

# **The Greek Energy Market: Reforms and Investment Potential**

**Nektaria Karakatsani,  
Regulatory Authority for Energy (RAE), Member of the Board  
nkarakatsani@rae.gr**

**China - Greece Investment and Financing Trade Forum,  
Xi'an, China, 11 December 2017**

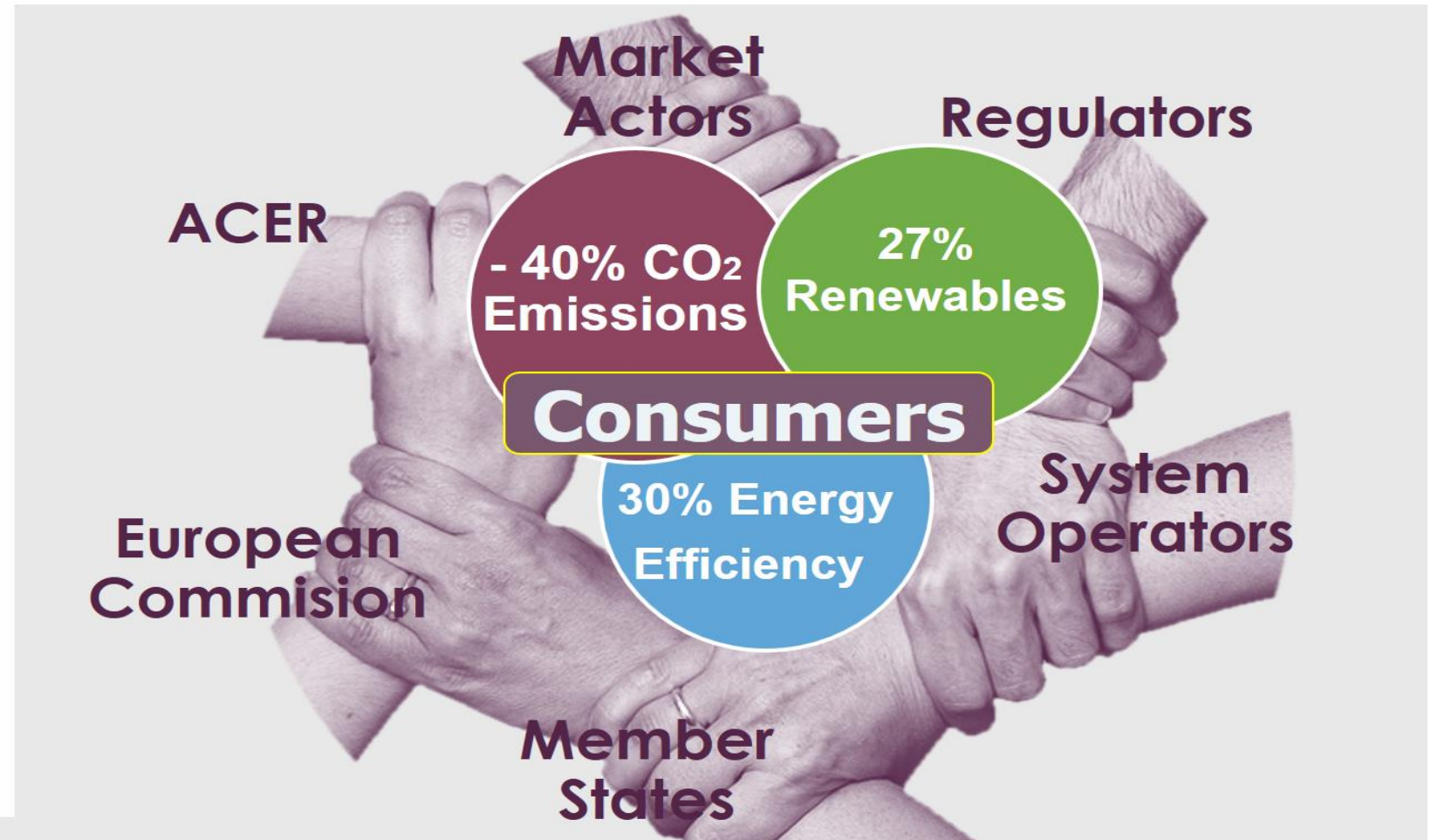
# Why Invest in the Greek Energy Sector?

- ❑ Our energy markets become **more competitive**.
  - **Divestment** of power assets (**lignite plants and mines**).
  - New investors in the **System Operators** (regulated activities, **attractive rates of return**).  
State Grid present in electricity (ADMIE) - has expressed interest for gas (DESFA, via the Italian Snam).
  - New shareholders in **gas supply** companies. **New operators** of gas distribution networks.
  - **Opening of the retail sectors** via antitrust measures (Gas release program, NOME auctions for electricity).
  
- ❑ **More integrated** with the European markets, with a strong regional role.
  - Better **connected**, with new infrastructure (gas pipelines and electricity cables).
  - **Harmonized** in terms of market rules.
  - Diversification and Security of Supply. **Strategic value. An energy hub is being shaped.**
  
- ❑ More focused on the **clean energy transition**.
  - Higher **renewables' penetration**.
  - **Gas** network is **expanded** across Greece.
  - **Interconnection** of islands or small-scale LNG (vs. diesel production currently).
  - **Upgrading of power plants** for environmental compliance and life-time expansion.
  - **Smart meters, electrical vehicles, energy efficiency, innovation (smart islands), energy communities.**

# Clean Energy Transition: EU objectives for 2030

## Common Vision

**Alignment**  
+  
**Coordination**  
+  
**Multi-sectoral  
approach**

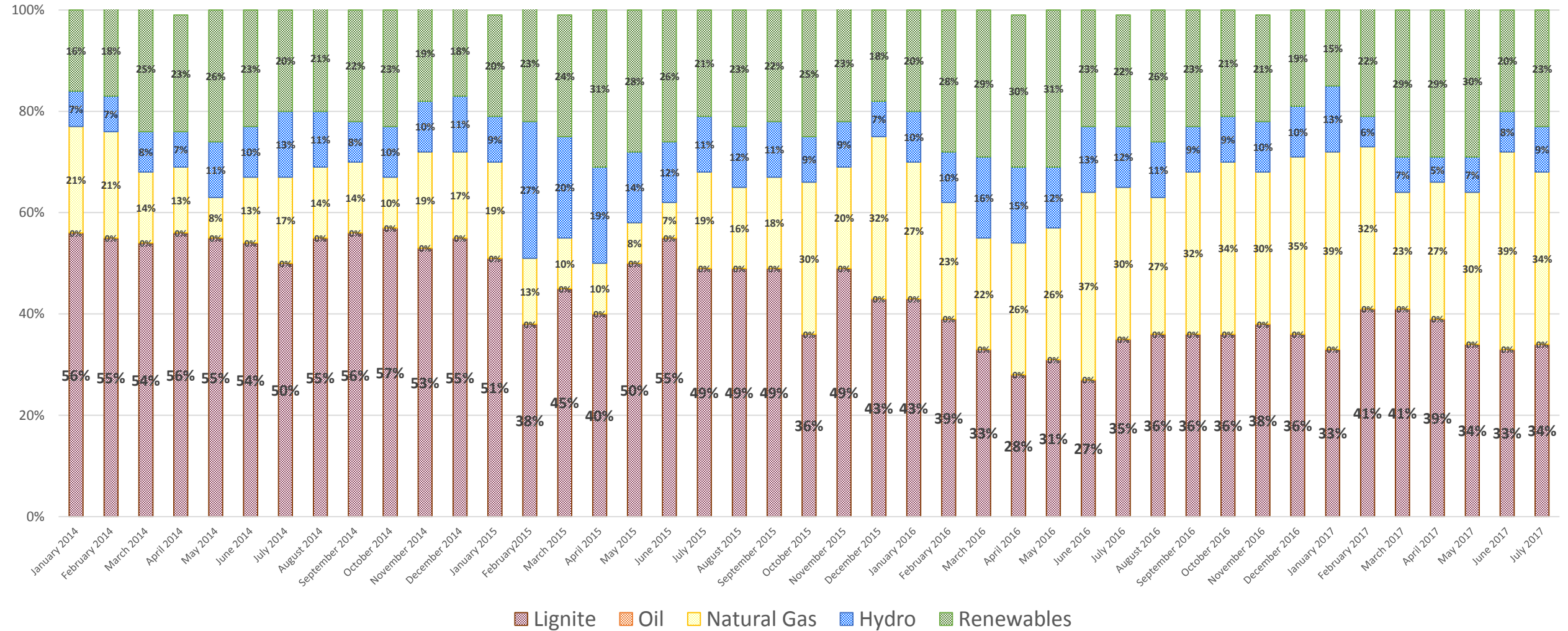


# Energy Union: Common Objectives and Challenges



- ❑ Several trajectories, reflecting local specificities, need to **converge**.
- ❑ **1 trillion € investments** are required at the EU level for the clean energy transition.
- ❑ **Key: An adaptive regulatory framework, which allows competition on fair terms and stimulates investments.**
- ❑ In Greece, we are focused on deriving solutions, in compliance with the European framework, which **exploit our local advantages and strategic position**.
- ❑ Principle: **Expand the business potential, so as to create value to energy consumers.**
- ❑ **Constructive collaboration with European Commission.**  
**This facilitated certification process e.g. for State Grid, as an investor in ADMIE.**

