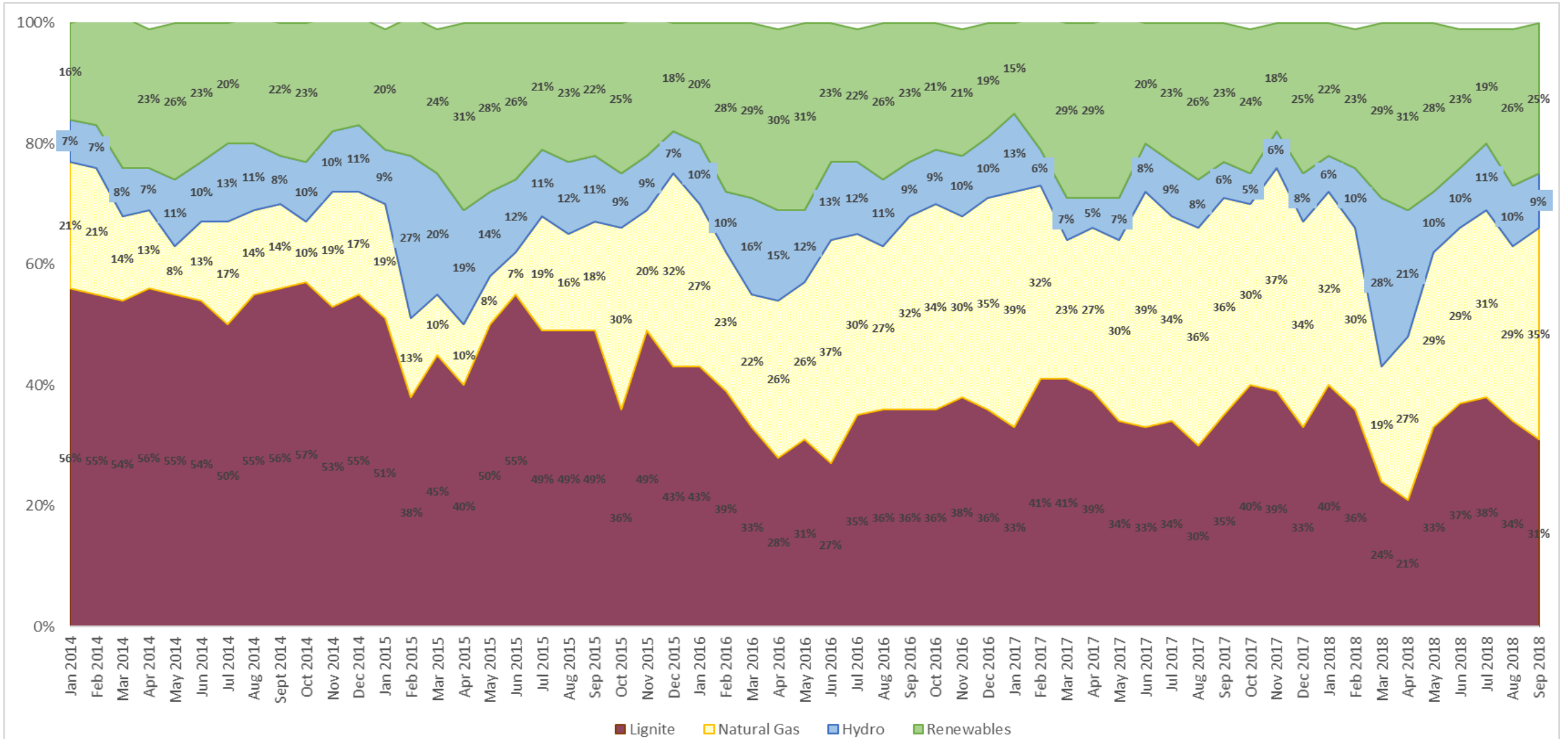


# **Energy Transition: The Interaction of Regulation with Global and Regional Challenges**

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Regulatory Authority for Energy (RAE), Member of the Board**

**2<sup>nd</sup> IENE Colloquium on “The Geopolitics of Energy Transition”  
Athens, 5<sup>th</sup> March 2019**

# Gradual Decarbonisation: Fuel Market Shares in Electricity Generation, 2014 - 2018



# Key Issues Reshaping Energy and Climate

## ☐ Global warming.

- ✓ Already **1°C above preindustrial level**. Increasing at 0.2°C per decade.
- ✓ Climate-related disasters: **290 bil € losses** in 2017, globally.

