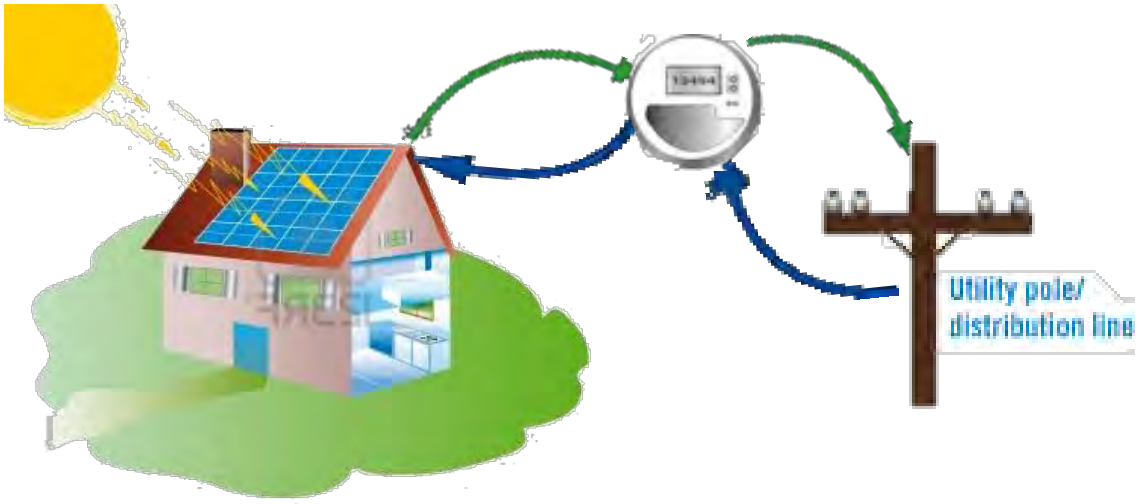
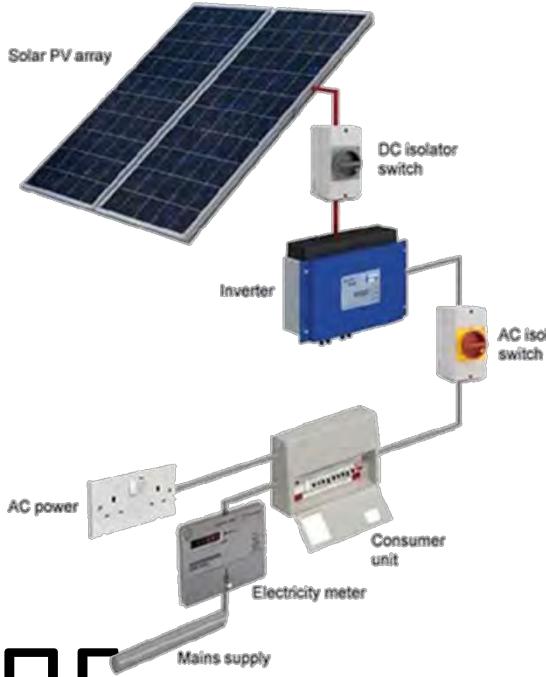



# Η διείσδυση των ΑΠΕ και η ένταξη τους στο δίκτυο

4ο Ενεργειακό Συμπόσιο

Ενέργεια: Ώρα για αποφάσεις

Τάσος Γρηγορίου

Διαχειριστής Συστήματος Διανομής(ΑΗΚ) Κύπρου

# The 2030 EU Climate and Energy Policy Framework


changes the rules
of the electricity market game
and the roles of the players and stakeholders

# 2030 Climate and Energy Policy Framework

- GHG TARGET: “a binding EU target of an at **least 40% reduction in greenhouse gas emissions by 2030 compared to 1990**”, “the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively”
- RES TARGET: “An EU target of at least **27%** is set for the share of renewable energy consumed in the EU in 2030. This target will be binding at EU level.”
- ENERGY EFFICIENCY TARGET: “An indicative target at the EU level of at least **27%** is set for improving energy efficiency in 2030 compared to projections of future energy consumption based on the current criteria”

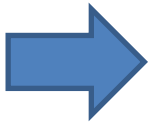
2 $^{o}$C decrease in global warming by 2050:
The Tipping Point for Utilities

transformation of energy infrastructure
towards
smarter,
efficient,
renewably powered economy
(or low carbon/decarbonised economy)

Utilities evolving from
pure-play centralised power gens
and distributors
to energy solutions providers.
Innovation, sustainability the essential
ingredients of any strategic goal.

# Triple energy challenge

- Security
- Cost
- Carbon



That's why we need entrepreneurship and innovation

*Source: Engineering innovation, a sustainable energy future for Europe – KIC InnoEnergy*

# 4d’s: The new slogan in EU

- decentralised energy (more)
- decarbonised energy (more)
- decreased demand
- digitilisation (making digital is not an option but a necessity)

# decentralization

- Η τεχνολογία υποστηρίζει και σπρώχνει προς την κατεύθυνση αυτή
- Το κόστος των ΦΒ μειώθηκε κατά 60% τα τελευταία 5 χρόνια
- Το κόστος αποθήκευσης με μπαταρία μειώθηκε κατά 50% τα τελευταία 5 χρόνια
- Χρειάζεται ανάπτυξη συνείδησης σε τοπικό επίπεδο σε ζητήματα, όπως για παράδειγμα η αυτάρκεια των πόλεων (Schrong στη Γερμανία, Varese Ligore στην Ιταλία και El Hiero (Κανάριοι Νήσοι))

# decarbonisation

- Για να μειώσουμε τη θερμοκρασία του πλανήτη κατά 2β μέχρι το 2050 χρειάζεται να μειώσουμε εκπομπές Θ/Κ αερίων κατά 70% από το 2010 στο 2050
- Χρειάζεται ανάπτυξη ΑΠΕ,  Η/Κ( ev), υδρογόνο, εξηλεκτρισμός της ενέργειας

# decreasing demand

- Μεγάλη θετική επίδραση στην κατανάλωση και κατ επέκταση στη κλιματολογική αλλαγή. Αν σήμερα η απαιτούμενη ενέργεια ήταν όμοια του επιπέδου του 1990, η πρωτογενής ενέργεια στην κατανάλωση θα ήταν 30% υψηλότερη και οι εκπομπές διοξ άνθρακα 20% ψηλότερη

