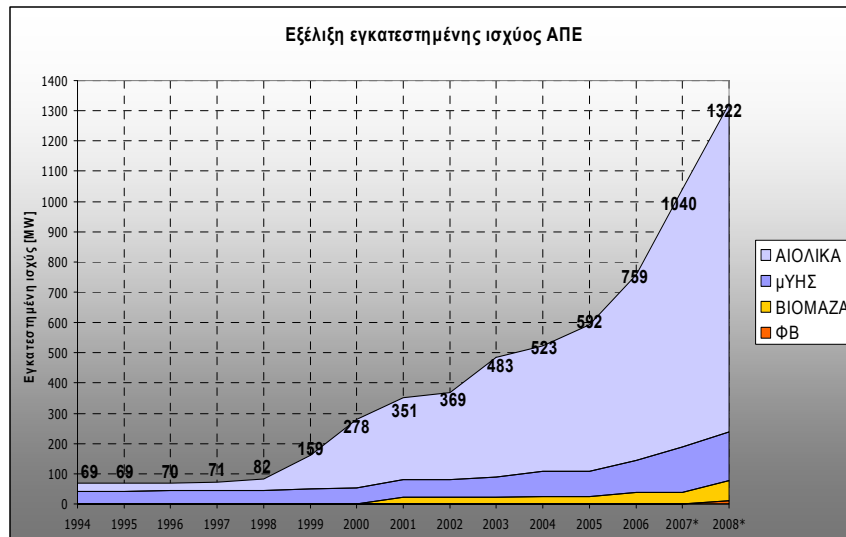


# TECHNICAL & INSTITUTIONAL CHALLENGES FOR LARGE SCALE WIND PENETRATION IN GREECE



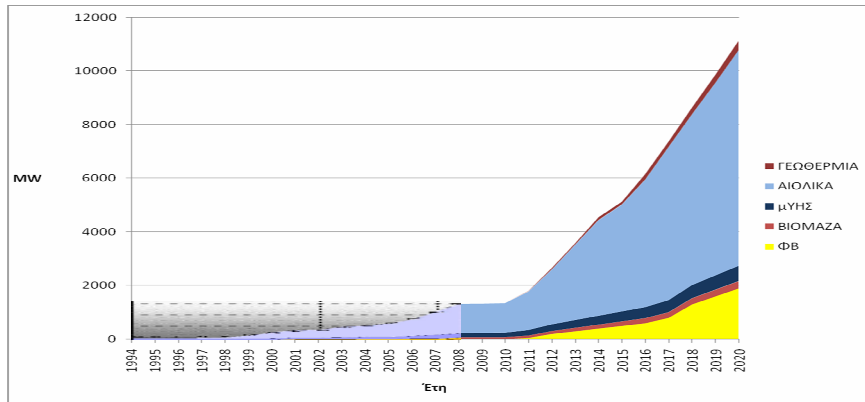
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## WHERE ARE WE TODAY...



### ... & WHAT IS THE TARGET Towards 2020

1. 20% Renewable Energy in the energy balance of 2020
2. 20% Energy Conservation
3. 20% decrease of emissions comparing to 1990
4. 10% participation of biofuels in transport



### DO WE HAVE OTHER ALTERNATIVES?

- ✓ All calculations result that the installed wind power in Greece should amount up to **9-10 GW** in year 2020
- ✓ No other alternatives exist! (Nuclear Power is not an option in Greece)

The correct question is NOT

**"High Wind Penetration or Not?"**

BUT

**"How can we achieve High Wind Energy Penetration?"**



**CONSIDERATIONS & IMPACTS FROM LARGE SCALE WIND  
PENETRATIONS ON THE ELECTRIC POWER SYSTEM (I)**

TECHNICAL CHALLENGES

- Frequency & Voltage Regulation (impacts from RES?)
- Power Quality (impact from RES?)
- Transmission Lines & Substations for RES stations (planning)
- Forecast & Power Guarantee from RES plants?
- Ancillary Services (possibilities/requirements from RES plants)
- Monitoring and Management of RES stations
- Effects to existing & planned thermal power stations?

**CONSIDERATIONS & IMPACTS FROM LARGE SCALE WIND  
PENETRATIONS ON THE ELECTRIC POWER SYSTEM (II)**

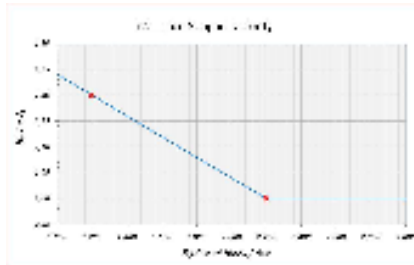
COMMERCIAL CHALLENGES

- Can priority to dispatch privilege be 100% maintained? (possible need of curtailments should be predefined and balanced with investments security)
- Impact to the conventional thermal stations expected market share which is expected to be reduced
- Benefits from reduce of emissions?
- Tariffs for RES kWh should be readjusted especially if subsidies on capital investment are decided to decrease
- Tariffs for large scale offshore & island projects?
- Tariffs for Hybrid Systems kWh?
- Tariffs for Ancillary Services from RES plants?
- Tariffs for low wind dispersed sites?