## ☐ Financing. Green bonds explode but remain **marginal**.

## ☐ Carbon leakage. Global price for carbon? **53 schemes** worldwide.

## ☐ Smart infrastructure: Global investments 40 bil € vs. 30 bil in gas plants.

- ✓ **Cyber-security** concerns.
- ✓ **Smart homes** in the EU: 8.5 mil in 2016 -> 81 mil in 2021.
- ✓ Still, new technologies create **new energy demand** (1% of global demand).

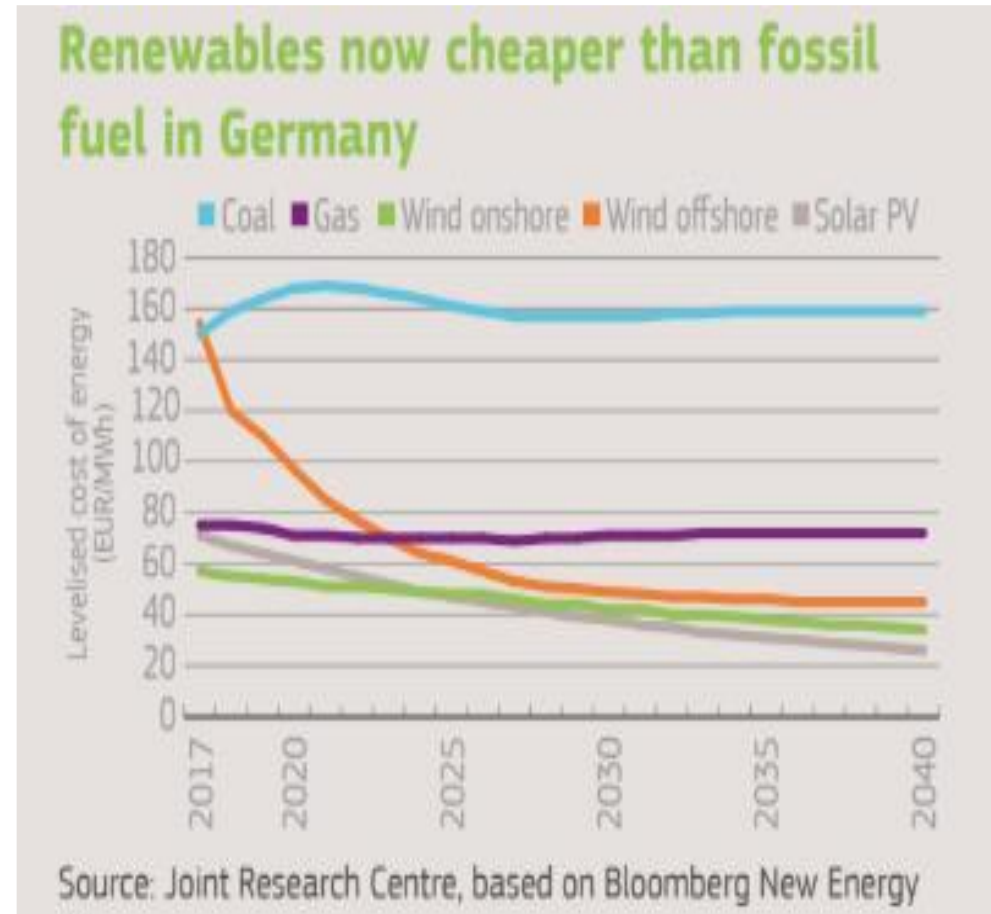
## ☐ Prosumers

- ✓ **Energy communities**: 17% of wind capacity, 21% of PV by 2030.
- ✓ **Half households** in EU (113 mil): **RES producers by 2050**.
- ✓ **Blockchains**: raised 265 mil € in 2017.

# Key Trends in Renewables

- ❑ RES: 17.5% of final energy consumption in Europe, 10% globally.
- ❑ China: Expected to invest more than EU and US combined.
- ❑ Cost of solar: dropped by 70% since 2010.
- ❑ Cost of batteries: dropped by 80% since 2010.
- ❑ RES in transportation: only 3.4%.
- ❑ 1.4 mil RES jobs in EU, 2017. Double by 2030.
- ❑ EV Sales: 60% up from 2018.
- ❑ But, lower incomes and coal regions struggle.
- ❑ Social contestation.
- ❑ Fossil fuel subsidies: 112 bil € over 2014-2016.