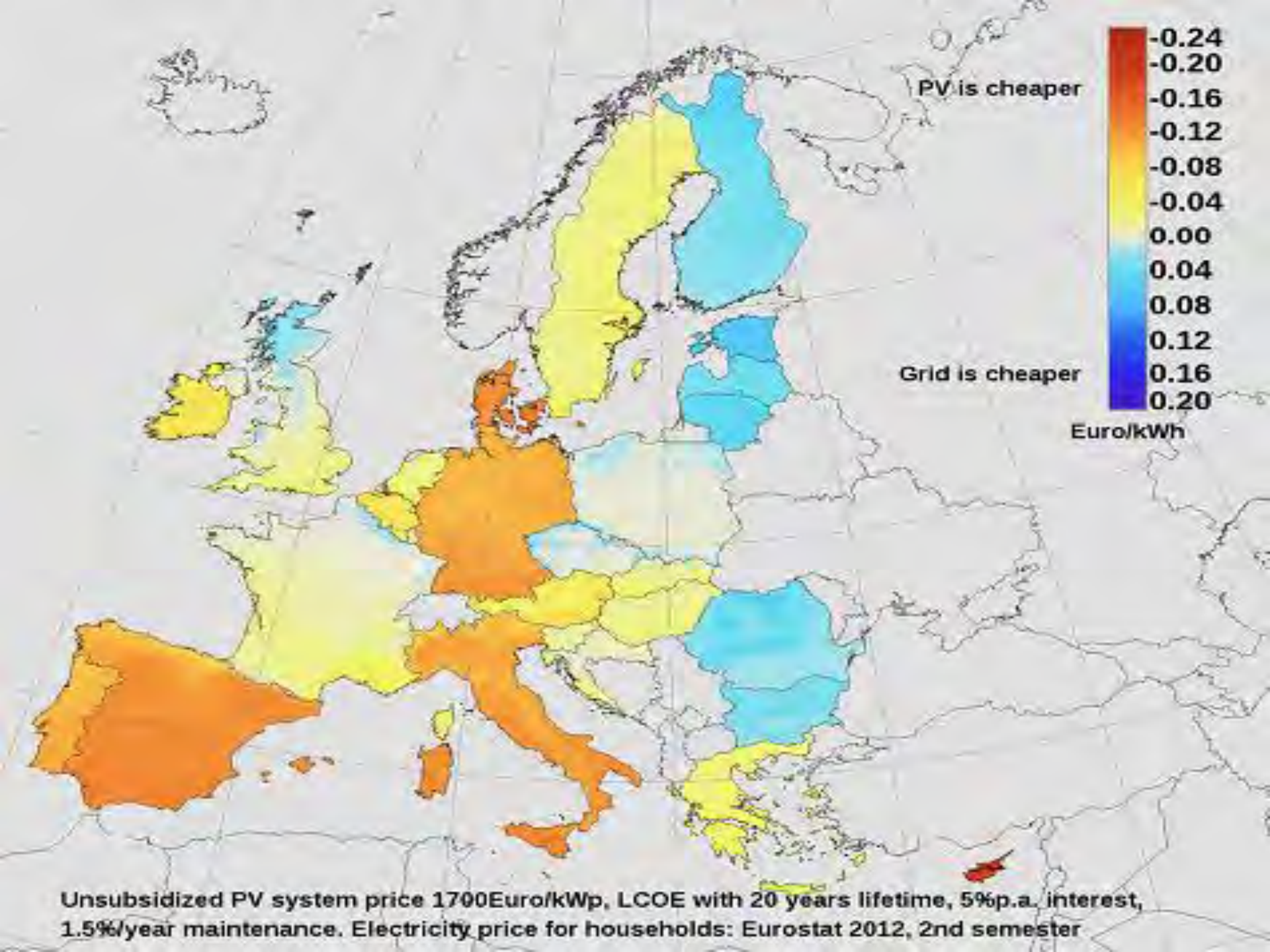
# digitalisation

- 41% του πληθυσμού της γης έχει διαδικτυακή σύνδεση
- Τα αντικείμενου του διαδικτύου θα πληθύνουν αφάνταστα, αφού υπολογίζεται ότι μεταξύ 2013-2020 θα αυξηθούν κατά 400%
- Ανάδυση νέων μοντέλων στη ψηφιακή διαχείριση με επίκεντρο τους έξυπνους μετρητές

“Run the grid the way a conductor leads a symphony orchestra: No instrument plays all the time but the ensemble continuously producers beautiful music”

*Amory B. Loving, quoting Clay Stranger – RMI Manager Armony awarded in 2009 Time magazine one of the world’s 100most influencial people. He is the world’s foremost champion of and authority on energy efficiency and renewably energy solutions*

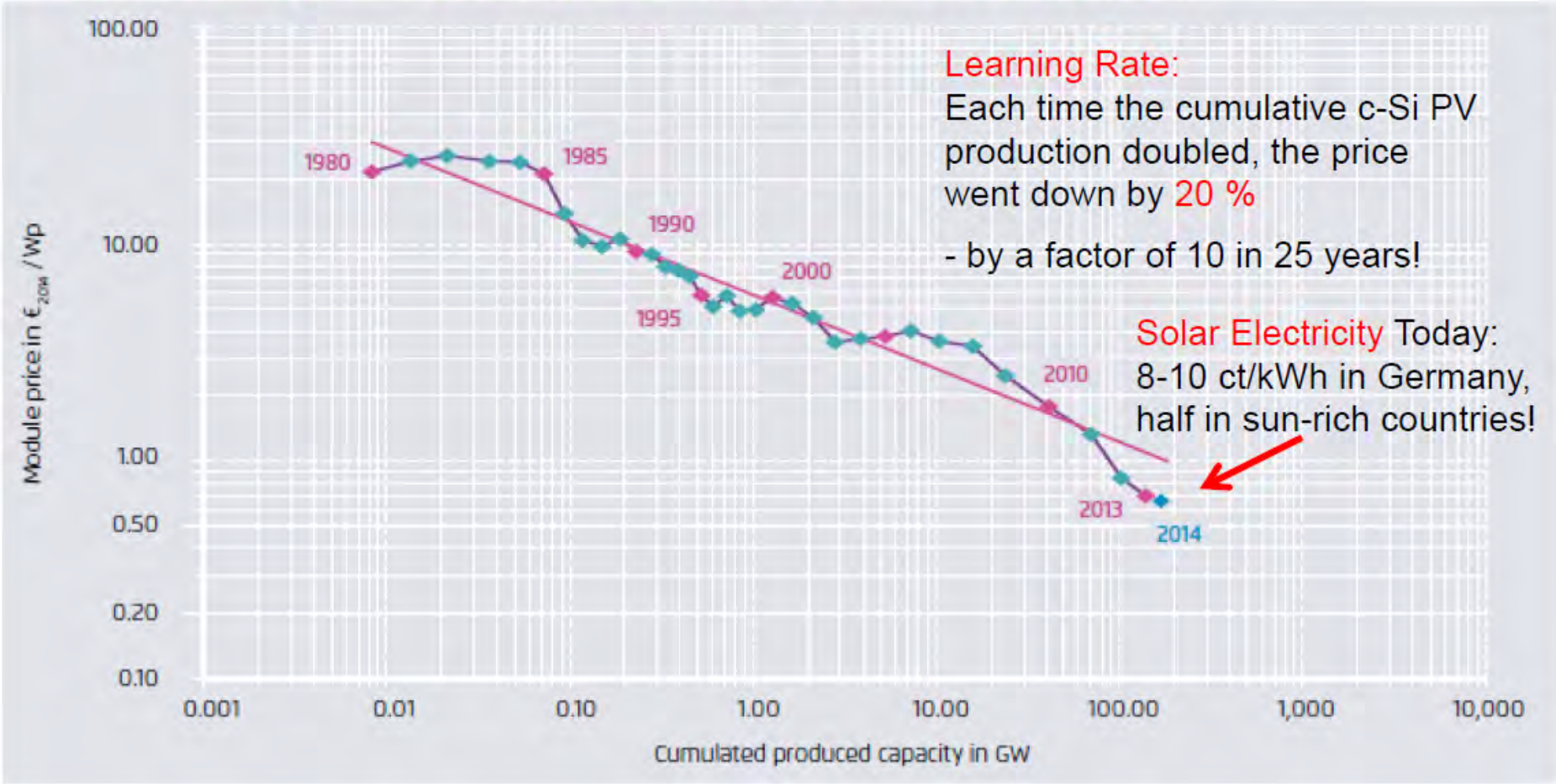
# Is the Penetration of RES the "first violin" in orchestrating this revolutionary environment ?




