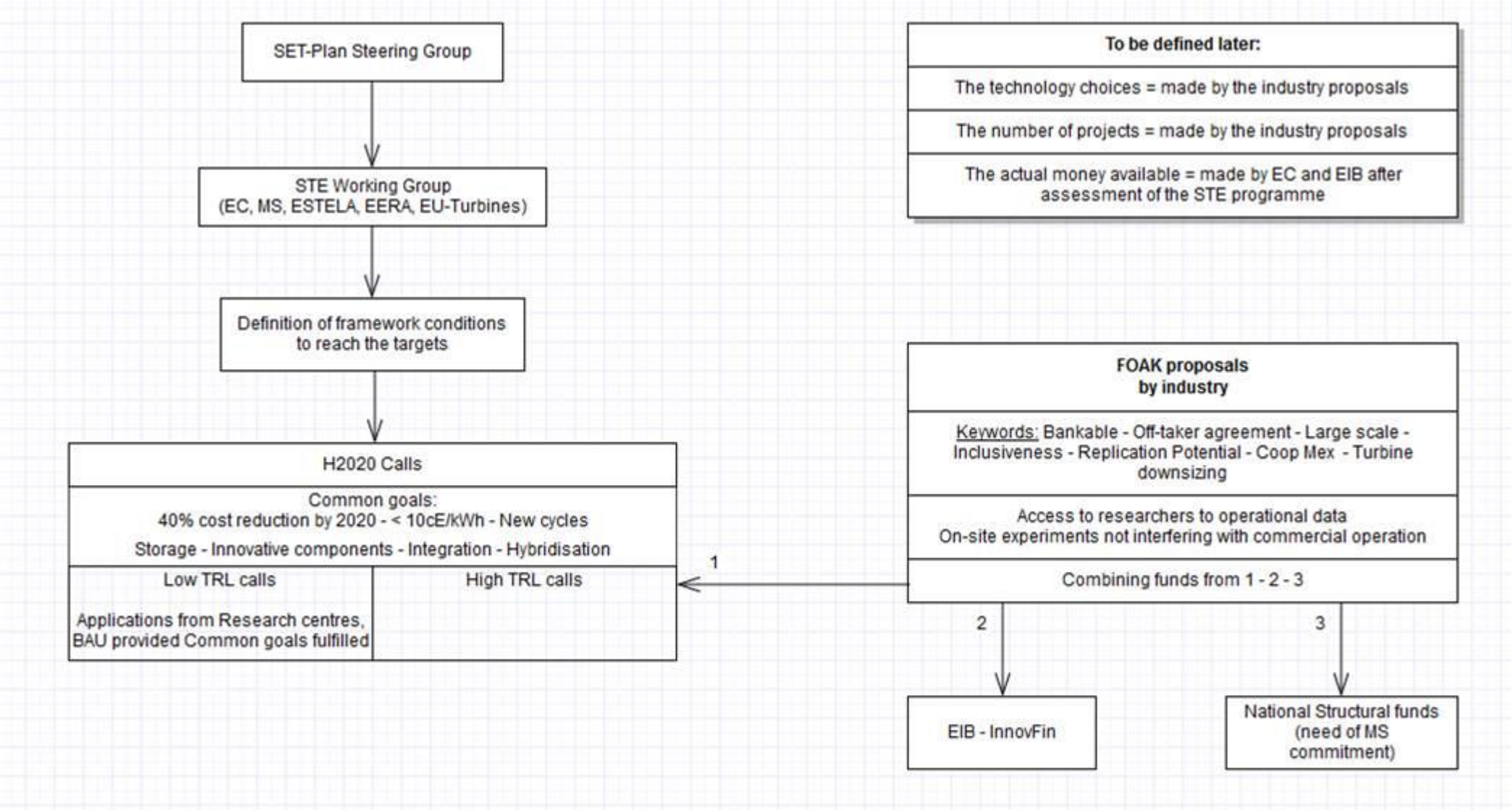
about "maturity"

✓ The PPAs for the two recently awarded STE plants in Morocco Noor 2 & 3 (200 MW PT & 150 MW T) were 15% lower than the previous one for Noor 1 awarded 2 years ago.