Changing focus: From scarcity to variability



# Global Drivers and Energy Transformation

- ❑ Shale gas revolution.
- ✓ US: Third largest exporter of LNG, following Qatar and Australia.
- ✓ Impact on Russian revenues. Contract renegotiations.
- ❑ China: Largest gas importer. Surpassed Japan. Demand shifting from coal.  
Trade war between US and China: Still unresolved.
- ❑ Decarbonization's trajectory: Coal to gas switch. But global coal demand stable.
- ❑ Dutch production: How Europe replaces this will redefine the EU gas market.
- ❑ Brexit, Sanctions on Iran, World economy outlook: Uncertainty.
- ❑ Focus shifted on countries possessing raw materials for RES and batteries (e.g.Chile).

# Transformation of the Greek Energy Sector (I)

- ❑ **More competitive markets, shifting away from monopolistic structures.**
- ❑ Antitrust measures on incumbents (PPC and DEPA).
  - ✓ **Electricity auctions:** Forward yearly products for suppliers (NOME).
  - ✓ **Gas release program:** Yearly & quarterly auctions for suppliers & large consumers.
- ❑ New investors in **System Operators**.
  - State Grid China: 24% of ADMIE.
  - Snam, Fluxys, Enagas: 66% of DESFA.
- ❑ **Divestment** of lignite assets.
- ❑ New shareholders in **gas distribution** and **supply** companies.
- ❑ **New market actors:** e.g. aggregators in electricity / paper traders in gas balancing.  
**Structural asymmetries are being alleviated.**

# Transformation of the Greek Energy Sector (II)

- ❑ **More integrated with the European markets.**
- ❑ Better **connected**, with new cross-border infrastructure.
  - Several PCI projects. **Major investment interest.**
  - Gas pipelines (TAP, IGB, East Med). Electricity cables (Euroasian, Maritsa East).
- ❑ **More harmonized in terms of market rules.**
  - **Target Model implementation:** New markets in isolated mode, 2<sup>nd</sup> Semester 2019.
  - Interconnection Point GR-BG: **Full compliance** with EU framework (CAM).
  - Gas balancing platform: 1<sup>st</sup> July 2018.
- ❑ More **diversified and resilient**, regarding Security of Supply.
  - LNG Terminal **extension**, Underground **Storage** (Kavala), **FSRU** Alexandroupolis.
  - **Reverse flow** from Greece to Bulgaria is now feasible.
  - Preventive Action Plan. Several **cost-effective measures** were adopted.



# Transformation of the Greek Energy Sector (III)

## ☐ More focused on the **clean energy transition**.

- Currently, **20% RES market share** in electricity production.
- **2600 MW of RES** to be auctioned until the end of 2020.
- Transition from Feed-in-Tariffs to **Feed-in-Premium**.

2.5 bil €  
RES investments

## ☐ Gas network is **expanded** across Greece.

## ☐ CNG / LNG framework for remote areas and customers.

250 mil €

## ☐ **Islands interconnections** and **small-scale LNG** to reduce oil-based production.

1.5  
bil €

## ☐ On-going developments on “**Smart Transition**”:

- **Electrical vehicles**: Framework for charging stations (RAE issued opinion).
- **Smart meters**: Roll-out scheme (under discussion).
- **Smart islands**: Tenders for hybrid stations (RAE issued opinion).
- **Energy communities**: Attractive incentives introduced.



# 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
<b>TOTAL</b>		<b>9,1</b>	<b>11,3</b>

(\*) LF=90%

## PCI Gas Projects

- TAP (10-20 bcma)
- IGB ( 3-5 bcma)
- Poseidon (10-20 bcma)
- LNG Northern Greece (5.5 bcma)
- EastMed (10-16 bcma)
- CS Kipi, Underground Storage (Kavala)



Source: PCI Interactive map

# IBG Exemption Decision: Some Terms and Conditions

- ❑ Exemption from unbundling requirements:
  - ✓ Fully certified prior to COD or 1<sup>st</sup> July 2020 or allocation of capacity with CAM.
  - ✓ Compliance program to avoid discrimination against non-shareholders.
  
- ❑ Exemption from Third Party Access:
  - ✓ Offer a minimum capacity at all times, non-exempted capacity at specified amounts.
  - ✓ Offer interruptible reverse flow capacity at least equal to firm forward flow capacity.
  - ✓ Market test to upgrade to 5 bcm/year.
  - ✓ Capacity caps for dominant players in Bulgaria and Greece.
  