Unsubsidized PV system price 1700Euro/kWp, LCOE with 20 years lifetime, 5%p.a. interest, 1.5%/year maintenance. Electricity price for households: Eurostat 2012, 2nd semester

# Price Experience Curve of Solar Energy (c-Si Photovoltaics)

## - Driven by Innovation & Market Introduction!



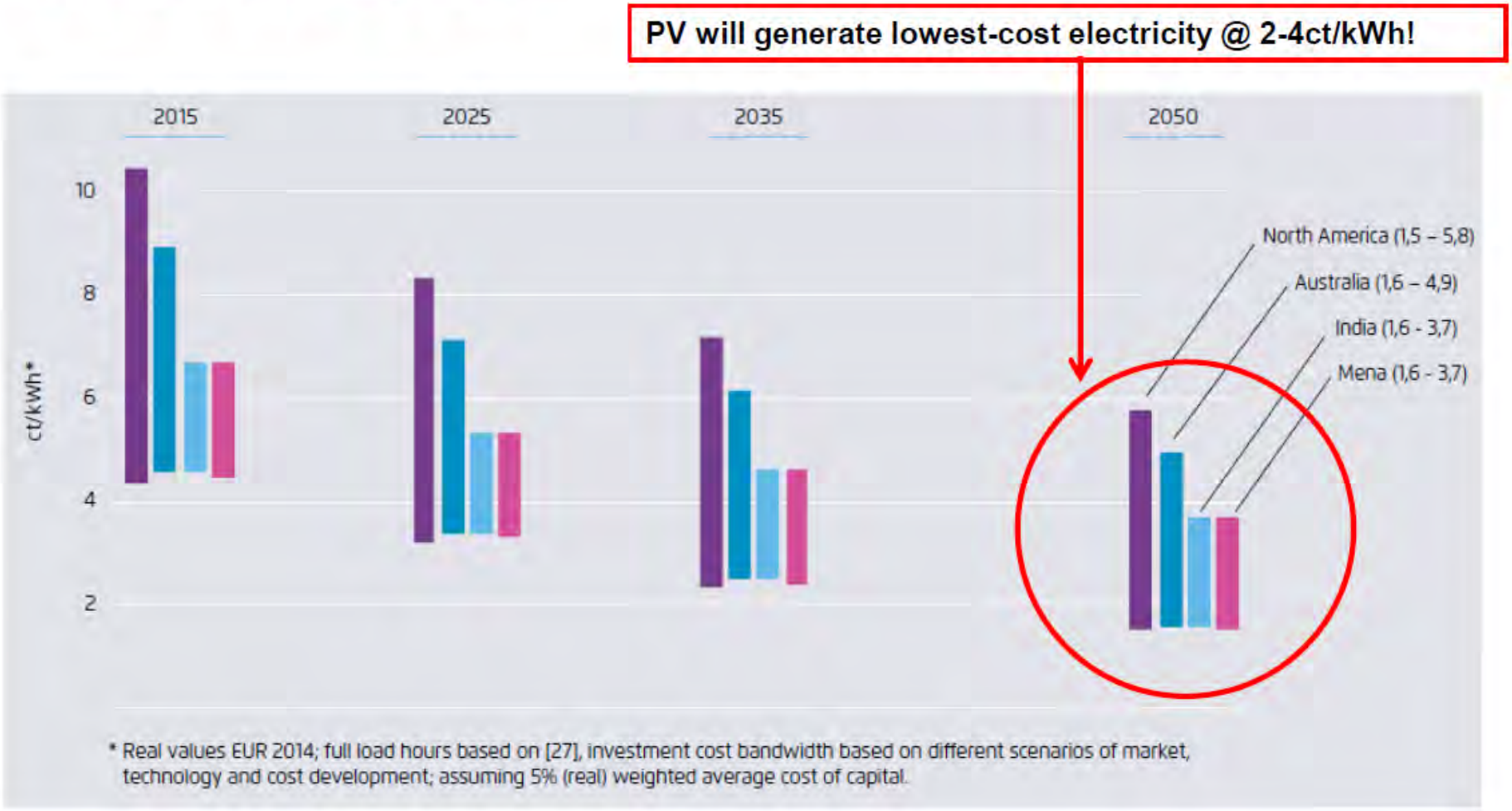

Source: Navigant Consulting; EUPD PV module prices (since 2006), Graph: ISE 2014





Fraunhofer ISE

# PV Electricity Cost (LCOE) till 2050
## in different regions



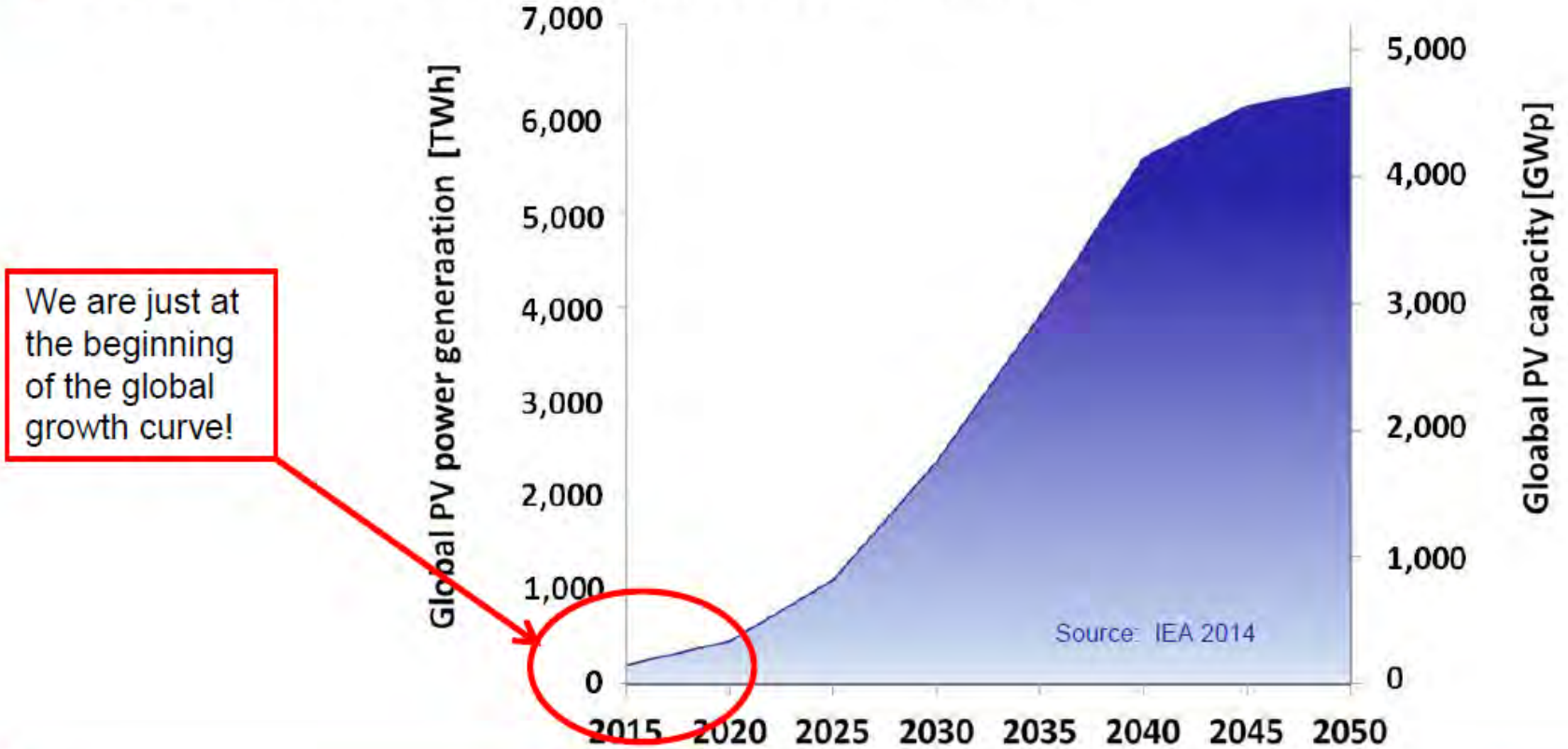

Source: ISE PV cost study 2014



Fraunhofer ISE

# PV Market Growth (IEA 2014)

- Rapid introduction of PV globally is fueled by availability of cost-competitive, distributed energy
- In 2050 between 4.000 and 30.000 $GW_p$ PV will be installed!
- By 2015, less than 200 $GW_p$ have been installed!