## TECHNICAL CHALLENGES & REQUIREMENTS

### Need for exploitation of dispersed low wind sites

- ✓ Sites between 5,0-6,0m/s are needed to meet the targets
- ✓ Increase of Capacity Credit thanks to non-correlated productions
- ✓ Exploitation of existing infrastructures (HV grids etc)
- ✓ Acceptance of local societies
- ✓ FAST realization of projects!

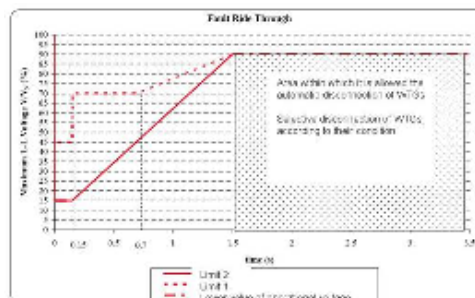


*The main tool to motivate wind farms development in such sites is the optimisation of feed in tariffs for low wind sites*

## TECHNICAL CHALLENGES & REQUIREMENTS

### Wind Turbines Technology

- ✓ Low Voltage Ride Through Capability is a must!
- ✓ Power regulation/limitation of peak power
- ✓ Modern WTGs may support the grid and provide ancillary services (WTGs driven to the grid with converters)
- ✓ Power Quality limits should be respected (WTGs with converters)

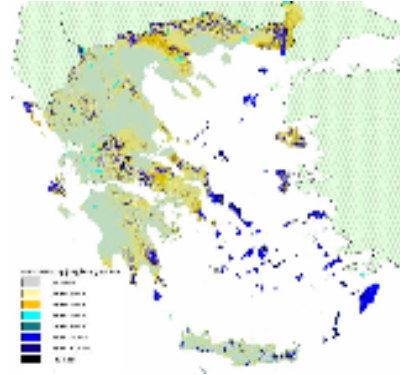


*Yes, Wind Turbines must improve but we should not expect everything from the evolution of WTGs technology!*

## TECHNICAL CHALLENGES & REQUIREMENTS

### Wind Farms Planning & Operation

- ✓ Spatial Distribution of WFs
- ✓ WFs should be compensated for providing ancillary services
- ✓ SVCs can help in many cases
- ✓ Allow different "installed power" & "max power" in WFs
- ✓ WF SCADA & TSO EMS – better collaboration needed
- ✓ Forecast Tools can be applied with incentives for producers



*Good Wind Potential should not be the only criterion for the location & approval of a windfarm - The market should give motives for more grid friendly WFs*

## TECHNICAL CHALLENGES & REQUIREMENTS

### ELECTRICITY NETWORKS 1<sup>st</sup> STEP

- ✓ It is needed considerable new transmission infrastructure!
- ✓ Main Transmission Lines for WFs should be possible to be constructed, operated & exploited by privates under conditions
- ✓ New flexible specs must be accepted for grid connection of WFs to the grid (S/S, OHL)
- ✓ Design and Operation of MV network must also be adjusted
- ✓ New & Upgrade of existing International Connections – Energy exchanges between the countries should be adjusted to support high wind energy penetrations



*It cannot be expected that all infrastructure needed will be undertaken by the TSO and the Power Corporation BUT the System should give more freedom to the privates*

## TECHNICAL CHALLENGES & REQUIREMENTS

### ELECTRICITY NETWORKS 2<sup>nd</sup> STEP (SMART & INOVATIVE SOLUTIONS)

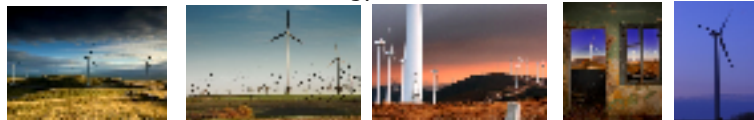
- ✓ Upgrade Transmission Capacity of Existing Grids with use of new materials technologies by simple change of conductors
- ✓ Connection of islands with HVDC technologies – exploitation of massive wind potential
- ✓ Energy storage & operation of Hybrid RES Systems with guaranteed power supply should be encouraged
- ✓ Careful selection of thermal power stations mix, able to support the needs for large scale wind penetration and lowering the emissions



*A total new planning of the System must be made for the new era!*

### **Other Non Technical Parameters affecting Large Scale Wind Penetration**

1. The issue of Public Administration – numerous licenses, many involved parties, steady increase of demands from developers but lack of people/knowledge/experience from the authorities
2. Legislation barriers for Grid Expansion – False “booking” of transmission capacity for WFs connection
3. Relations with local communities – lack of information, wrong mentality towards private investments
4. The Greek Justice System (“industry” of applications against windfarms to the Court of State, Huge delays for the final court decisions)
5. Continuous changes in the legislation create confusion
6. Lack of a clear National Energy Plan for the future



**THANK YOU!**