- ❑ Tariffs: Competitiveness, Predictability and Transparency
  - ✓ The Tariff Code shall define the pricing mechanism for all capacity products offered by IGB, for different durations of firm and interruptible nature.
  - ✓ Initial IRR 7.9% and cap value 8.5%.
  - ✓ Any revenues from capacity bookings leading to higher IRR will be returned to IGB shippers.

# Regulatory Framework and Geopolitics: The Extension of Turkish Stream

- ❑ **Alternative routes** for 10 bcm Gazprom's gas:  
Bulgaria-Serbia-Hungary-Slovakia, ITGI or Incremental CAM, or TAP.
- ❑ The **Serbian Regulator** requested an opinion from the **Energy Community**.
- ❑ Energy Community: **Pipeline would increase gas supply security**.
- ✓ **But additional terms were proposed, to be reviewed by the Serbian regulator:**
- ✓ **Auctioning of gas and granting access at the S-B, S-H borders and 3 points within Serbia.**
- ✓ **"Already interested parties could deliver gas from Norway and the Netherlands"**.
- ❑ Serbian Gas Association: **"The Americans will not allow the project due to their shale gas"**.
- ❑ Bulgaria: **Tender suspended but not for political reasons**.
- ❑ **Complaint to Anti-Monopoly Commission by a company participating in construction.**
- ❑ Regulatory aspects in new routes via Greece: Treatment of **submarine segment**.  
**In Italy, the Ministry is the competent authority. Political support is essential.**

# Regulatory Framework and Geopolitics: Nord Stream 2

- ❑ The 1,225 km pipeline has **divided** the EU.
- ✓ Eastern countries, including Poland, interpret this as **increasing EU reliance on Russia**.
- ✓ Countries in northern Europe, especially Germany, **prioritise economic benefits**.
- ✓ Sweden and Baltic States have all granted permission.
- ✓ **Denmark** hasn't completed national permitting and was threatening to block the project.
  
- ❑ The **revised Gas Directive**:
  - ✓ Derogations may be obtained by "MS where the **first entry point of the pipeline is located**".
  - ✓ Denies the Danish regulator a decisive say over the project.
  - ✓ Gives the power **primarily to German regulators**.
  
- ❑ Germany can seek **an exemption** if this is **not detrimental to competition** in the EU.
  - ✓ The European Commission will take the **binding decision** on the exemption.
  - ✓ If MS's assessment differs, the **Commission's assessment prevails**.

# Regional Cooperation: Essential at Several Levels

- ❑ Risk assessment and crisis mitigation both for electricity and gas.  
Solidarity obligations arrangements to be adopted.
- ❑ Capacity mechanisms: Cross-border participation is a key element.
- ❑ Regional Operational Centers: reserves requirements and sharing.
- ❑ RES Schemes: Mandatory participation in tenders of RES from other MSs.
- ❑ Still, regional challenges emerge in SEE.
  - Efficient co-operation on infrastructure projects (TAP, IGB, Maritsa 2).
  - GR-BG Gas IP: Capacity auctions, reverse flow feasible, renomination cycles.
  - Coupling of electricity markets: Delayed. Currently, positive momentum.
  - Reliability of Greek-Italian electricity interconnector? Technical or commercial?