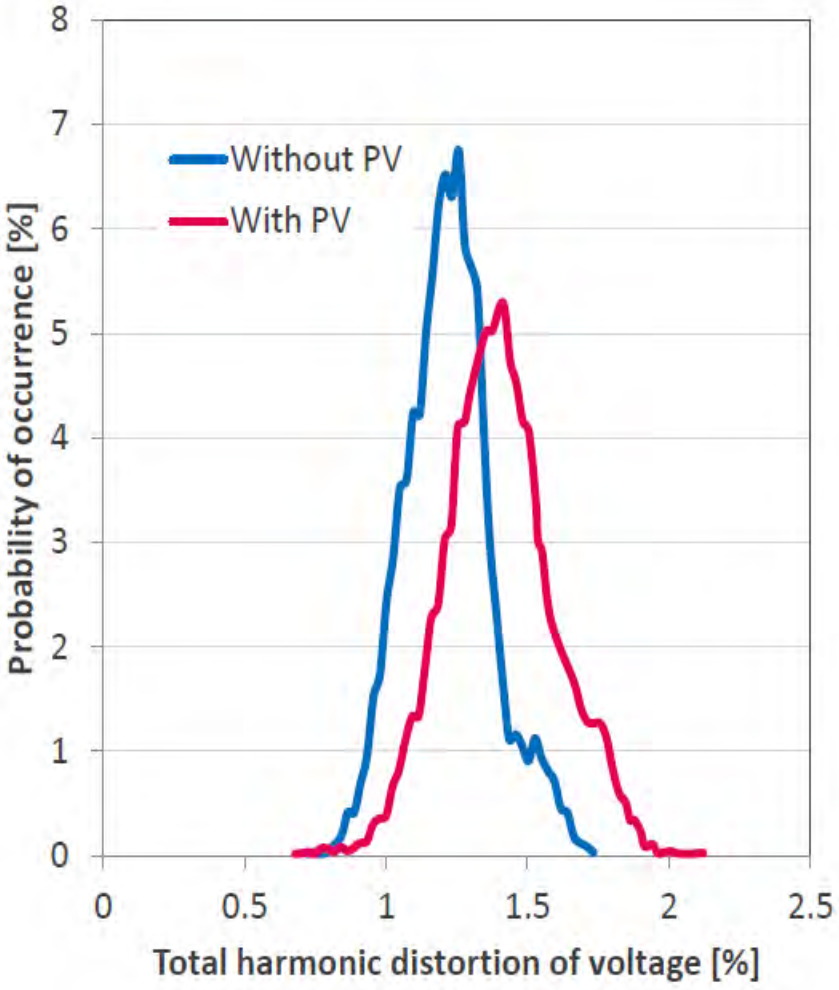





Fraunhofer ISE

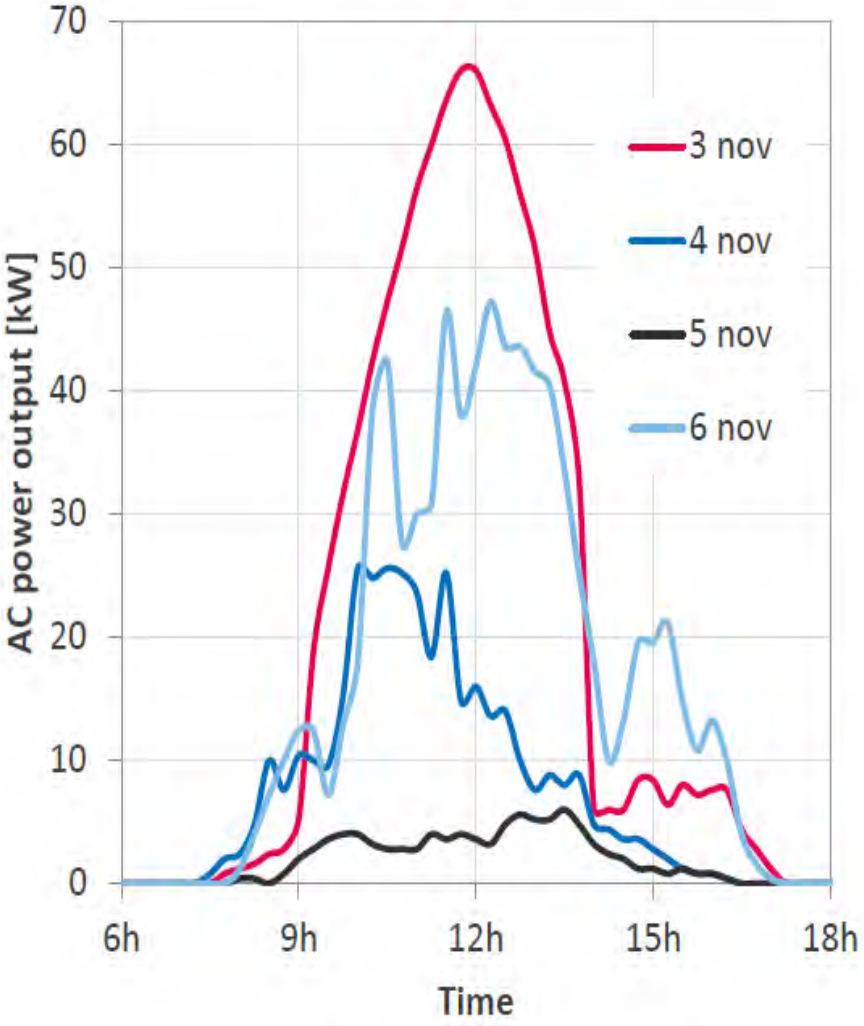
# Risks for distribution networks

- Function of distribution networks: delivering electricity to end user with good quality of supply:
  - Continuity of supply
  - Voltage quality
- Risks from PV:
  - Reverse power flows and transformer loading
  - Harmonics
  - Line losses
  - Voltage deviations



# Intermittency

- Impact
  - Barrier to integration in electricity market
    - Risk
    - Value of non-dispatchable electricity
  - Increased use of reserves
- Solutions
  - Aggregation over large areas and combination with other renewable sources
  - Energy storage
  - Forecasting



# ΕΣΔ ΑΠΕ ΣΤΗΝ ΚΥΠΡΟ

Στόχος (2020)= 13 % επί της συν. κατανάλωσης

Αναλύεται σε

- Ηλεκτρισμός = 16%
- Μεταφορές = 10%