✓ A 110 MW STE plant with 17,5 hours of storage, partly hybridized with PV, was recently selected in Chile with a PPA of $110/MWh, in competition with all other generation technologies including Gas Combined Cycle.

✓ The tariff for the current "Expedited round" in South Africa is 20% less than the previous one for Round 3 established 18 months ago.

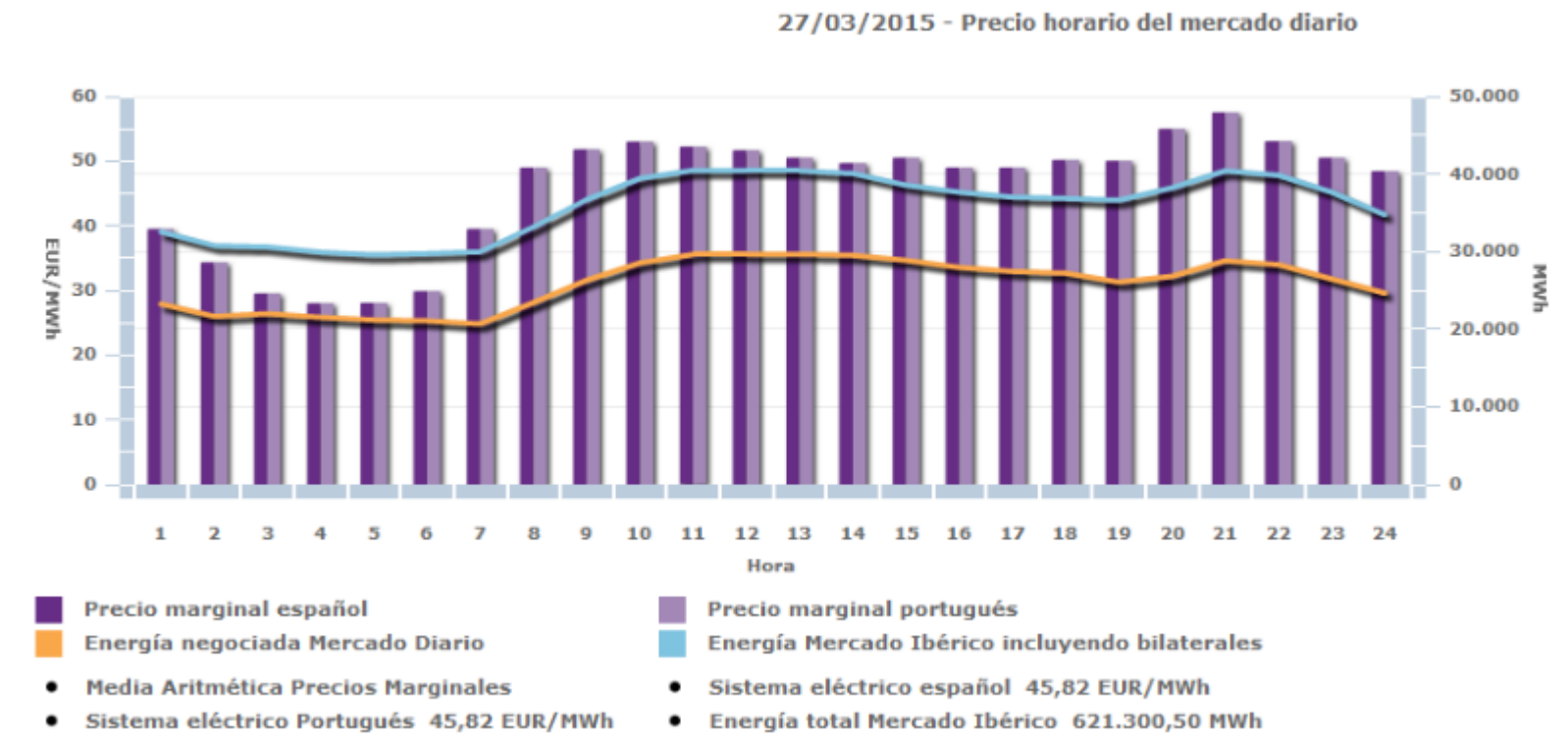
THE SET-PLAN INITIATIVE FOR STE



RATIONALE FOR A „FOAK PROPOSAL“ BY THE INDUSTRY (1)

In all the European countries, we observe a value systematically higher than the pool value in the peak period (afternoon-night) that is usually between 10 and 40% higher than the average daily price.