# Preventive Action Plan 2018

## Strategies and Measures assessed

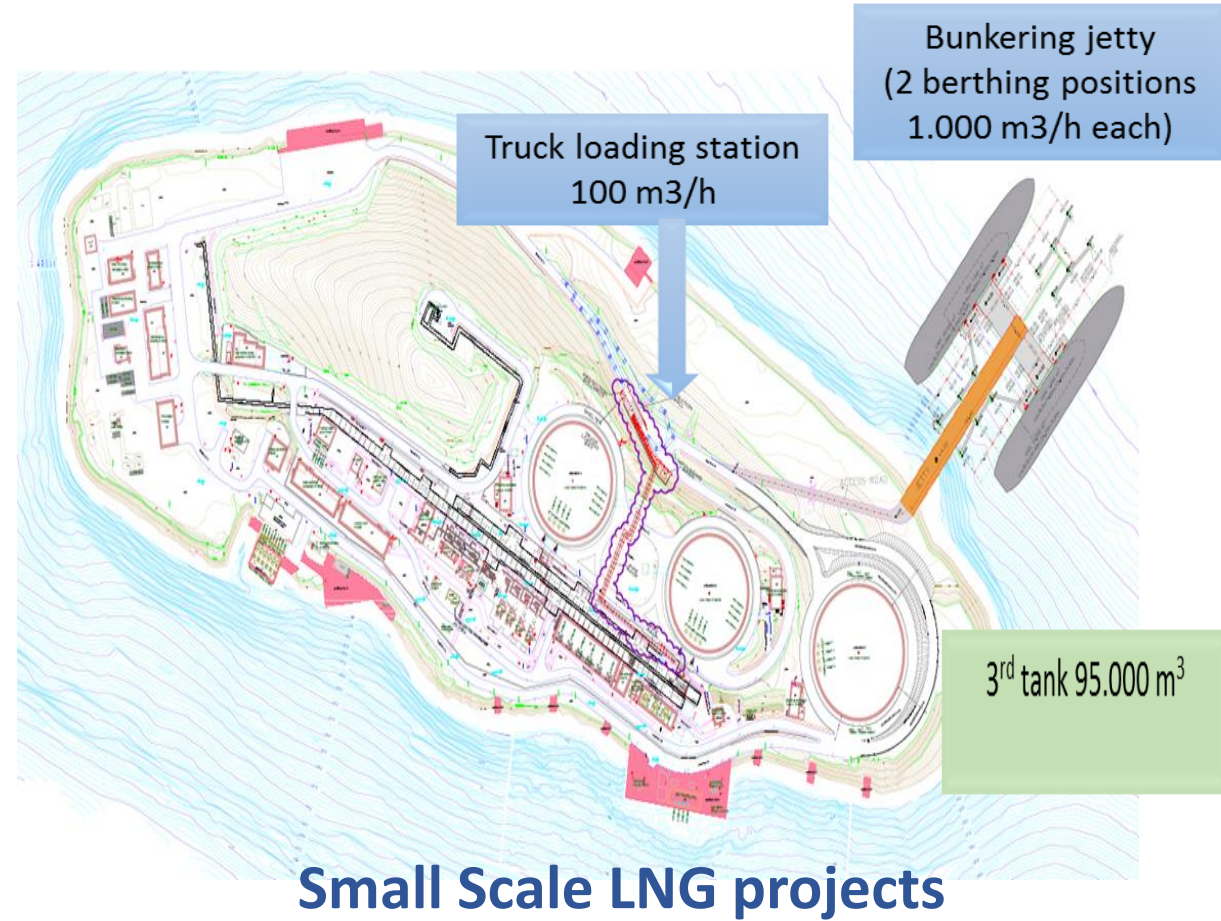
- Strategy 1**  
 Enhance the effectiveness of demand management measures
- Strategy 2**  
 Emergency supply and temporary storage of LNG (winter 2017-2018)
- Strategy 3**  
 Increase the level of the power sector preparedness to address risks/disturbances in the supply of natural gas



		Measures	
		2017	2018+
	D1. Enhancement of the interruptible consumers measure		
	D2. Enhancement of dual fuel availability (3 to 5 units)		
	D3. Winter stock/ FSU		
	D4. Supplementary supply agreements		
	D5. Winter stock/ Revithousa LNG tank		
	D6. Introduction of electricity market rules to reflect fuel availability		