- Θ & Ψ = 23.5%

Ανάλυση στόχων ηλεκτροπαραγωγής

- ΦΒ 288 MW
- Αιολικά 175 MW
- Βιομάζα 15 MW
- Ηλιοθερμικά 50 MW

# Πορορστά διείσδυσης

| ΕΤΟΣ | ΣΥΝΟΛΙΚΗ ΠΑΡΑΓΩΓΗ (GWh) | ΒΙΟ ΙΣΧΥΣ (MW) | Φ/Β ΙΣΧΥΣ (MW) | ΑΙΟΛ ΙΣΧΥΣ (MW | Η/Θ ΙΣΧΥΣ (MW | ΣΥΝΟΛΙΚΗ ΠΑΡΑΓΩΓΗ ΑΠΕ (GWh) | Ποσοστό |
|---|---|---|---|---|---|---|---|
| 2014 | 4.315 | 10 | 61 | 147 | 0 | 302 | 7% |
| ΣΕΠ 2015 | 3.468 | 10 | 75 | 158 | 0 | 301 | 8,7% |
| 2015 | 4.530 | 10 | 80 | 158 | 0 | 397 | 9% |
| 2020 | 5.100 | 15 | 288 | 175 | 50 | 791 | 16% |

# Energy and Electricity Mix in Cyprus

## 2015

**Energy Mix**

- **PV :** 80 MWp
- **Wind:** 158 MWp
- **Biomass :** 10 MWp
- **Peak Demand :** 900 MW

## 2020

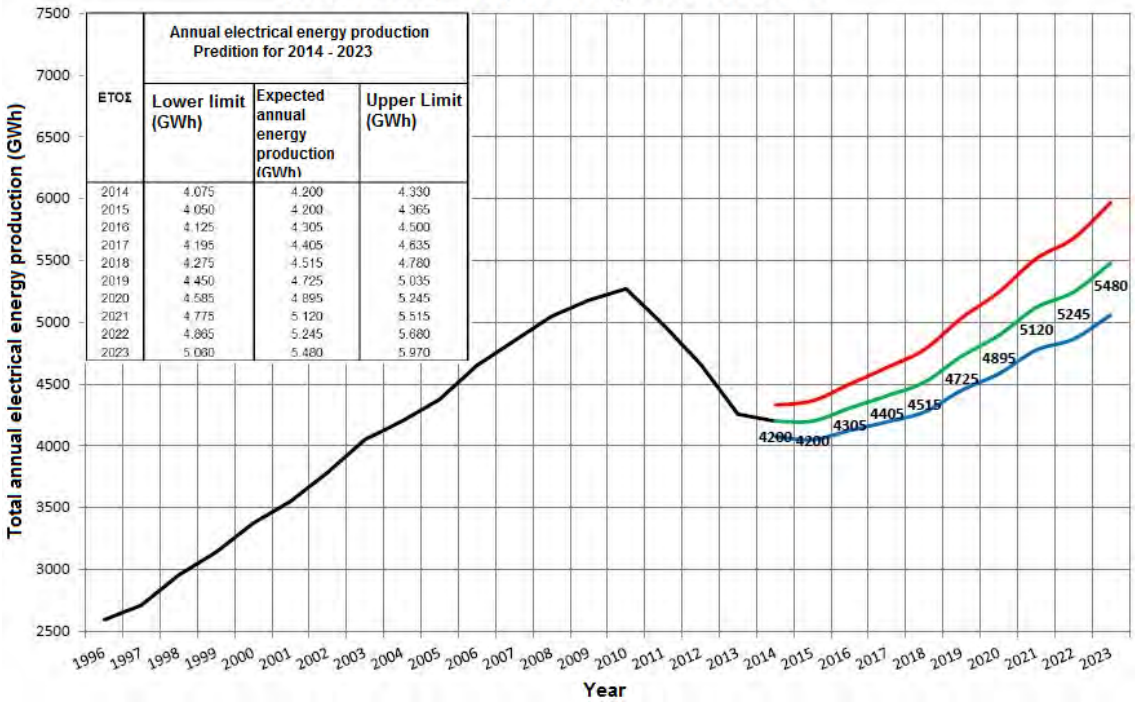
**RES Target**

- **PV :** 288 MWp
- **CSP : 50** MWp
- **Wind :** 175 MWp
- **Biomass :** 15 MWp