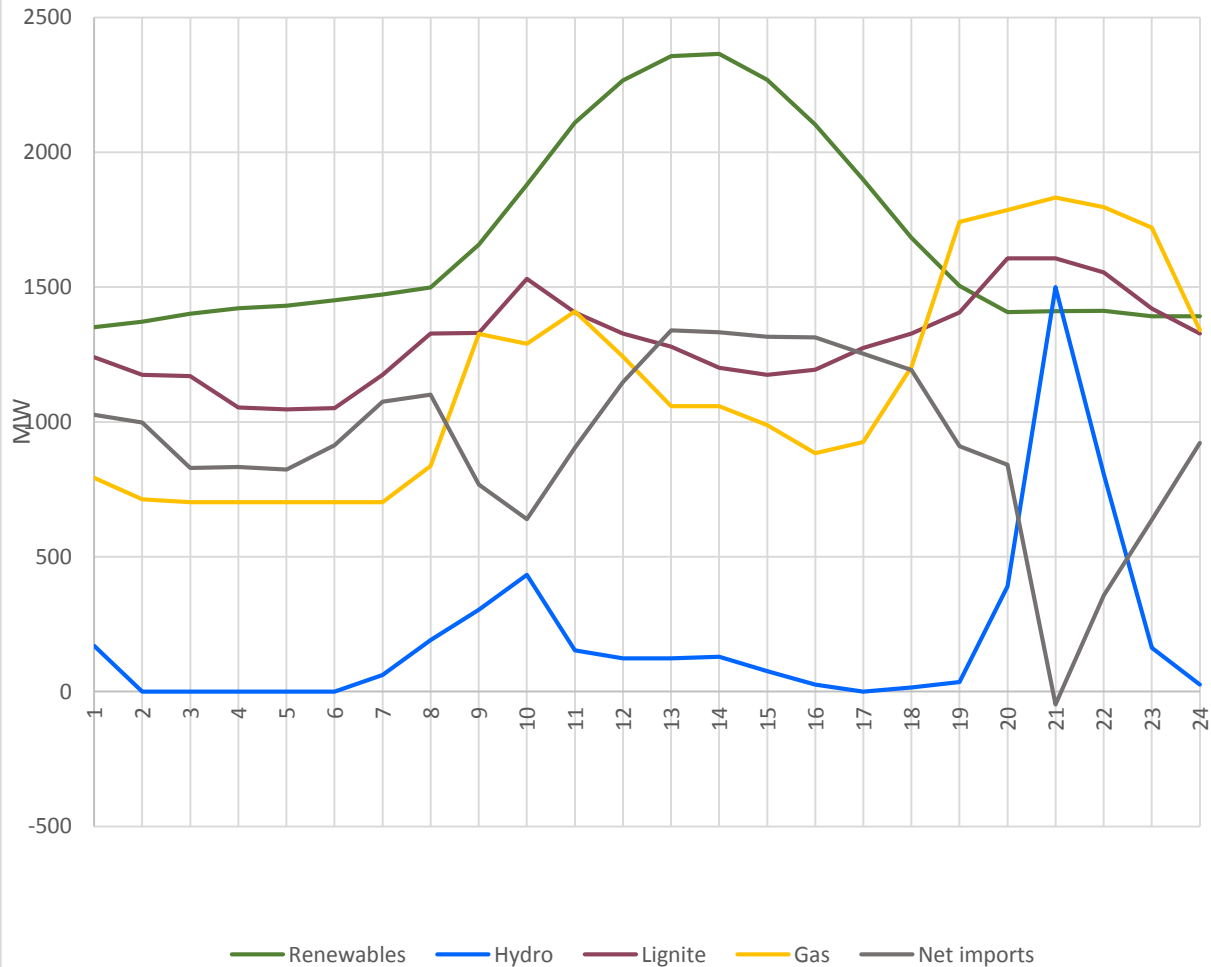
# Decarbonisation Process: Fuel market shares in Electricity Generation, Jan 2014 - Jul 2017



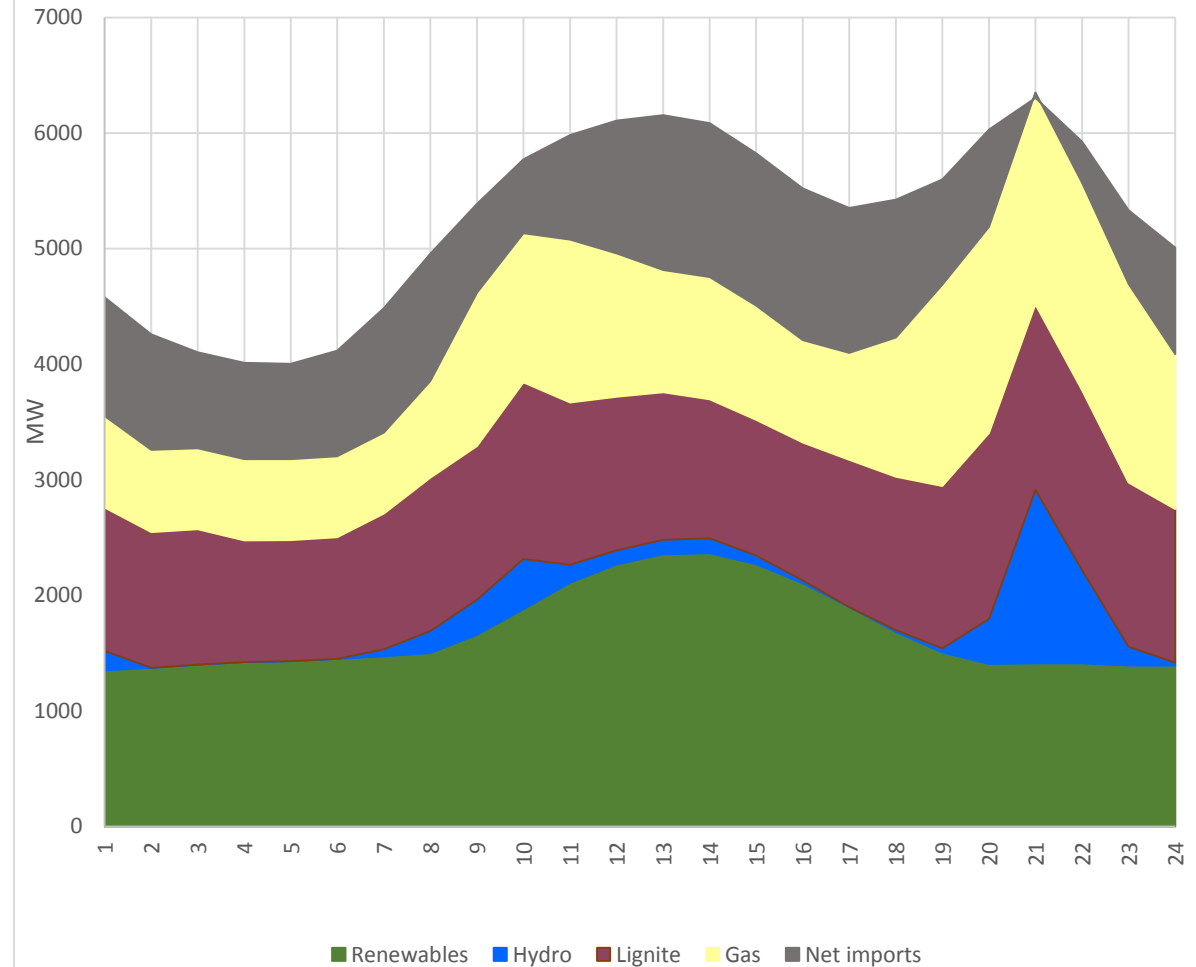
# Greece: Intra-day Energy Mix

## Key Aspects: Lignite-Gas Competition, Renewables, Imports

Generation mix 29-09-2017



Generation mix 29-09-2017



# Electricity Market: Transition to Target Model

- **A Power Exchange is being founded.**

Forward, Day-ahead, intra-day and balancing markets.

- **Market Coupling** with Italy (Sept 2018), then Bulgaria and other neighboring countries.

- **Expands** the market both in **geographical** scope and **time horizon**.

- Reduces **market power** potential. **Efficiency** gains from cross-border flows.

- Generators will **secure** production volumes -> Facilitates financing.

**Value of plant flexibility** to be better reflected.

- **Hedging** for suppliers -> More competitive retail products.

- Derivatives are expected to **multiply the market value by 3-5 times**.

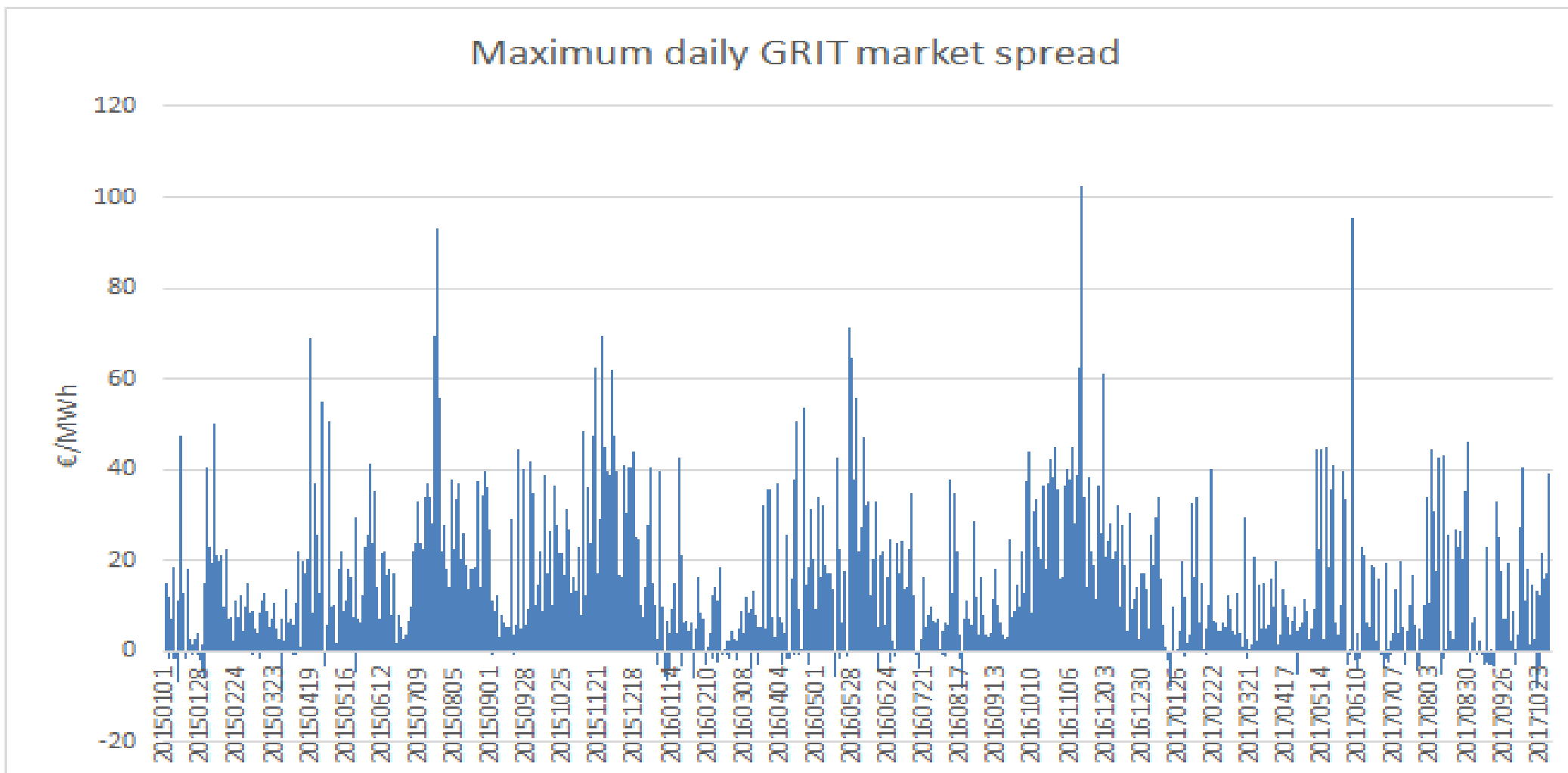
The Greek market is becoming more competitive and attractive for trading.