Example Spain 27/3/2015. Average 45,82, Max. 57,55, Dif. 25,6%



RATIONALE FOR A „FOAK PROPOSAL“ BY THE INDUSTRY (2)

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VALUE OF SOLAR POWER ACCORDING TO RES PENETRATION SHARE

Example for 33% and 40% RE shares in California (NREL, May 2014)

	33% renewables		40% renewables	
Value component	**STE with storage value (USD/MWh)**	**PV Value (USD/MWh)**	**STE with storage value (USD/MWh)**	**PV Value (USD/MWh)**
Operational	46.6	31.9	46.2	29.8
Capacity	47.9-60.8	15.2-26.3	49.8-63.1	2.4-17.6
Total	94.6-107	47.1-58.2	96.0-109	32.2-47.4

Conclusion:

It is equivalent for the total cost of the system to pay 50 to PV than 100 to STE

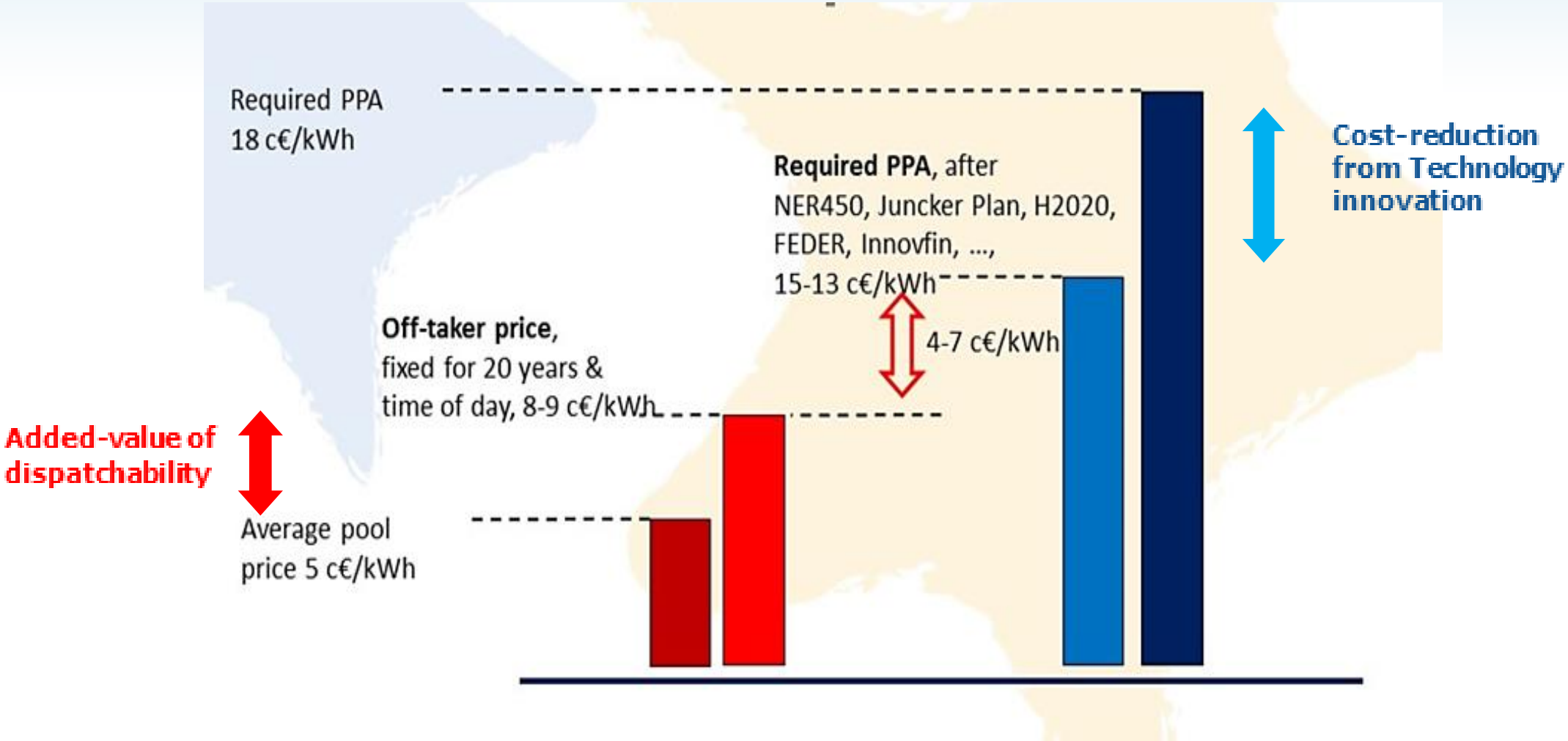
- **What does operational value means:**

