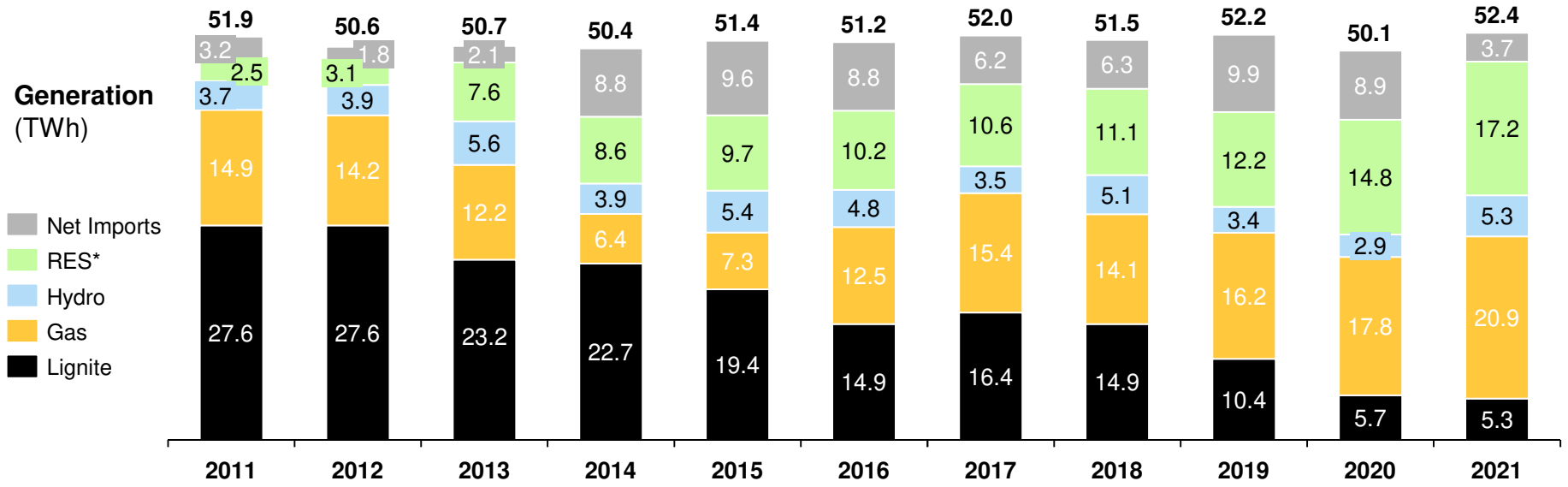
The Greek RES Market
The necessity of energy Storage and the potential role of Hydrogen

Dr. Sotiris Kapellos

President of the Energy Committee

Natural Gas covers the majority of thermal demand
Lignite is decreasing
RES volume (incl. Hydro) has surpassed NG generation