Opportunity for investors to become shareholders of the Power Exchange.

**Tender expected in Q1 2018.**

# An Exciting Price Spread

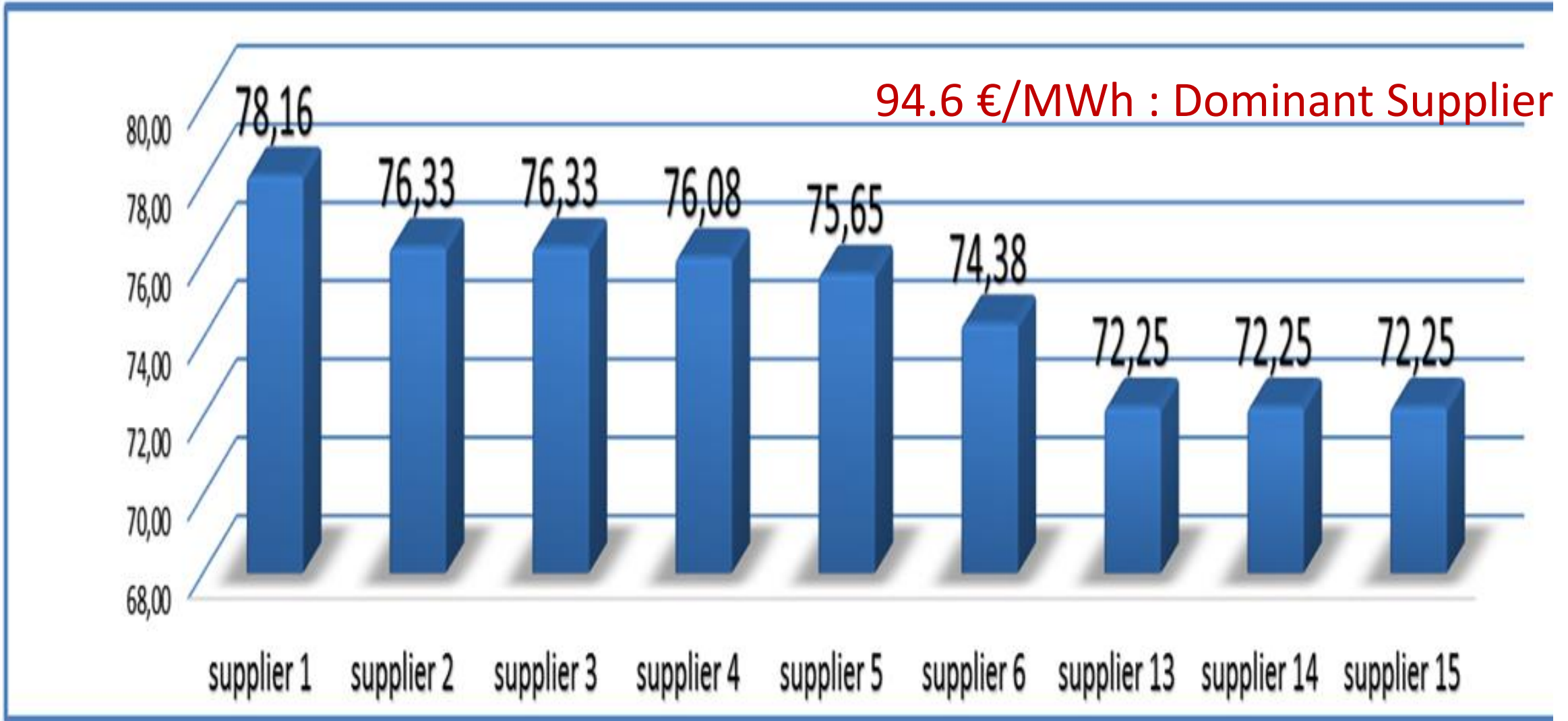
## Greece - Italy, Jan 2015 - Nov 2017





# Retail Market becomes more Competitive

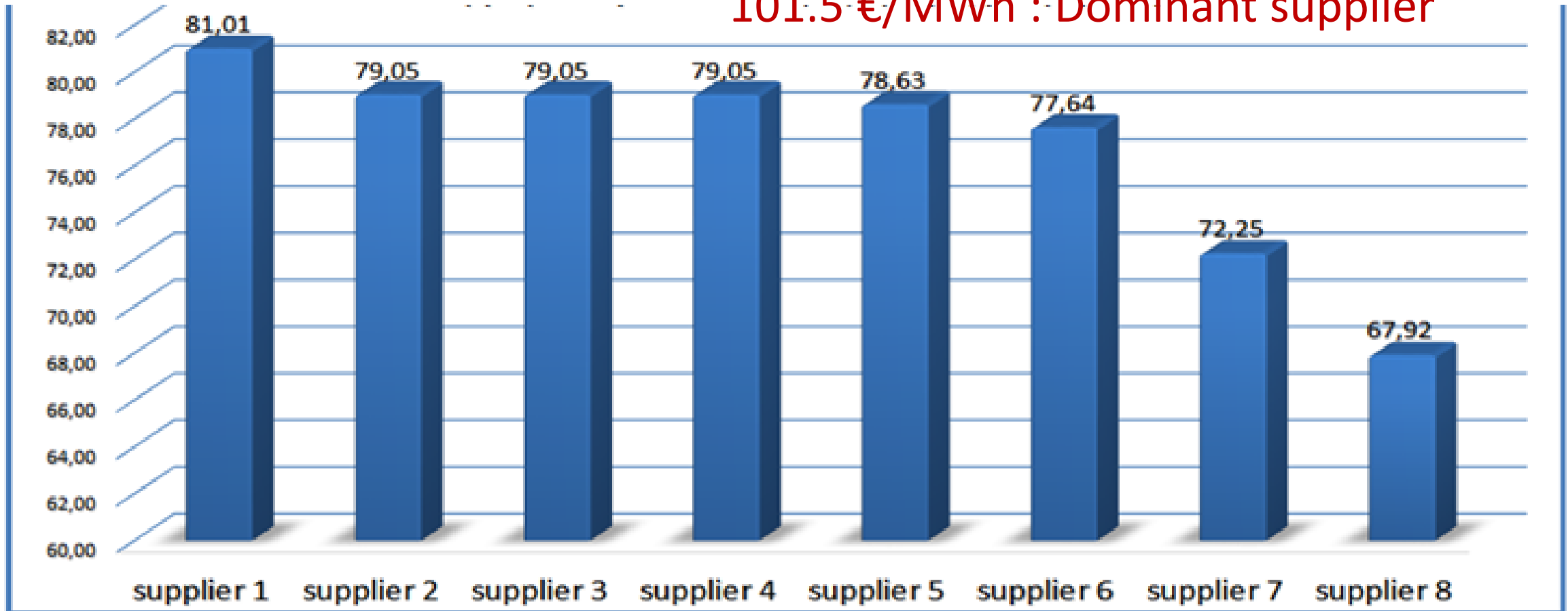
## Lower charges for Household Consumers (Q3 2017)



# Retail Market becomes more Competitive

## Lower charges for Commercial Consumers (Q3 2017)

101.5 €/MWh : Dominant supplier



# Smart Meters: Essential Tool for Consumers and Operators

## - A New Business Area in Greece

### Consumer choice: smart meters

Household consumers with electricity smart meters (%) - 2016



- Smart meter roll out close to 25% in European total perspective
- 17 MSs meet minimum technical functionalities as determined by EU law

# Electricity: Key Facts and Market Indicators

- The market structure is evolving in **a more competitive direction**.  
Currently: **Dominant player** (PPC) in both wholesale and retail.  
**79%** of conventional capacity.  
**60-70%** of conventional power production at monthly level.  
**57%** of day-ahead volume with RES included (September 2017).  
**83%** retail market share (vs. **92%**, a year ago).
- Regulatory incentives for new capacity yielded **more than 2 billion € investments**.  
**2500 MW** were installed by Independent Producers (6 CCGT, 1 OCGT).  
**>2000 MW** by PPC: 2 CCGT, 1 Hydro + 1 Lignite under construction.
- Generation Mix: **Well-diversified**.  
Lignite (23%), Gas (29%), Hydro (19%), Renewables (29%).
- **Retirements of plants** due to aging or environmental constraints.