  Operational value represents the avoided costs of conventional generation at their respective dispatching times along with related ancillary services costs, such as spinning reserve, etc. Savings on emission costs are also accounted

- **What does capacity value means:**

  Capacity value reflects the ability to avoid the costs of building new conventional generation in response to growing energy demands or plant retirements

RATIONALE FOR A „FOAK PROPOSAL“ BY THE INDUSTRY (3)



COOPERATION MECHANISMS (RES DIR 2009/28/EC)

The EU Renewable Energy Directive 2009/28/EC sets the legal framework for the use of cooperation mechanisms with binding national renewable energy sources (RES) targets for EU Member States for 2020.. **4 types of cooperation mechanisms provide for different levels of cooperation between countries:**

- **Statistical transfer (Article 6):** Renewable energy (electricity, heat or transport energy) which has been produced in one Member State is virtually transferred to the RES statistics of another Member State, counting towards the national RES target of that Member State.
- **Joint projects between Member States (Article 7):** RES electricity or heat projects are developed under framework conditions jointly set by two or more Member States; the involved Member States define which share of the energy production counts towards which Member State's target.
- **Joint support schemes (Article 11):** Member States merge or coordinate (parts of) their RES support schemes and jointly define how the renewable energy produced is allocated to their national targets.
- **Joint projects with third countries (Article 9):** Joint projects can also be implemented between Member States and third countries i.e. countries outside the EU. A precondition is that an amount of electricity that equals the electricity amount generated from RES and subject to this joint project is physically imported into the EU.

Thank you for your attention!

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BACKUP SLIDES

GLOBAL GROSS POWER GENERATION CAPACITY ADDITIONS, 2010–30 (GW)