# LNG Terminal Expansion



❑ **Impact on: Both commercial services and Security of Supply.**

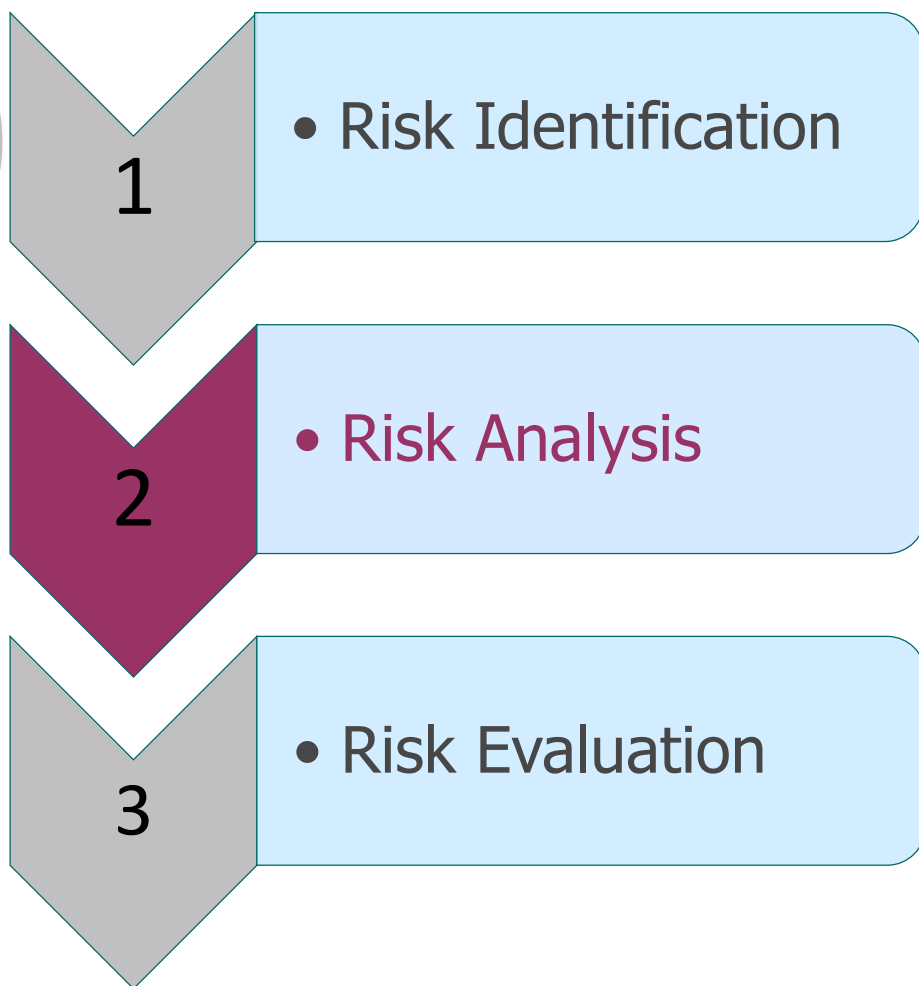
- ✓ Storage: From 130.000 to 225.000 m<sup>3</sup>.
- ✓ Unloading LNG vessels: size up to 260.000 m<sup>3</sup>.
- ✓ Truck Loading. Bunkering Jetty.

**LNG Swaps and New Services**



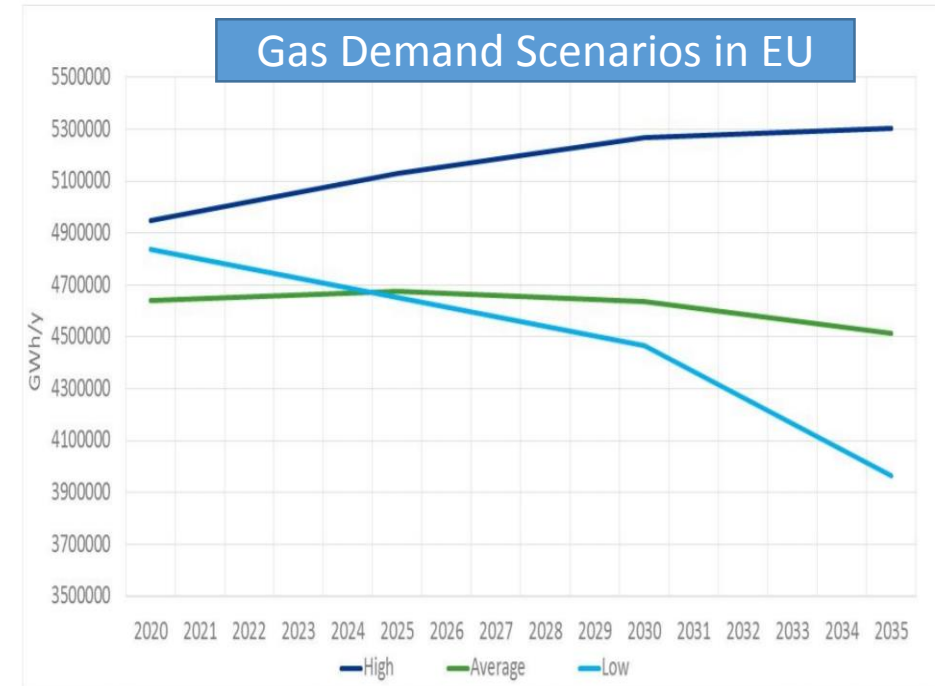
# Trans-Balkan Joint Risk Assessment

## RAE: Co-ordinator



# Gas Needs to be Redefined: Renewable Gases and Sector Coupling

- ❑ Crucial for flexibility, SoS and **emissions reduction**.
- ❑ Role in **heating** depends on energy efficiency.
- ❑ Expansion in **transportation**, including shipping.
- ❑ Development of **green gases**.
- ❑ **Power to gas**. Gas grids to act as storage for RES.
- ❑ From pilots to large scale (Leeds example).
- ❑ **Co-ordination** between electricity and gas in scenarios and planning.
- ❑ **Regulatory issues**: GOs for renewable gas, TSOs neutral role, Networks tariffs reflecting joint value, Innovation incentives, hydrogen standards.