**Significant potential for investments.**

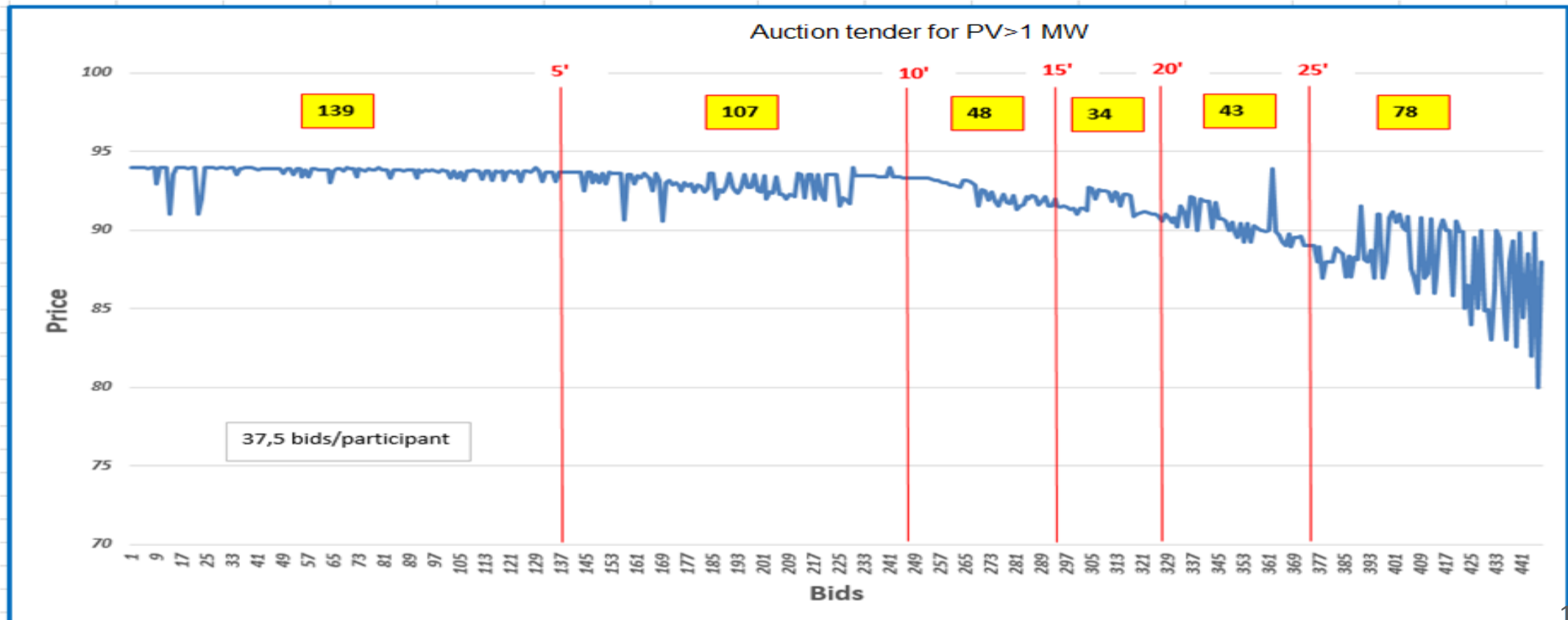
# Competitive Forces and Structural Reforms

- **Strong competition between CCGT units.**  
Reflected on the dynamics of their bids and the improvement of their technical parameters.
- Fuel Competition: Emerged since October 2015.  
**Lignite vs. Gas** - Comparable marginal costs (impact of falling oil prices).
- **Structural asymmetries: to be alleviated.**  
Currently, only PPC holds a portfolio of plant technologies (Lignite, hydro and gas).
- **Structural measures are being implemented.**  
**Divestment** of ~40% lignite capacity.  
Equivalent characteristics with PPC remaining portfolio.
- **Market test is being launched by the European Commission this week.**  
2 packages of lignite plants + related mines:
  - a) Megalopoli 3 and 4 in South Greece (600 MW nominal capacity).
  - b) Meliti 1 and option (license) of Meliti 2 in North Greece (780 MW).

# Renewables in Greece: A Dynamic Sector with huge potential

Objective: **RES to exceed 40% by 2030**

## Pilot auction for PV >1MW (Dec 2016)



# Remarks on Pilot Auction and New RES Framework

- **Competition** emerged in both categories (small and large projects) - 40 MW total.
- **Significant reduction in prices** were achieved compared to reference values:
  - Category I ( $\leq 1$ MW): Price range: 94.97-104 €/MWh → **weighted average price: 98.78 €/ MWh.**
  - Category II ( $> 1$ MW): Price range: 79.97-88 €/MWh → **weighted average price: 83.3 € / MWh.**
- In parallel, the price outcomes rendered the **projects viable.**
- Law 4414/2016 introduced the new RES framework.  
A **new RES support mechanism** (Sliding Feed In Premium) was approved by European Commission.
- **Permanent auction procedures:** Ministerial Decisions to be issued by March 2018.  
Both technology-specific and technology neutral auctions will be conducted.  
**First RES auctions expected in April 2018.**
- **RES participation** in the market.  
Regulatory framework to be finalized in Q1 2018, including aggregators.

# Gas Realities and Perspectives

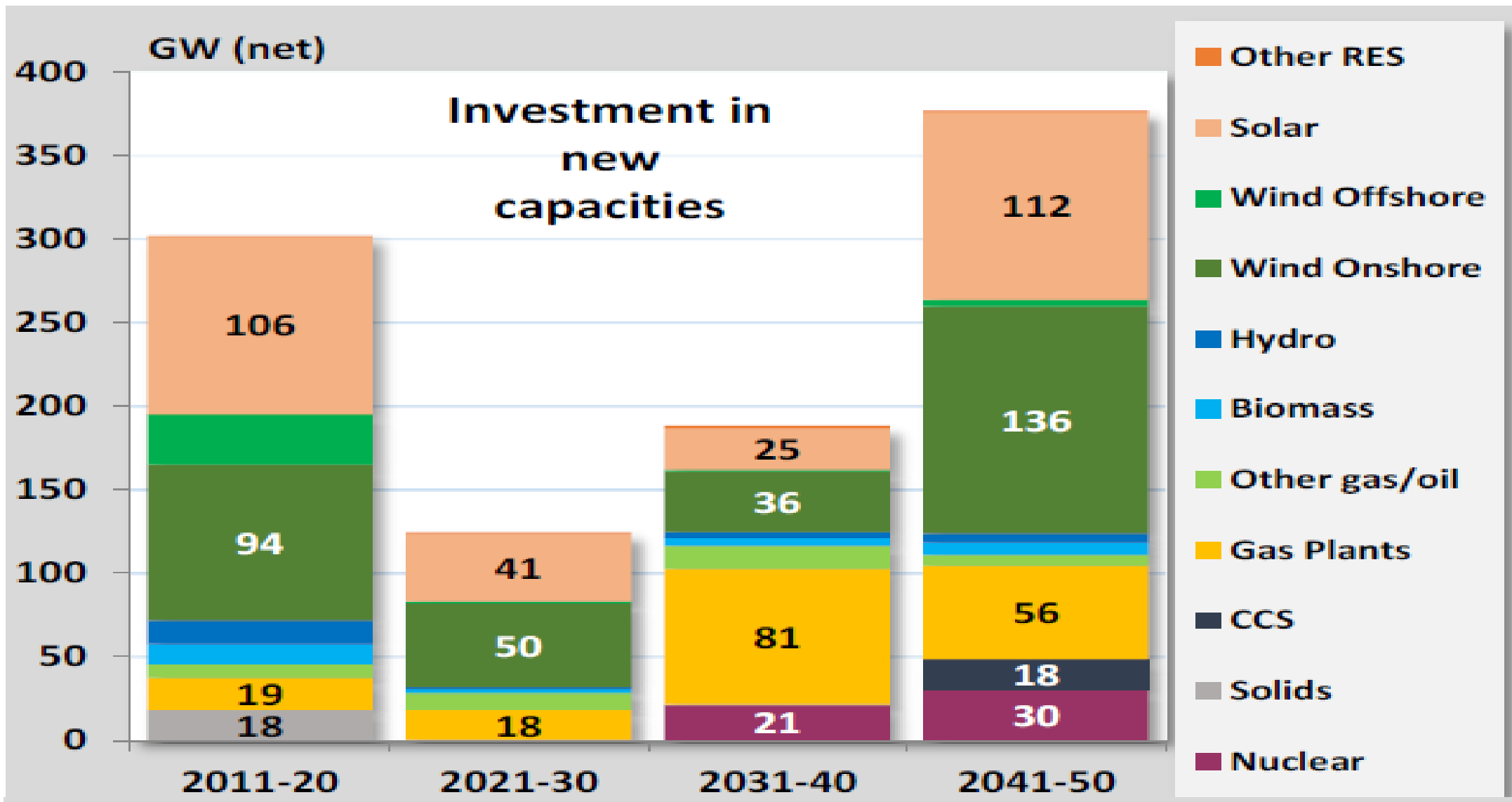
## A transitional fuel facing challenges but also a huge potential

- **Flexibility:** Back-up technology for balancing renewables' fluctuations.
- RES suppress wholesale prices-> **More than 20GW of gas plants mothballed in EU.**
- Recession Impact: **Gas demand dropped by 17%** (2015 vs. 2008) in EU.  
But, the trend is being **reversed**.
- Crucial for **SoS** and **emission reduction targets**.
- Expansion in **transportation**, including shipping.
- **Innovative** applications.





# Investment in Gas Capacity in European Union: Projected to Escalate



A common framework for gas markets in Europe has focused on:

- **Transparency**
- Short-term **liquidity**
- Enhance **competition**
- Stronger **connectivity** among markets
- Remove market entry **barriers**
- **Harmonisation** of legislation.