→ **16 % RES Energy**

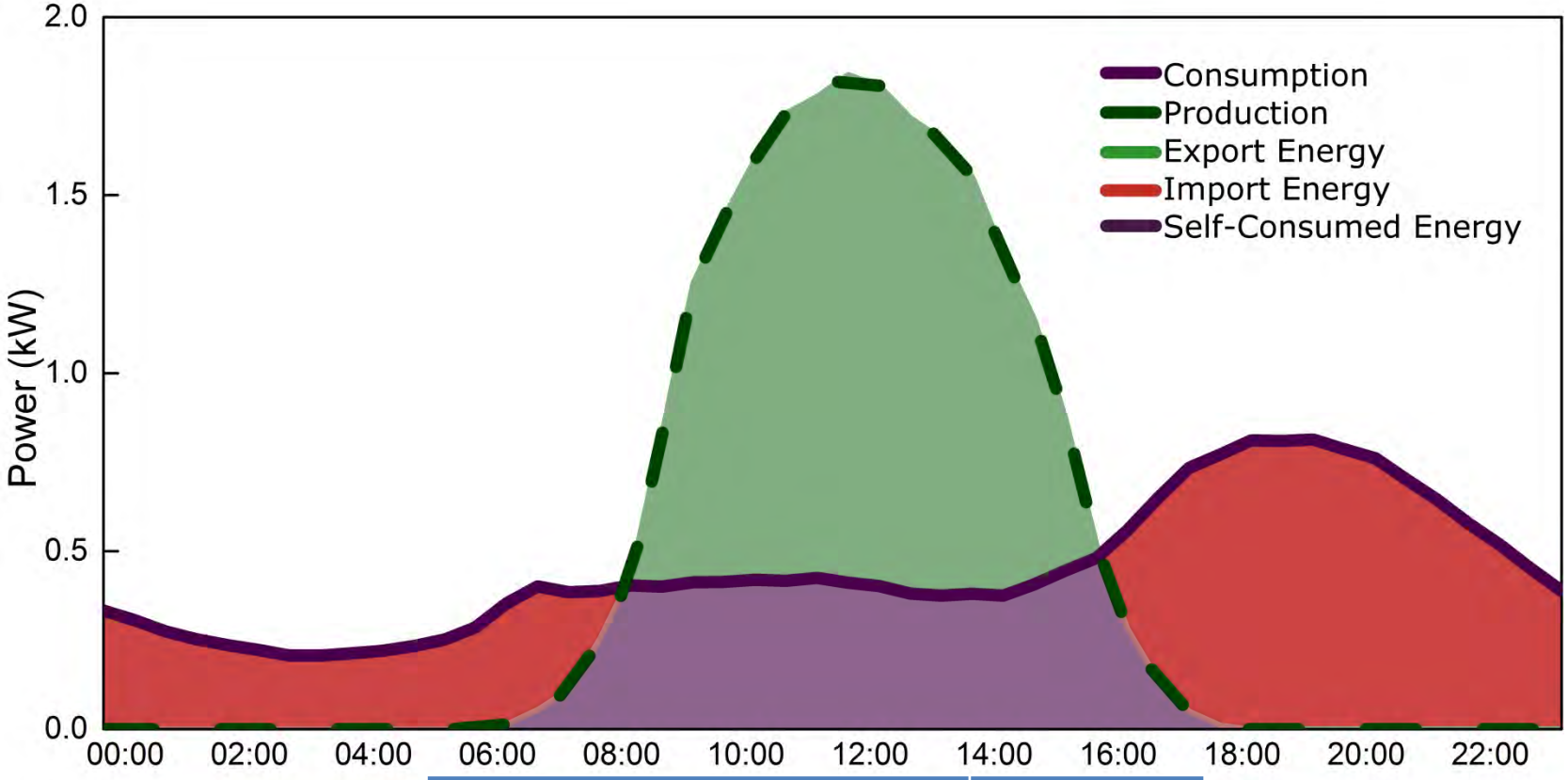
**Official Prediction of the total electrical energy production (GWh) for the years 2014-2023**

| ΕΤΟΣ | Annual electrical energy production Predition for 2014 - 2023 | | |
|---|---|---|---|
| | Lower limit (GWh) | Expected annual energy production (GWh) | Upper Limit (GWh) |
| 2014 | 4.075 | 4.200 | 4.330 |
| 2015 | 4.050 | 4.200 | 4.365 |
| 2016 | 4.125 | 4.305 | 4.500 |
| 2017 | 4.195 | 4.405 | 4.635 |
| 2018 | 4.275 | 4.515 | 4.780 |
| 2019 | 4.450 | 4.725 | 5.035 |
| 2020 | 4.585 | 4.895 | 5.245 |
| 2021 | 4.775 | 5.120 | 5.515 |
| 2022 | 4.865 | 5.245 | 5.680 |
| 2023 | 5.080 | 5.480 | 5.970 |