**Transportation  
LNG & CNG**

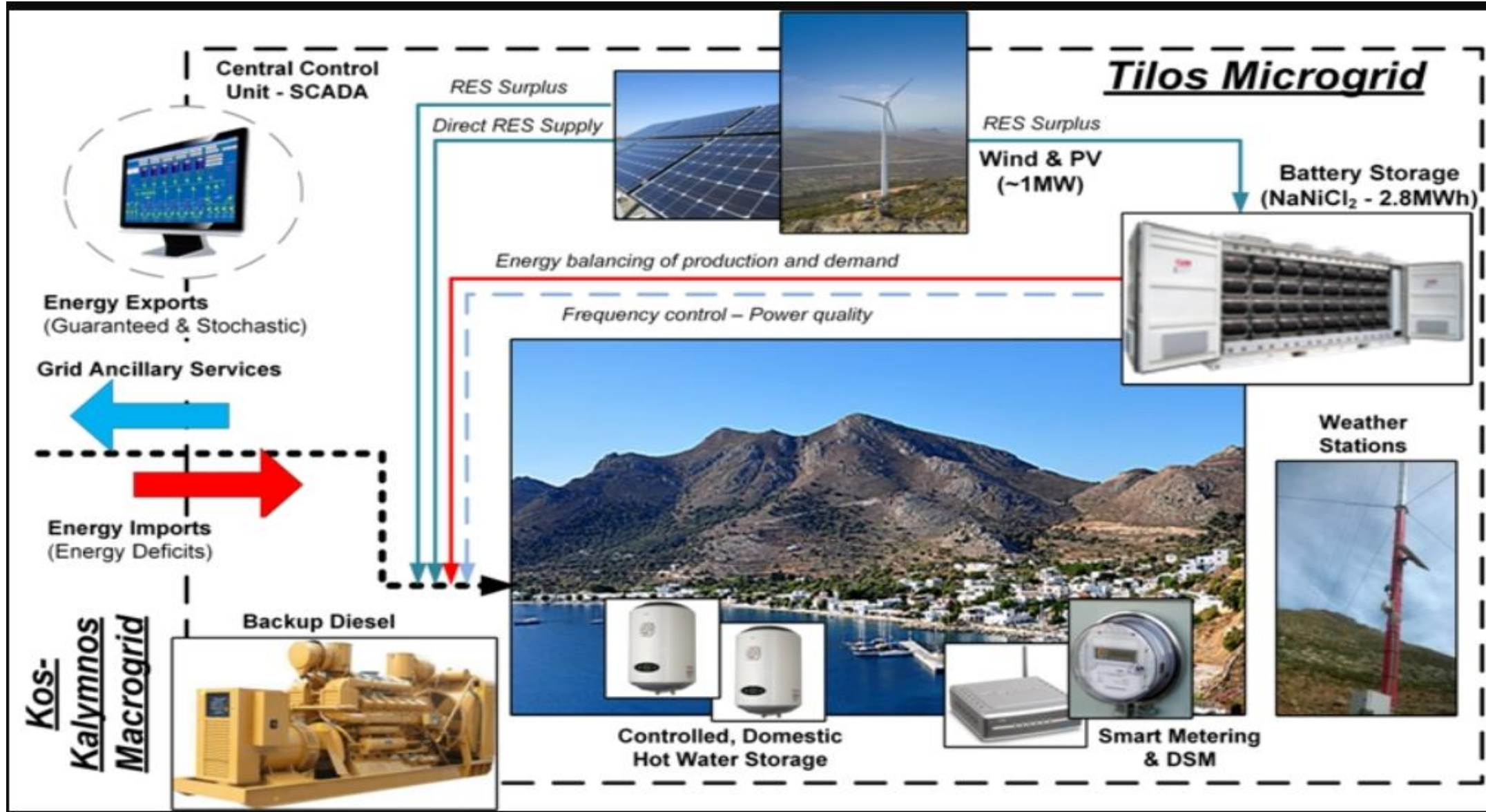


**Small-scale LNG  
and CNG**



**Power-to-gas**

# Smart Island of Tilos: An Inspiring Case

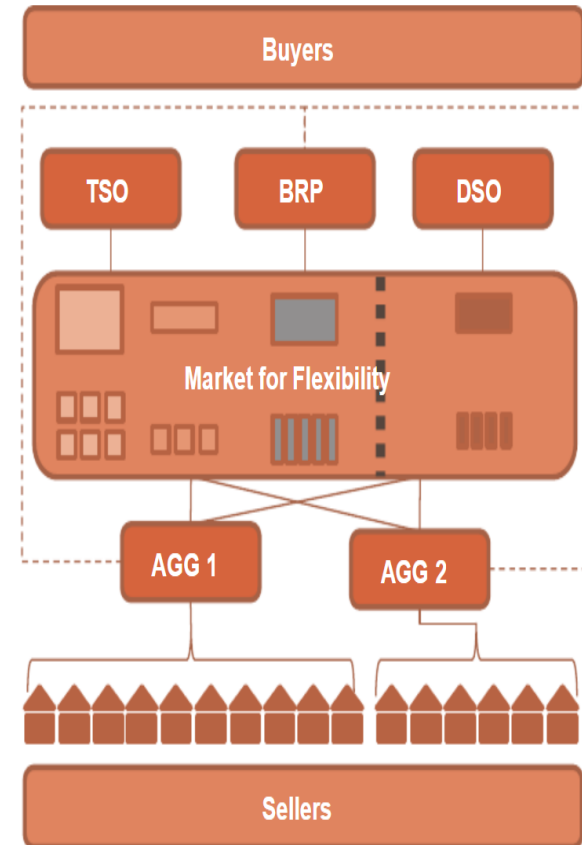




# Market Solutions to Infrastructure Challenges

## EcoGrid 2.0: Danish Island Bornholm

- Market design is reshaping infrastructure.
- On-going, large-scale, smart grid demonstration.
- 1<sup>st</sup> Phase: **Real-time market**. Variable prices for consumers at 5-minute intervals.
- 2<sup>nd</sup> Phase: Creating a new commodity, a platform on which it is valued, and a reconfiguration of actors taking part.
- Introducing a **flexibility market**: supplementary to intra-day and regulation markets.
- 2 Aggregators control heat pumps and electrical heating within prespecified limits.
- They compete for consumers.
- Incentive to develop innovative services.
- Feedback and info via web applications.
- Consumption adjustable to fluctuating consumption.
- Metrics of consumers' behaviour: peak response, time to peak response, energy delivered, ramping, how response changes w.r.t. to external conditions.



# Clean Energy Transition: Challenges for Energy Regulation

- ❑ **Adaptive**, open to innovation.
- ❑ **Reliable** and **predictable**, avoiding abrupt changes.
- ❑ **Independent**, reflecting technical capability and accountability.
  