❑ **Impact on EU consumers**

More fair prices and more options have emerged.

❑ **Impact on market integration**

Less congestion.

Higher price convergence.

Increasing liquidity and flexibility tools.

**Gas  
Target  
Model:**

**Key  
Objectives**

# Gas System: Security of Supply and Diversification



## Volume Shares

	2016	2017
Bulgaria	64%	55%
Turkey	16%	12%
LNG	20%	33%

## Revenue

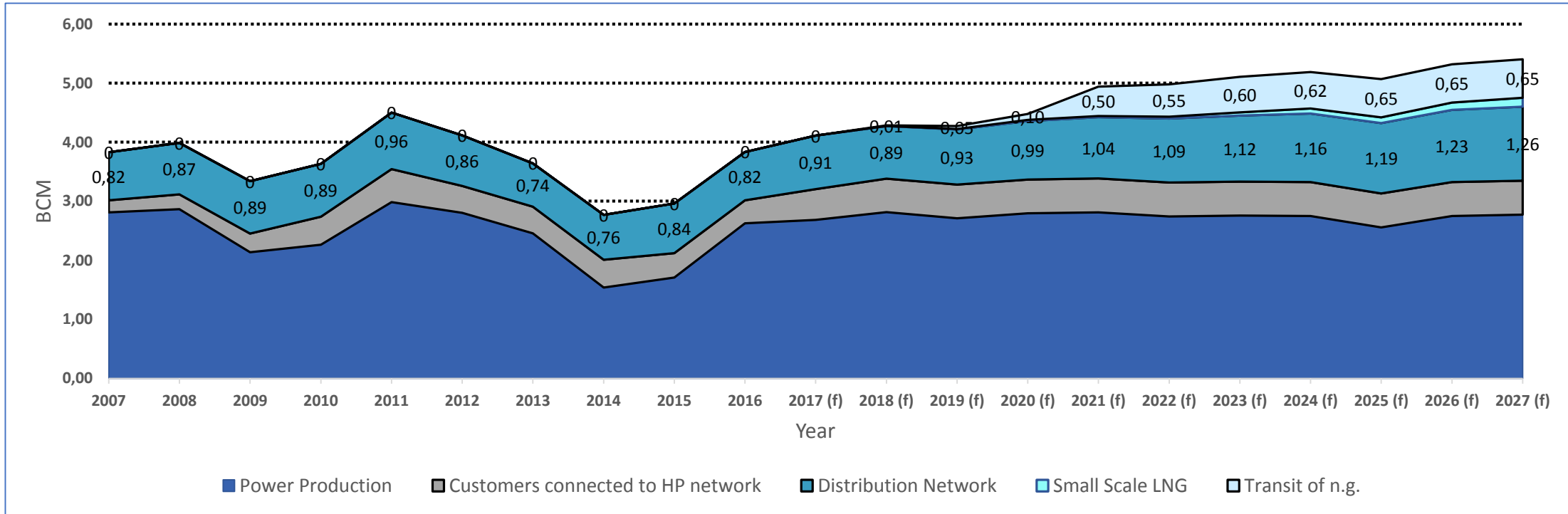
159 mil €

**Strong profitability**

**WACC: 9.23% (currently)**

**A tender is in progress for the 66% of the TSO (DESFA).**

# Gas Demand in Greece: Strong growth after a stagnation period



Source: DESFA S.A., National Natural Gas Development Study (2018-2027)

- ❑ Gas demand **decreased significantly** after 2011, when it reached a max of **4.5 bcm**.
- ❑ Consumption in 2016 amounted to **4 bcm**.
- ❑ Demand in 2017 has already **exceeded annual forecast**, being revised at **4.3 bcm**.

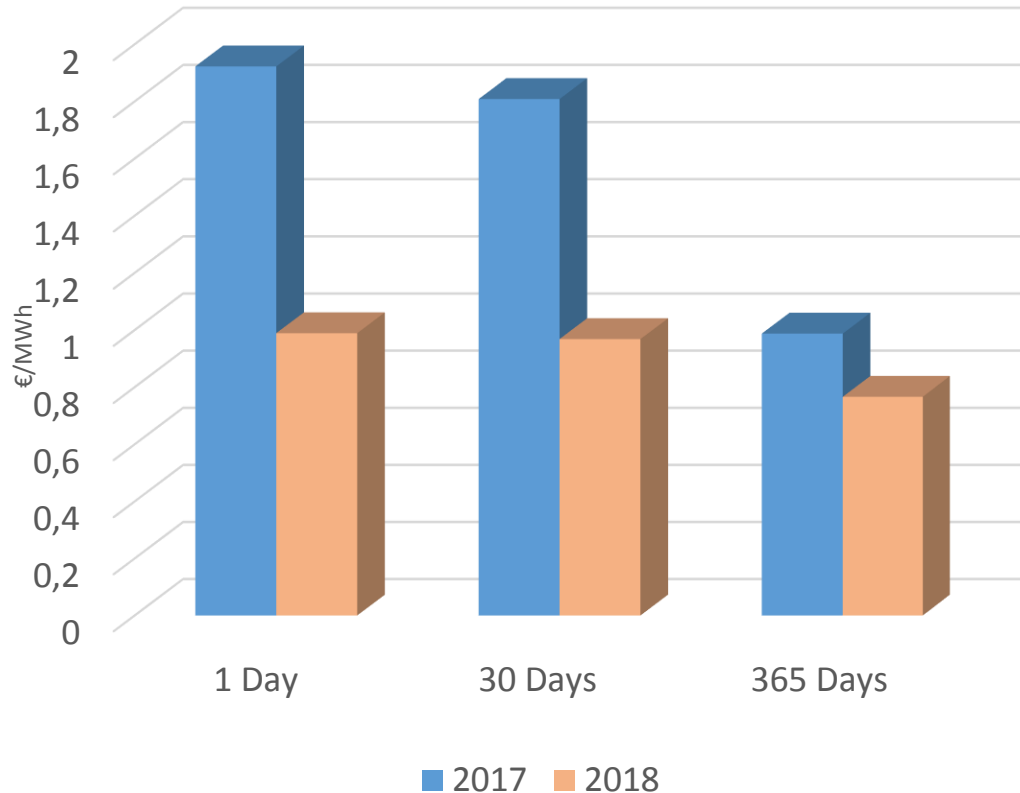
# New Tariff Regulation:

## Due to excess revenue - **6% reduction in network tariffs**

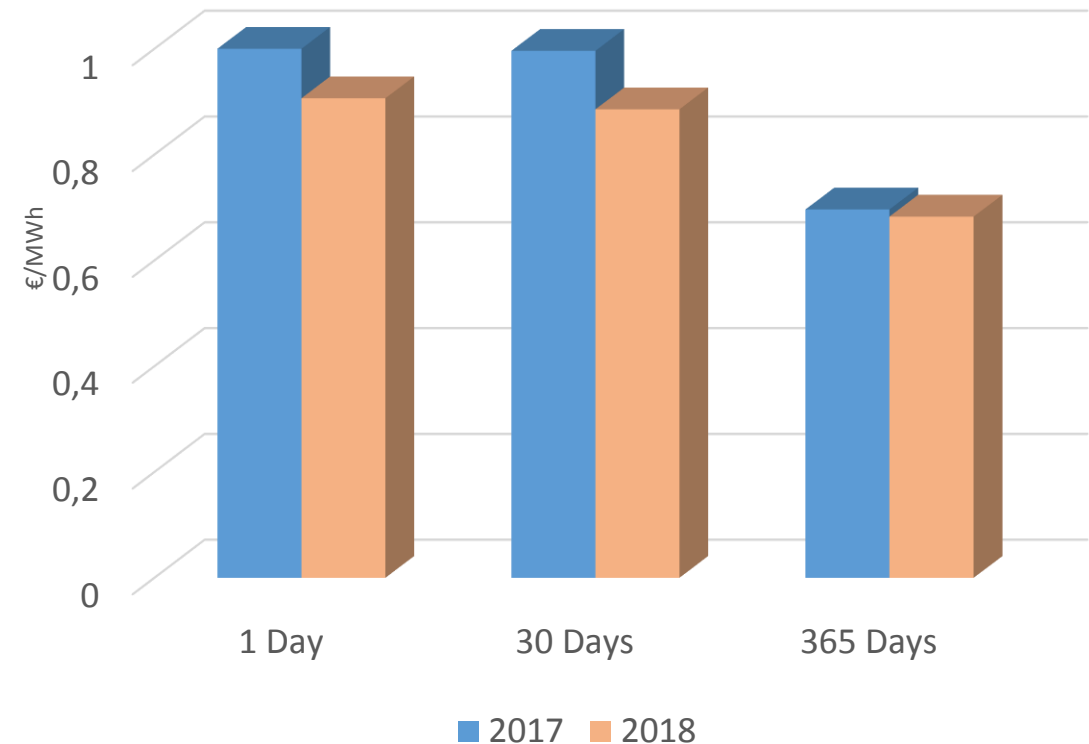
## **Stimulus for consumption**

### Examples

### Revithousa

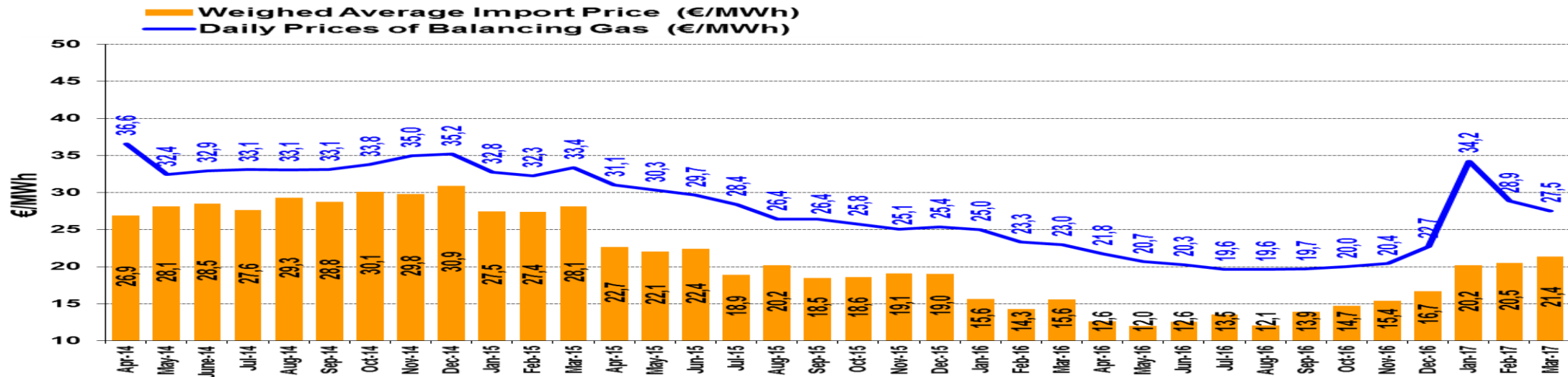


### Sidirokastro



# Price Dynamics in Greece

## Reforms enhance market activity



- Six importers active at the Interconnection Point with Bulgaria since end of 2016, vs. a single player previously.
- Retailer with 20% share among industrial consumers.
- 17 active players at the Virtual Nominations Point.
- A balancing platform to become operational in the 1<sup>st</sup> quarter of 2018.
- Network users will trade gas without the obligation of booking capacity (paper trading).
- Potential for capacity auctions with Turkey, similarly to Bulgaria.

# Key Gas Developments in Greece

Entry-exit tariff	<input checked="" type="checkbox"/>
Virtual point for trade	<input checked="" type="checkbox"/>
Capacity auctions at Interconnection Points	<input checked="" type="checkbox"/>
Congestion management procedural provisions	<input checked="" type="checkbox"/>
Price revealing mechanism	<input checked="" type="checkbox"/>
Gas release program	<input checked="" type="checkbox"/>

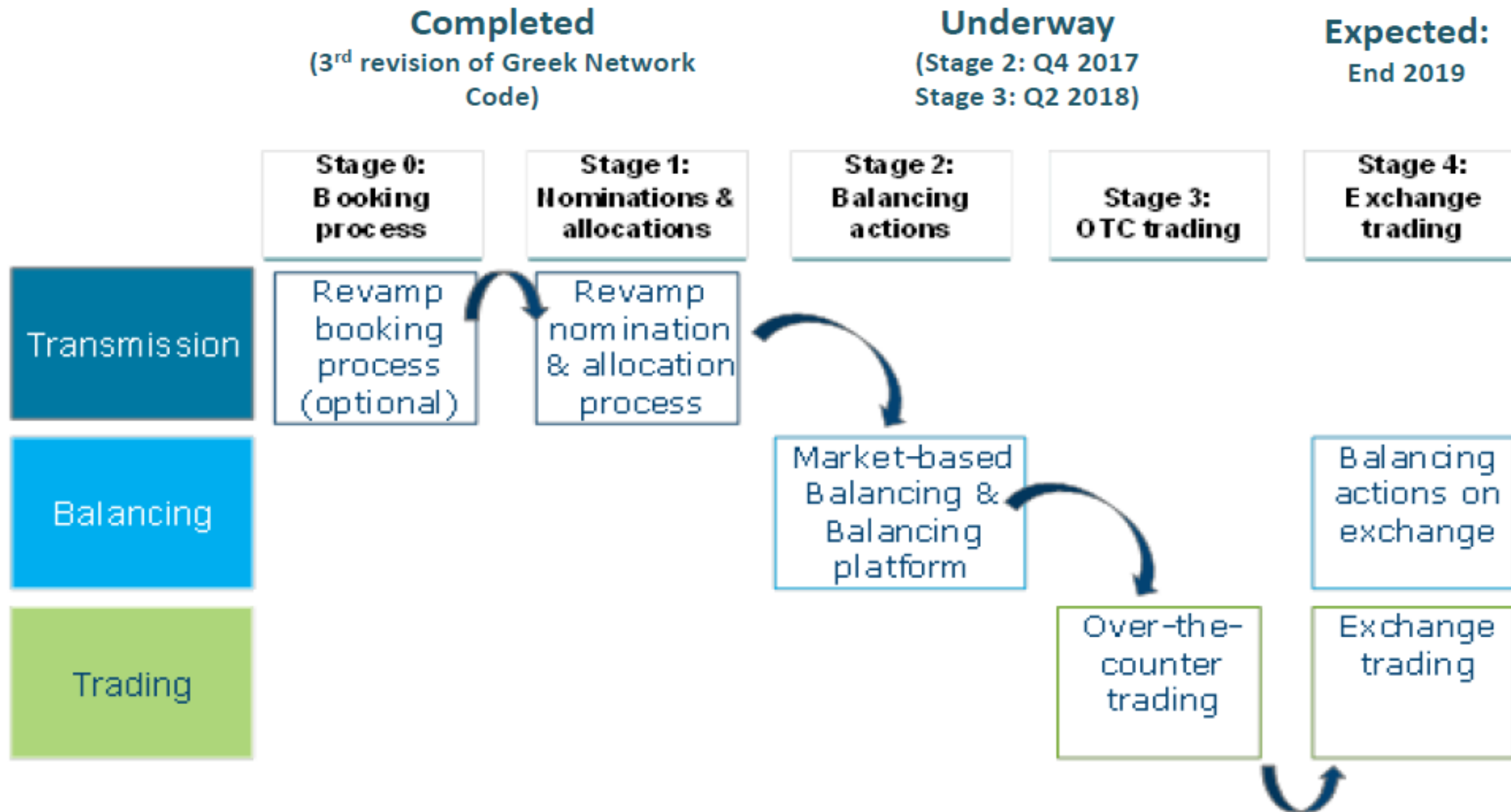
# Compliance with EU Framework (BG-GR)

- Interconnection Agreement: signed in June 2016 between the TSOs of Greece and Bulgaria. Enabled **commercial gas flow from Greece to Bulgaria from 1.7.2016.**
- EC: “ *A crucial step towards implementing EU rules on one of the last cross-border points in Europe where **historic transit arrangements, tailored to a single company, prevailed**”.*
- **Capacity booking** at the Interconnection Point:  
**Auctions** at the Regional Booking Platform since 01.01.2017.
- **Reverse flow:** Auctioning of an interruptible daily product possible since Sept 2016. On 6 March 2017, a bundled firm reverse yearly product was offered for the first time.
- Bundled products for firm forward capacity cannot be offered yet. Non-availability of firm forward capacity from BG side (**pre-existing long-term contracts**).
- **2<sup>nd</sup> version of the Interconnection Agreement** came into effect on 1.6.2017.

**Physical gas flow has become possible + flexibility for players.**



# A Gas Hub is emerging: Steps



# Major Interest for New Infrastructure

Entry Capacities (bcma)(*)			
		2016	2018
Existing Infrastructure	IP Greece - Turkey (NNGS)	1,4	1,4
	IP Greece Bulgaria	3,5	3,5
	LNG - Revithousa	4,1	6,3
TOTAL		9,1	11,3

**3<sup>rd</sup> Tank in LNG Terminal: Q2 2018**

## PCI Projects

- TAP (10-20 bcma)
- IGB ( 3-5 bcma)
- IGI (10 bcma)
- LNG Northern Greece (5-6 bcma)
- EastMed (8 bcma)
- CS Kipi