Bloomberg NEW ENERGY FINANCE

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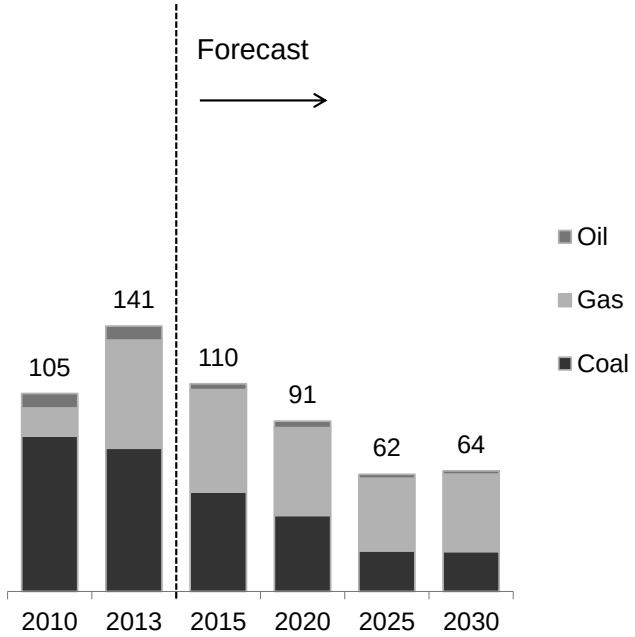
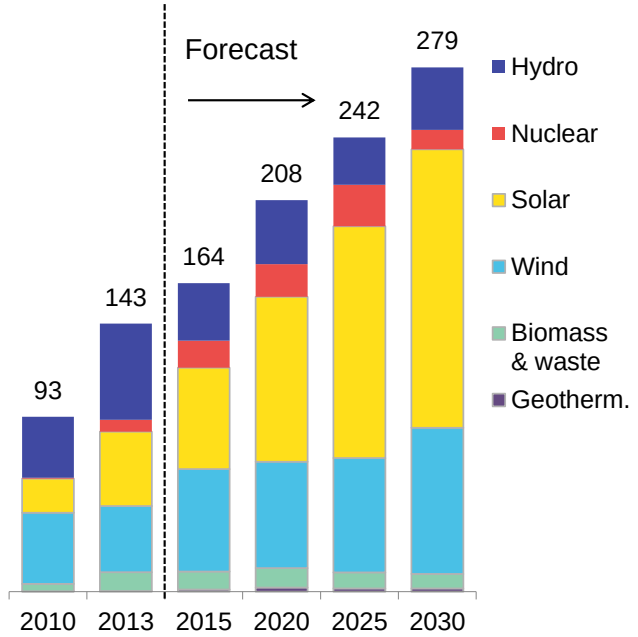
FOSSIL FUEL



Note: Underlying data is from GREMO 2014

CLEAN ENERGY



Source: Bloomberg New Energy Finance

RES technologies account for most of the new capacity additions in the last years at world level and this trend will increase exponentially in the near future

- Who can ever promote – on a pure commercial basis - a new coal, gas combined cycle or nuclear power plant in most of the countries in the world?
- Which financing organization could take the risk of uncertain carbon taxes or even strong operational restrictions during the payback time of the loans?

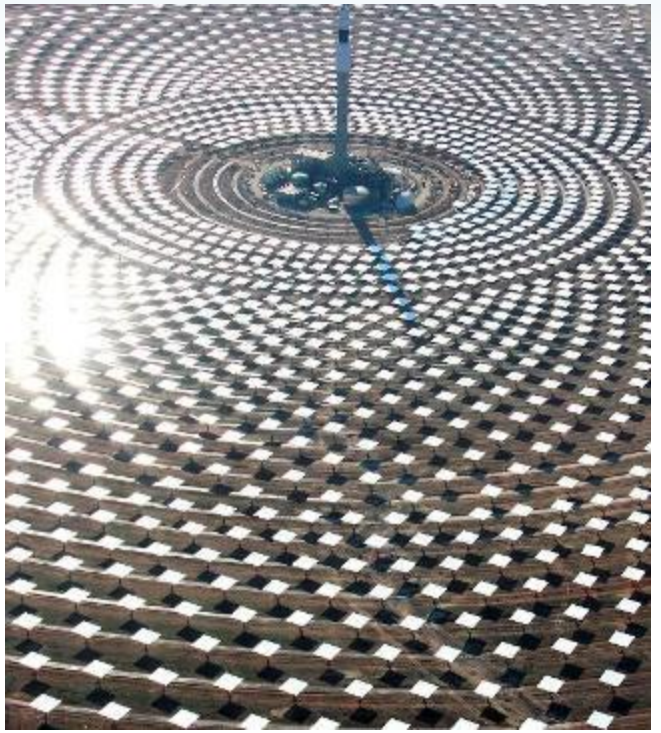
Therefore RES will in the future rarely compete with conventional power plants …

Proposal: A STE-Flagship project in Southern Europe

Illustrative estimations, depending on the support framework and on the project final specifications (to be defined with the off-takers)

For example, a tower STE plant with molten salt receiver:

- Capacity: 100 MW with 4h of storage
- Localisation: To be defined
- Energy cost: 12-14 c€ (taking into account European structural funds and Horizon 2020 support)
- Off-taker: Trading company from a central European country to determine. Possibility to consider buying contracts of 2 or more companies from the same or different countries.
- Profile of the dispatch: 80% of the production in hours of higher pool price, or to support the electric system when it goes up.