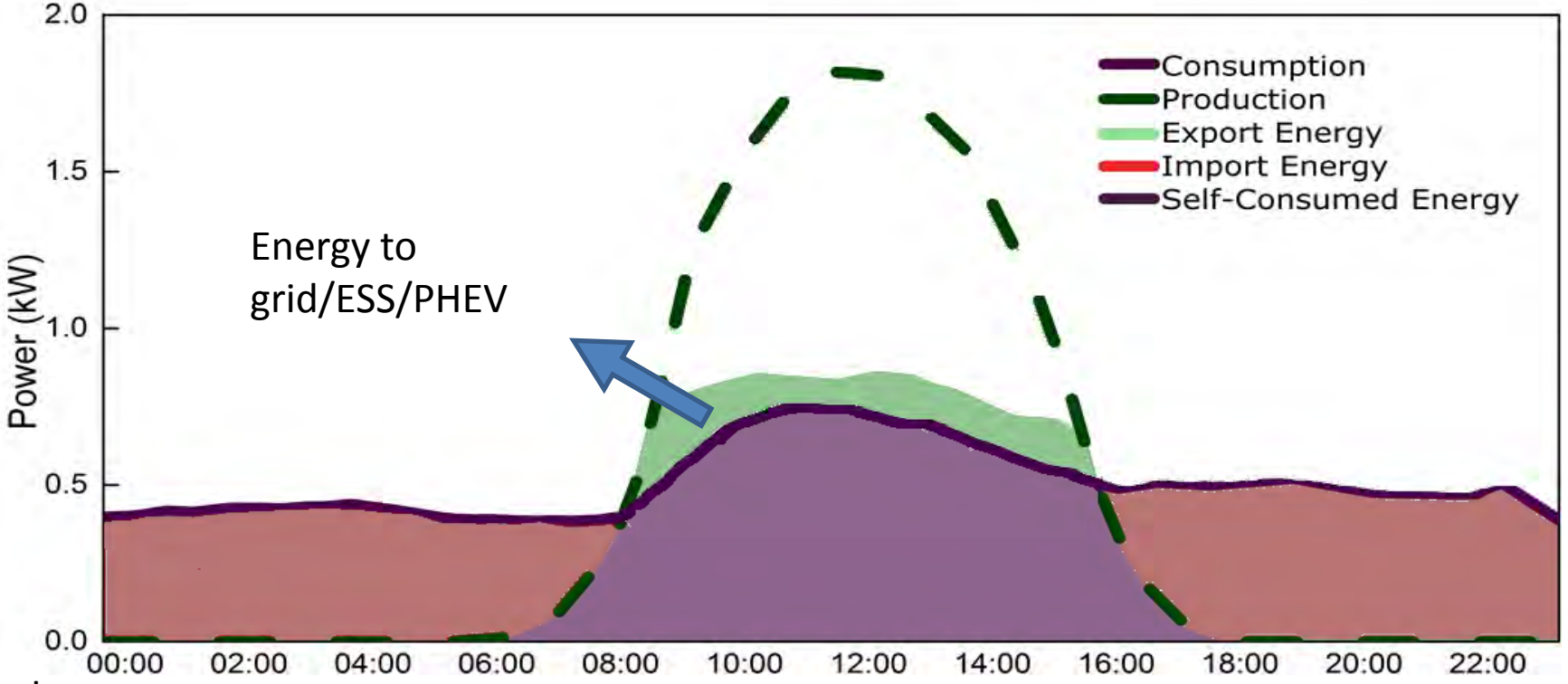

Electricity demand drops due to the economic depression → Great opportunity to restructure the energy plan for Cyprus

# Typical Prosumer profile in Cyprus (Winter)




| | |
|---|---|
| Consumption | 10.65 kWh |
| Production (3 kWp System) | 11.21 kWh |
| Self Consumption | 3.80 kWh |
| PV Utilization Factor | 34 % |

# Prosumer profile in the Future




Goals:

Increase the utilization factor of the PV system

Shift energy during the peak periods to off peak periods (or energy producing periods)

Make use of ESS/PHEV to fill consumption valleys and to minimize the spill-out energy to the grid

Grid operators may use the stored energy to flatten the overall system load demand

# DSOs -The Challenging Task of Integrating DG*

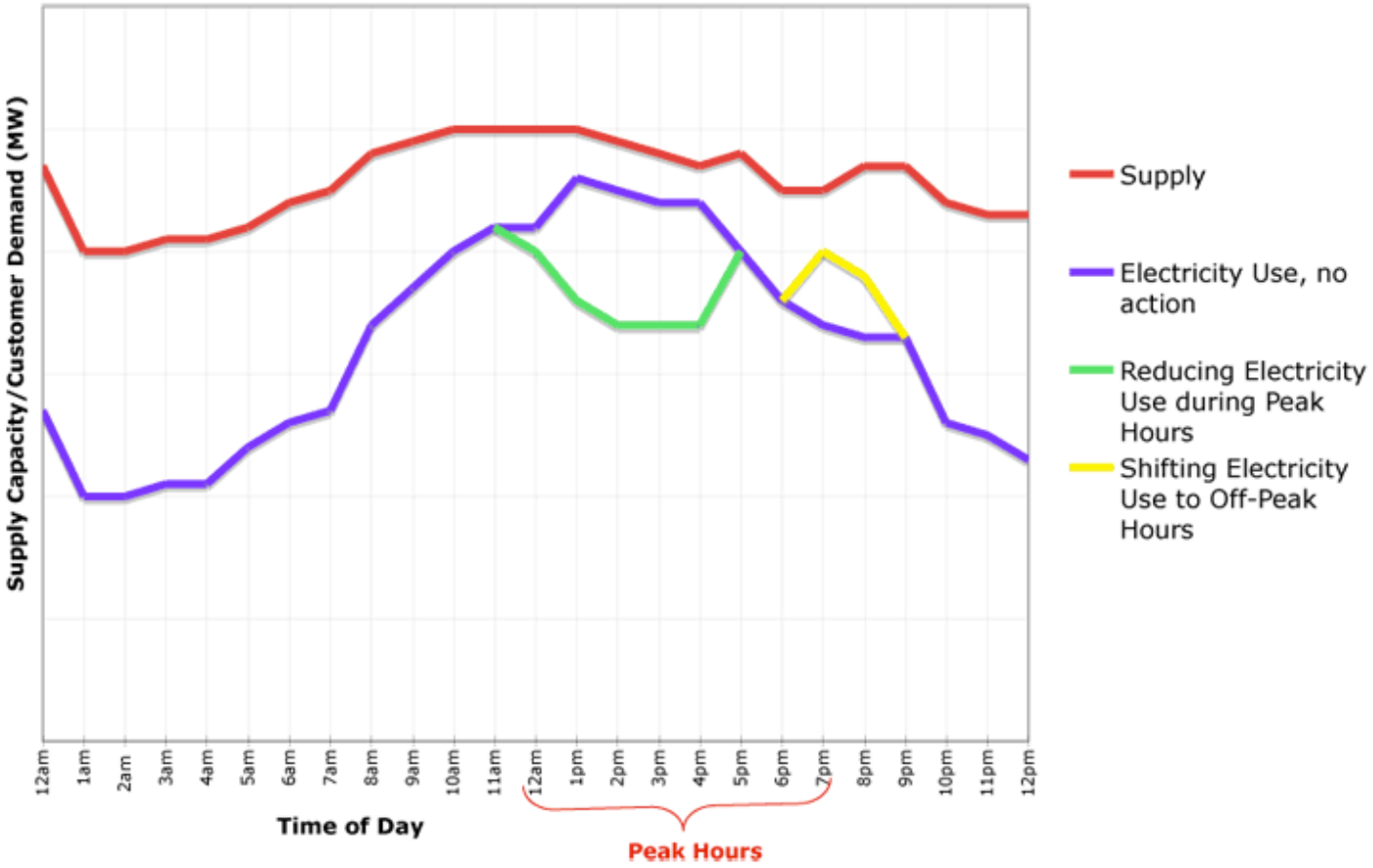
- Intermittent solar and wind generation.
- DG connected to low and medium voltage distribution systems.
- Concerns for reliability of supply and quality of service due to the increasing DG penetration, depending on the type of connected generation, the voltage level of the connection to the grid and their geographical location.
- The network must still be designed to satisfy peak load when there is no DG.
- Concerns for additional investment for network reinforcement when DG generation exceeds local demand.