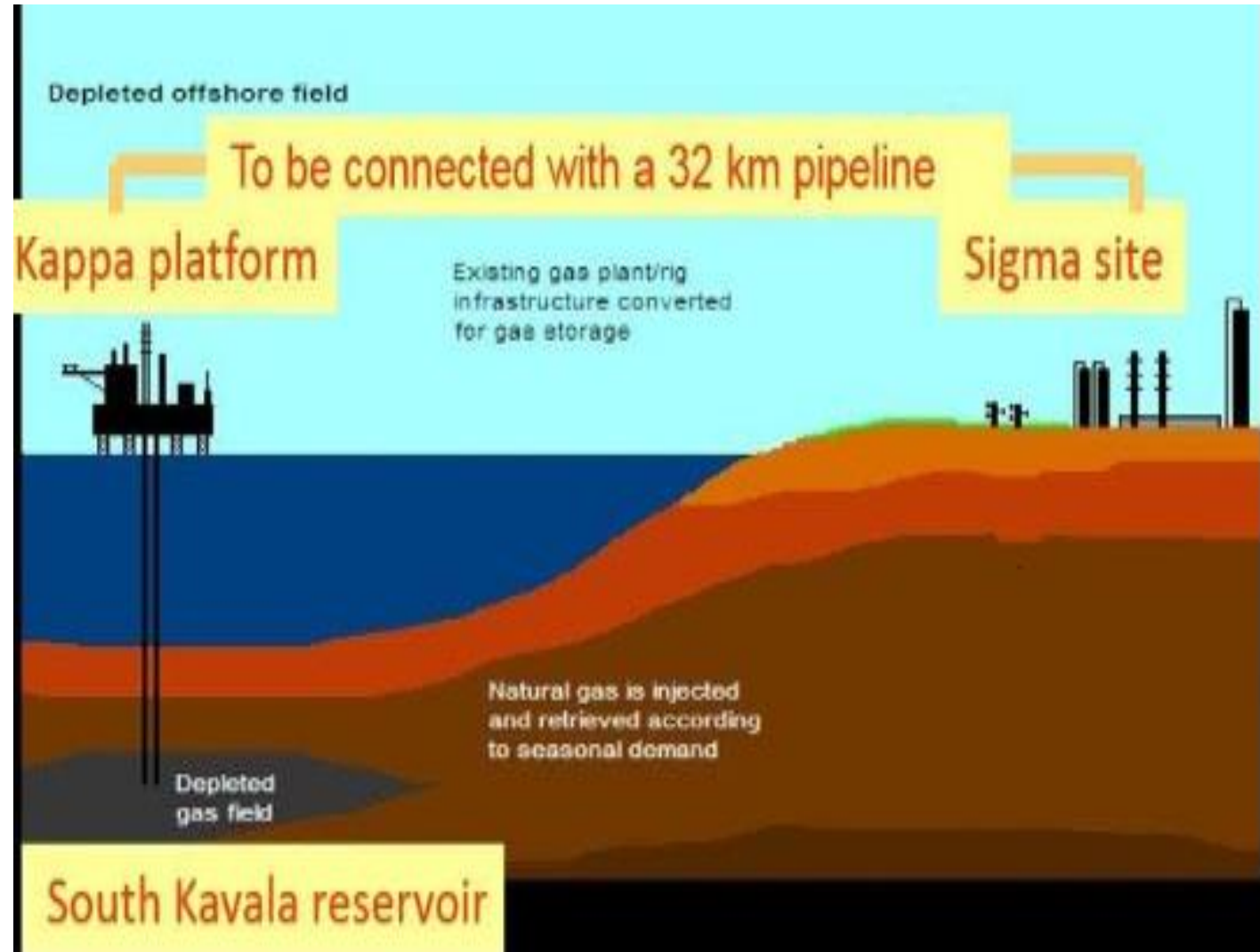


Source: PCI Interactive map

# Gas Storage Reservoir - South Kavala

## Forthcoming Tender

- ❑ **Project:** Conversion of depleted offshore gas field to Underground Gas Storage.
- ❑ Preliminary planning: Basic Scenario
  - Capacity: 950 mcm, of which **~350 mcm recoverable**.
  - Injection rate: 5 mcm/d.
  - Extraction rate: 4 mcm/d.
  - Possibility for 2 cycles per year.
- ❑ Security of Supply: ~150 mNm<sup>3</sup>.
- ❑ **Strategic Reserve.**



Source: <http://www.greekhydrocarbons.gr>

# The IGB Pipeline – A Market Test on the way

- 12.2015 - 4.2016: Non-binding phase (EoI) Phase was conducted.

9 companies expressed interest.

Up to 4.4 bcma forward flow, 1 bcma reverse flow.

- Market Test: May 2016 - January 2017.  
Encouraging response. Signing of ARCAs. Spare capacity to be allocated.
- Given gradually emerging interest, a supplementary market test will follow.
- In July 2017, a refined exemption application was submitted to NRAs.
- The two NRAs and the EC are collaborating closely on the exemption decision.
- The commercial operation of the pipeline is envisaged for 1<sup>st</sup> half of 2020.

# LNG in Northern Greece (FSRU)

- ❑ 170.000 m<sup>3</sup> LNG permanently located 17.6 km from the port of Alexandroupolis and 10 km from the nearest opposite shore.
- ❑ 24km subsea and 4km onshore pipeline interconnection. 14 months construction.
- ❑ Send-out capacity: 0.7 mcm/h. Annual capacity: 6.1 bcm.
- ❑ Direct access to the Bulgarian market via IGB and to the Turkish market.
- ❑ Market integration: Regional (South East Europe +Serbia+FYROM) and beyond.
- ❑ Security of Supply.

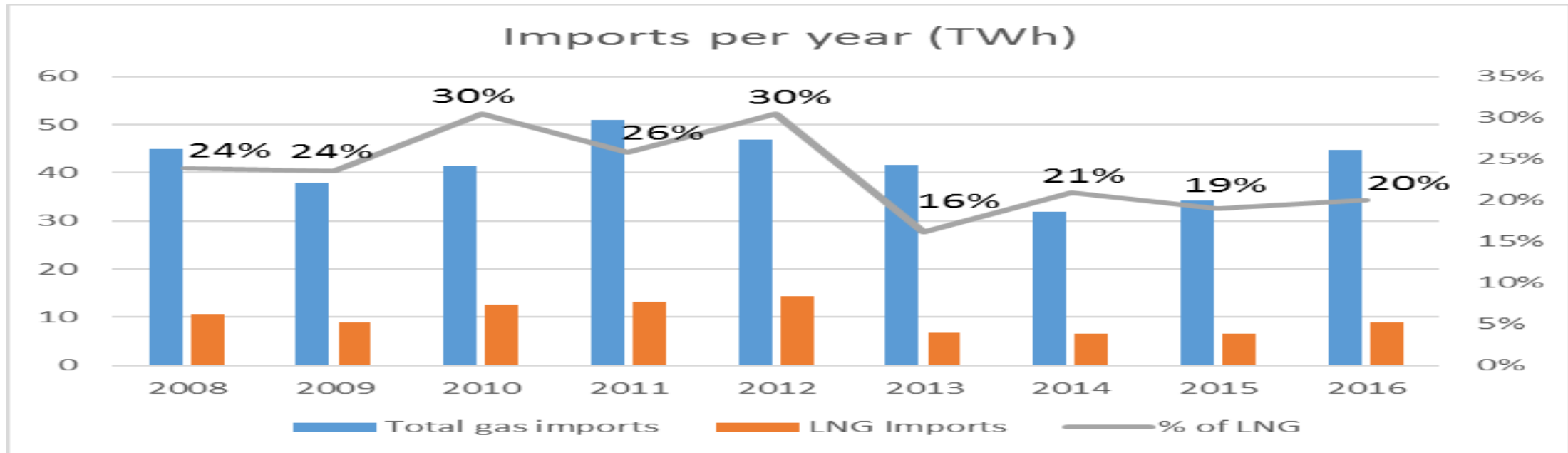


# Value in Regional Developments



- ❑ Crucial Corridor: Greece, Bulgaria, Serbia, Hungary.
- ❑ BG-RO bi-directional.
- ❑ Extended to Slovenia and Croatia.
- ❑ Harmonizing TAP flows with Italian storage use.

# LNG Share in Gas Imports - Strong Reversal: 33% in 2017



- LNG share declined from 25-30% prior to 2012 to **15-20%** afterwards, following the EU pattern.
- **Global** LNG dynamics, economic **recession**, **RES** penetration, regulatory changes in electricity market design.
- **Strong momentum** since December 2016.

# EC Follow-up Study on LNG and Storage

Market	LNG import total modelled		
	2016	2020	2025
BE	20.0	20.0	20.0
IT	75.8	75.8	68.3
NL	0.0	0.0	0.0
PT	19.8	11.5	25.0
UK	110.0	119.3	219.9
HR	0.0	2.1	6.2
LT	6.7	19.1	36.9
ES	95.9	106.2	87.6
MT	0.0	3.6	3.4
GR	11.4	31.1	39.1
TR	78.4	50.6	162.7
FR	50.0	25.0	25.0
PL	13.2	38.2	38.2
<b>Total</b>	<b>481</b>	<b>502</b>	<b>732</b>

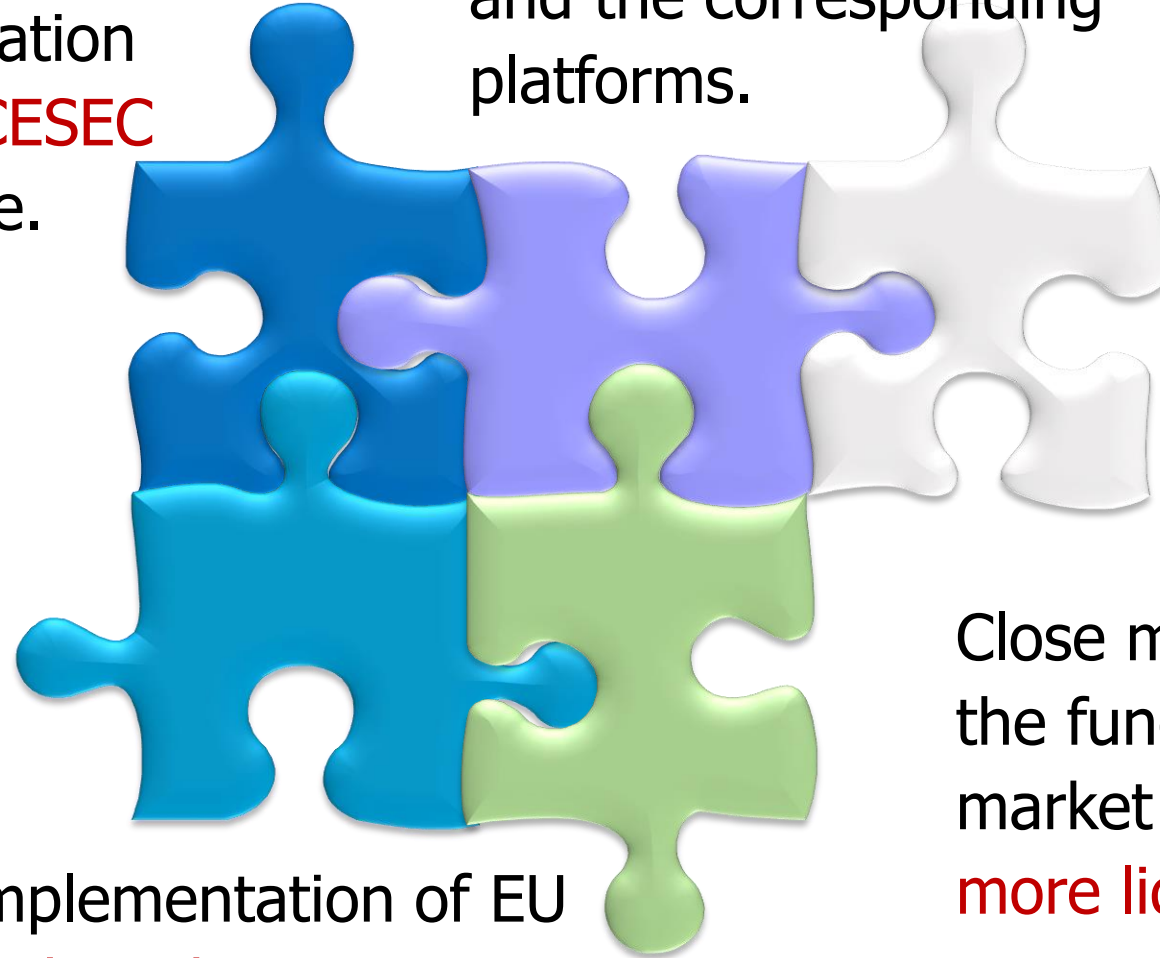


# Way forward

Active participation in the **CESEC** initiative.