Jobs that would be generated by the STE flagship project

- 5000 jobs year equivalent for a 1-year period along all the phases of the project (promotion, engineering, manufacturing and construction)

- 50 direct jobs per year during all the operational life of the plant

Macroeconomic impact references from plants built in Extremadura

- Between 400 y 600 persons on site during the 24 months of the construction phase
- Great impact in hotel business, restoration, transports and many other services
- Contribution to the economic convergence of the CC.AA. with a significant impact in its PIB.
- Local taxes improving the life quality of the population.

ORIGIN AND DESTINATION OF THE POWER PRODUCED

Location of the plant:

There are places **for example** in Spain Extremadura with projects at promotion stage totalling a capacity of circa 5 GW. In many cases, it is about 2 or more plants of 50 MW at the same place, making it very easy to select quickly an appropriate place.

Receiving country or countries:

The receiving country or countries (it will be possible to set up several off-takers' contracts) will record the production in view of complying with the 2020 objectives, will contribute to support the production to place the off-taker's contract in competitive conditions.

The meaning of such project for Europe

- ❑ Demonstrates the viability and true value of the cooperation mechanisms set up in the Directive.
- ❑ Supports the future power generation sources where it makes more sense to boost technological innovation and achieve a fast cost reduction.
- ❑ Constitutes a real example reinforcing arguments in favour of the IEM electricity internal market and of the increase of interconnection capacity.
- ❑ Contributes to maintain the leadership of the European industry first withtin a domestic market providing the best references to be successful on export markets.

DG Research and ESTELA are analysing the possibility to set up a contract (PPP-type o similar) to support the “Solar European Industry Initiative” of the SET Plan, that includes as first objective the construction of a “first of its kind” STE plant under the frame and mechanisms described in the RES Directive.

Other possibilities to explore

- Article 9 of the RES directive allows also to fulfil the binding RES objectives for 2020 through physical import of electricity from North Africa.
- The World Bank has expressed on different occasions its interest in supporting STE projects that could integrally or partially share their generation capacity with central European countries. MASEN would also be open to explore deployments in its territory beyond the Moroccan Solar Plan.
- An industrial plan in this respect would have a great economic impact and an inestimable political value in a period where Europe has to demonstrate with facts its involvement in the political modernisation of those countries.
- Spain being a country of transit on top of having in STE the technological leadership, could reap many benefits. Thanks to the functioning rules of the European power market, allowing additional generation capacity in STE in Spain in times of generation surpluses would not be a matter of concern since the exportation of this energy could be garanteed.

WHAT IS ESTELA?

ESTELA is the **Euro-Mediterranean STE Industry Association** supporting the deployment of the solar thermal electricity industry for the deployment of green power in Europe and abroad, mainly in the Mediterranean region

ESTELA involves and is **open to all main actors in the Euro-Med zone**: promoters, developers, manufacturers, utilities, engineering companies, research institutions

ESTELA is building a **global cooperation platform with AUSTELA, SASTELA, MESIA, CSP Alliance as well as the Chinese industry** to bundle forces for addressing political target groups. The name of this platform will be STELA-World

INDUSTRY, INNOVATION AND RESEARCH

ESTELA directly participates **in 5 EU projects** (EU-SOLARIS, STAGE-STE, SFERA II, KNOWRES and Solar CV) with the main role to be the interface between industry and R&I.

Most recently, in the framework the SET-Plan, **EERA, ESTELA and EUTurbines presented together to EU member states their most important targets related to CSP.**

These targets were endorsed by Member states and EU services will now work closer with ESTELA to support the implementation of these targets.