- ❑ **“3D” Transition: At least cost for consumers.**
  - ✓ Huge costs involved in connectivity and smart networks.
  - ✓ **177 bil €/ year up to 2030.**
  - ✓ For a smooth impact on consumers (**prosumers**):
  - ✓ **Competition, demand-response, storage.**
  - ✓ **Revised grid tariffs, synergies across sectors.**
  
- ❑ *“The art of progress is to preserve **order amid change** and **change amid order.**”*  
Alfred North Whitehead

# Electricity Markets: Challenges at EU Level

- ❑ RES suppress wholesale prices and displace conventional plants, while requiring flexibility.
- ❑ Coal and Nuclear phase-out plans. More than 20 GW of gas plants have mothballed.
- ❑ Capacity mechanisms: More harmonized, auctions, emissions limit -> Uncertainty.
- ❑ Storage and Demand Response: Despite progress, business case + barriers.
- ❑ More ambitious environmental targets for 2030.  
Transition to feed-in-premium + RES auctions: to alleviate distorting impacts.
- ❑ More than 1 trillion € investments are required in infrastructure and capacity.
- ❑ Higher overall costs, often distributed across stagnating demand.  
In electricity bills, 50% reflects non-contestable charges. Network tariffs to be revisited.

**Do markets provide the right signals for investments?**

# EU Decarbonization Strategy Road-map across Sectors