Energy mix evolution (Interconnected System) | 2011-2021



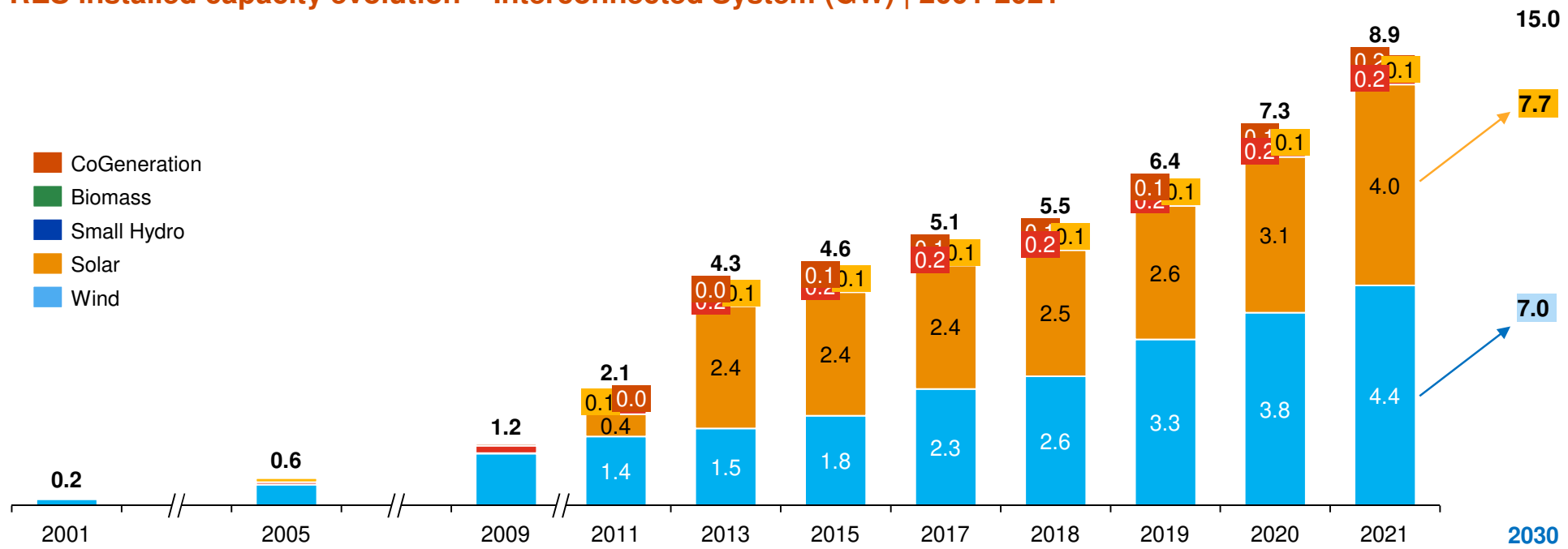
- RES volume includes generation from high efficiency CHP (ΣΥΘΥΑ) units

** SMP: System Marginal Price

Sources: ENEX, ADMIE, DAPEEP, PwC Analysis

RES capacity has increased significantly the period 2009 – 2021 and currently stands at almost 9GW*
In 2022 it is expected to exceed 10 GW

RES installed capacity evolution – Interconnected System (GW) | 2001-2021



	2011	2013	2015	2017	2018	2019	2020	2021	2030
RES Generation as % of Total Demand*	**4,8%**	**15,0%**	**18,9%**	**20,3%**	**21.6%**	**23.4%**	**29.5%**	**32.8%**	**National Plan**
RES capacity as % of Total Capacity	**14,5%**	**24,7%**	**25,4%**	**29,9%**	**31.3%**	**34.7%**	**37.4%**	**45.5%**	

* Not including large hydro

Sources: ENEX, ADMIE

Outlook of the Greek RES

The current National Energy and Climate Plan (NECP) which is translated to 63% RES-E target for 2030 is under revision (REpowerEU) and a target for RES-E of 70-80% for 2030 is expected

It is realistic to expect that the current 2030 targets for Wind (7.0 GW) and PV (7.7 GW) will be revised:

- Wind offshore of 2 GW to be added.
- A new target for PV should not be less than 10 GW

The challenge in order to increase RES penetration in the electricity production mix is to deal with the intermittency of RES production

A bridge technology has been the gas fired power plants, but the cost of NG in the last months poses big challenges

Energy Storage Technology and the need for Hydrogen

RES Intermittency is dealt with several energy storage technologies and mainly hydro storage and batteries. Hydro can cover baseload but not batteries.

Here comes Hydrogen (H2) as the energy storage means:
electrical energy → chemical energy → electrical energy

In addition H2 can be used not only for electricity production but also for use in greening the transportation (through direct use or via fuel cells)

Hydrogen: The Challenges

The use of H2 poses a big challenge to many aspects of its use, here are some of them:

1. Storage and transportation (cost of infrastructure and transportation)
2. Production costs (including investment costs – electrolyzers)
   Green H2 production costs 4-5 times more than the grey H2
3. Energy Losses in the transformation electricity – chemistry – electricity
4. A H2 based market to reduce production costs does not exist (yet)

Following the recent EU announcements about H2 the perception that has been created to the (non expert) EU citizen is that it is coming tomorrow…

The question is

Are there commercially acceptable solutions to the above challenges and when is it expected H2 to become main stream?