# DSOs -The Challenging Task of Integrating DG*

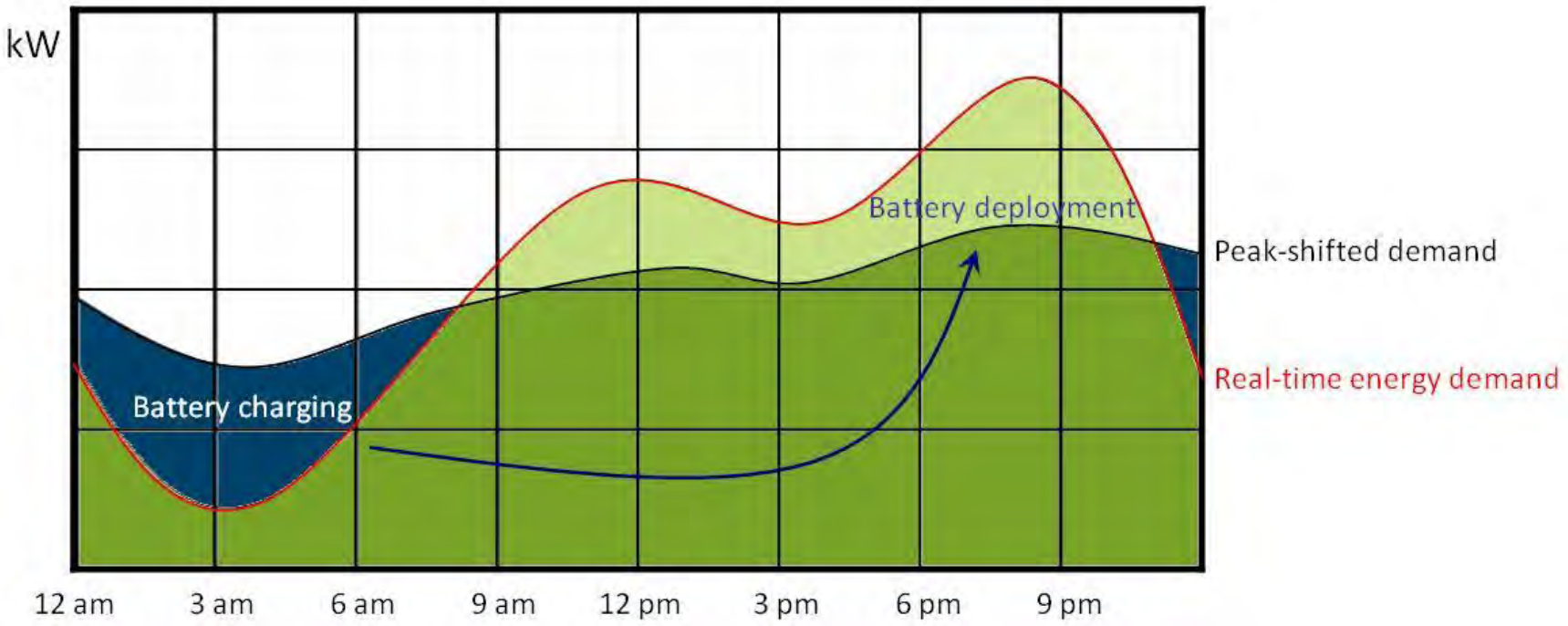
- Need for investment in more complex protective relaying and control systems.
- Proper DG integration will make the energy system become more sustainable.
- Bad DG integration will raise the risk of power outages and increase costs for customers .
- The growth of DG has implications for how DSOs are regulated.
- Growing need for active system distribution management.
- Need to shift to more cost-reflective distribution system network tariffs.

* Active Distribution System Management, EURELECTRIC paper, February 2013.

# DSOs : Using Flexibility to Solve Distribution Grid Constraints



# DSOs: Using Flexibility to Solve Distribution Grid Constraints



# Who benefits ?

## CUSTOMERS

- Increased awareness and savings
- Increased participation and economic benefits of personalised and flexible contracts

## SUPPLIERS

- Ability to offer new products and services for customers
- Enhanced balancing and hedging opportunities

## NETWORK OPERATORS

- Opportunity to optimise the use of and investment in new network assets to relieve constraints
- Increased network performance

## GENERATORS/TRADERS

- Investment optimisation in peaking generation plants and back-up capacity
- Possible benefits in terms of portfolio diversification

# Pilot Project for AMI

- Pilot project of 3.000 customers
- Installation: New start early 2016, finish end 2016
- Technology : PLC based
- Basic features :

✓ Automatic metering
✓ Remote connection/disconnection
✓ Customer profiling/DSM

- Plan : Roll out of smart meters by 2018
- Basis for smart grid development

# Green + NER 300 Project

- Innovative DRM project (smart grid) awarded for funding under NER300 2nd call. EAC is the Project Sponsor.
- “Green +” falls under the sub-category DRMa (Renewable energy management and optimization for small and medium scale DG in rural environment with predominant solar generation (20MW on LV + 50MW on MV).
- Multi – microgrid network hierarchically organized.
- Anticipated entry into operation 2019.

# Green + NER 300 Project

- Estimated investment cost 41M
- Mountain region, densely forested, target is to maintain balance between supply and reliable electricity and minimal impact on the sensitive local environment in the most sustainable way
- Sustainable growth and local economy boost
- Mixture of 7500 rooftop PV’s (30MWp) and 26 large scale PV parks (31.3MWp) and 2 Wind parks (22,1MWp)

# EV Charging Stations

- 18 charging stations in operation
- Each charging station is equipped with 2 Outlet Type 2 sockets
- Charging is performed by Mode 3 charging mode
- Charging capacity per outlet up to 22kW
- Charging time : 1-3 hours depending on EV capability
- Infrastructure for direct debit to customer's account (through GPRS, RFID card)

# Stakeholders Views : EC Public consultation on New Electricity Market Design

- support the full integration of RES into the market
- Full balancing obligations for RES
- Phasing out priority dispatch
- Controversial concerns on phasing out public support schemes

Conclusion: the Penetration and integration of RES is the "first violin" in orchestrating this revolutionary environment!