Working on a more **coordinated approach** to regional gas trade and the corresponding platforms.

Implementation of **harmonized access** rules.



Full implementation of EU **Network Code** provisions.<sup>33</sup>

Close monitoring of the functioning of the market to allow for **more liquidity**.

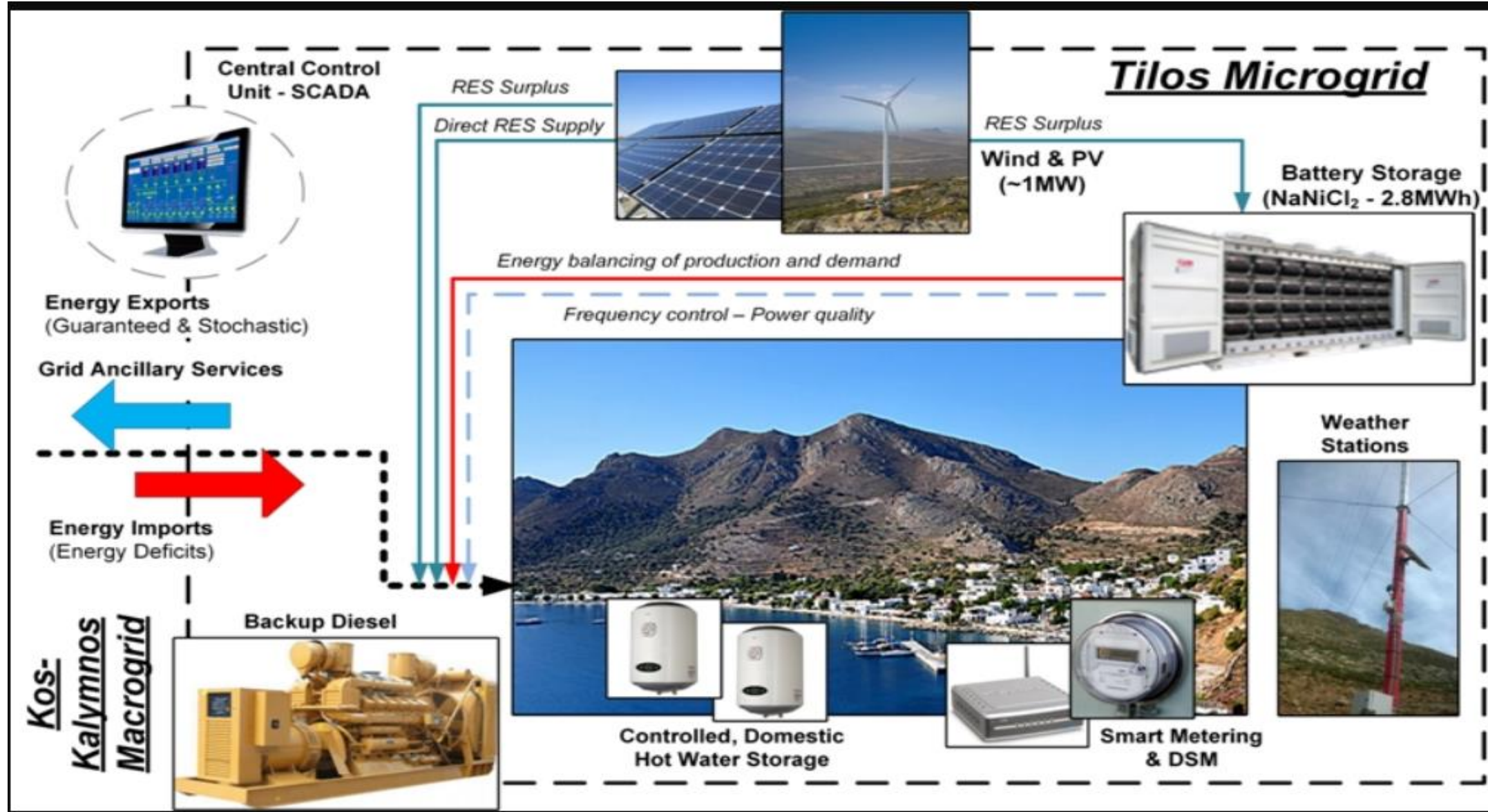
# Towards Full Opening of the Gas Market

- All gas customers will be eligible customers as of 1<sup>st</sup> January 2018.
- This will put an end to existing gas supply exclusivity.
- Several electricity supply companies have obtained gas supply licenses and the reverse. Combined products for electricity and gas are emerging.
- ❑ New services are planned at the LNG Terminal (Truck loading, LNG for shipping).
- ❑ Framework for CNG Virtual pipeline: being developed for the supply of remote customers. Development plans of DSOs will be approved by RAE. More than 250 mil. € investments and 1500 km new infrastructure to be developed.
- ❑ Both the gas and the electricity markets in Greece are being transformed, unravelling new business opportunities. An energy hub is emerging.

# From Windmills to Windparks: The Evolution in a Greek Island

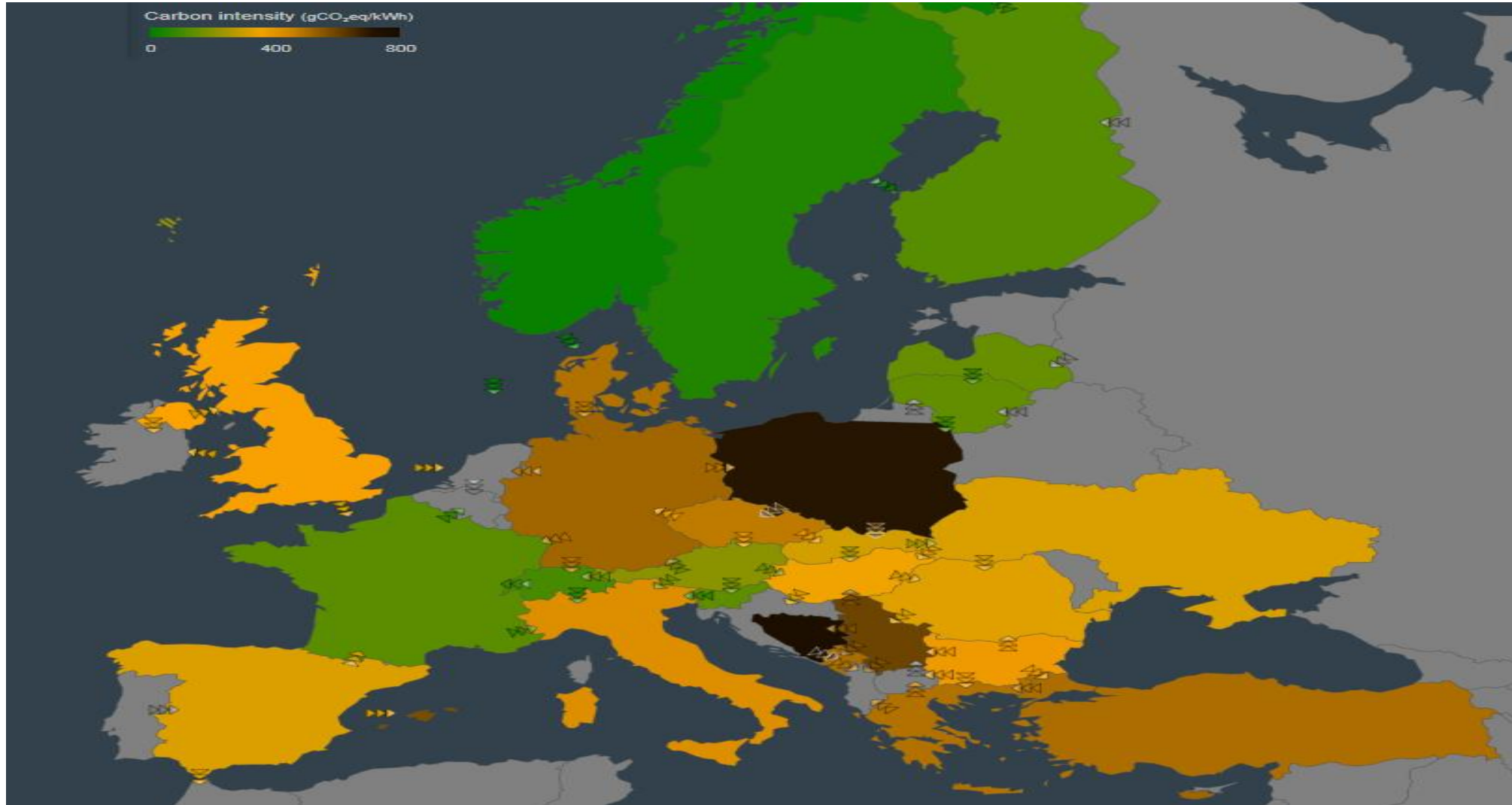


# Smart Island of Tilos: An Inspiring Case



# The Decarbonisation Challenge: Carbon Intensity for Electricity Production

## 5 December 2017



# Challenges and Relevant Quotes

## The Clean Energy Challenge in Europe:

**“3Ds”:** Decarbonisation, Decentralisation, Digitalisation

**In Greece, we believe that the energy sector is the right choice for investments, as we consistently reform our energy markets in a more competitive, more integrated and more sustainable direction.**

**“5Cs”:**

**“You need to make a **choice** in order to take the **chance** to create **change**”**

**“Remain **consistent** and **committed** to the reform process”**

# Future: To be invented

