

“The role of IENE in RES development in Greece”

WIND Mission

Deree – The American College of Greece

October 14-15, 2019

A Presentation by Mr. **Costis Stambolis**,
Chairman and Executive Director
Institute of Energy for S.E. Europe (IENE), Athens

INSTITUTE OF ENERGY
FOR SOUTH EAST EUROPE



IENE Background

- Established in 2003 as a **non-profit** and **non-governmental organization** by a small group of energy professionals active in the broad energy field
- Headquarters: Athens, Greece
- IENE's activities cover 15 core countries in SE Europe and several in the periphery
- IENE's activities include:

Energy policy and geopolitics, production, transmission and distribution of electricity, hydrocarbons (upstream, midstream and downstream), electricity (solid fuels, hydroelectricity and nuclear energy), Renewable Energy Sources (RES), energy efficiency (transport, industry, buildings), hydrogen, energy and transport, energy and the environment ("greenhouse" effect, climate change, CO2 emissions), bioclimatic applications and energy conservation in the building sector, solid waste and sewage management for heat and power generation, clean coal technologies for electricity generation

The SE European Region Defined



- Core countries**
- Albania
 - Bosnia and Herzegovina
 - Bulgaria
 - Croatia
 - Cyprus
 - Greece
 - Hungary
 - Israel
 - Kosovo
 - Montenegro
 - North Macedonia
 - Romania
 - Serbia
 - Slovenia
 - Turkey

- Peripheral countries**
- Austria
 - Egypt
 - Italy
 - Lebanon
 - Moldova
 - Slovakia
 - Syria
 - Ukraine

Objectives

- ❑ To **provide** a forum for the presentation and discussion of energy and environmental issues
- ❑ To **encourage** public debate on energy and related issues backed by fully documented studies and analysis
- ❑ To **participate** in public consultations at national and European level
- ❑ To **contribute** in the formulation of energy policies at national, regional and international level, especially in SE Europe
- ❑ To **provide** professionals and the public at large with factual and unbiased information on energy and the environment

IENE's Mission and Vision

- IENE's **mission** is:
 - To promote a broader understanding of the key energy and environmental issues in the region
 - To provide a permanent forum and a suitable platform for the exchange of views and information
 - To be open to professionals, companies and stakeholders who are actively involved in the energy sector

- IENE's **vision** is to establish itself as the leading energy think tank in the region and at the same time develop a highly credible and worthwhile range of services covering information provision, research, assessment studies, sectorial surveys, educational activities, event organisation and networking
 - These services are offered primarily to its members, but also to government and industry and energy professionals at large

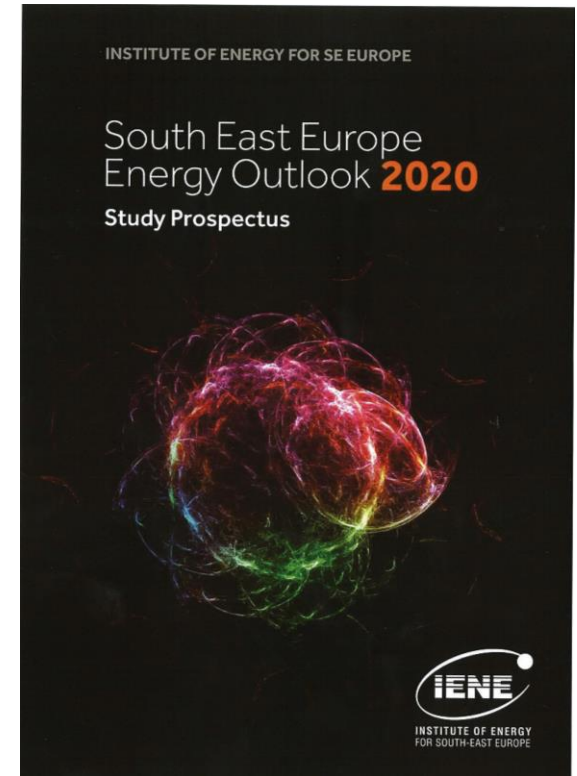
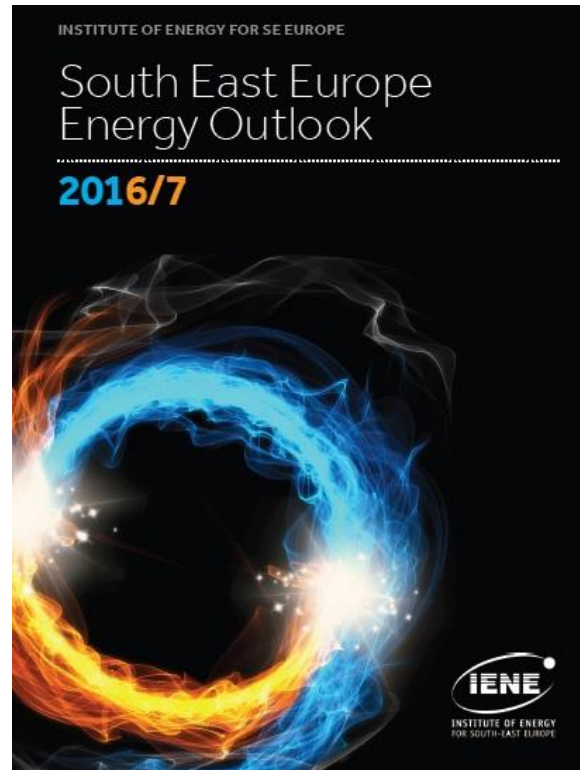
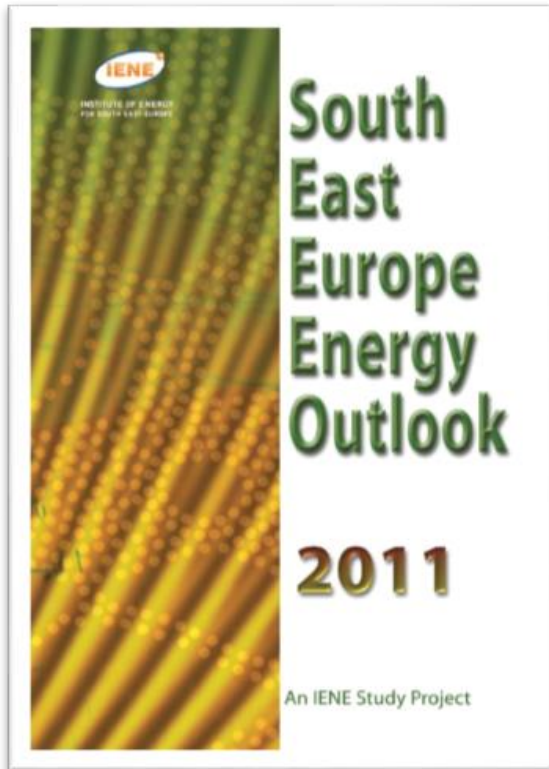
Activities and Services provided by IENE

- Documentation
- Information provision and dissemination
- Education (seminars, lectures, specialized courses and mid-career training)
- Research and technological development
- Participation in EU, international and regional programmes
- Cooperation with national and international organizations and private entities
- Cooperation with other S.E. European institutes and organizations
- Event organisation (Conferences, Seminars, Workshops, Roundtables)

Renewable Energy Sources have been central to IENE's Activities

- Since its inception RES have played a key role in the Institute's activities and development
- Since its start IENE has focused on RES related research studies, Working Papers and publications
- Several of IENE's founding member had long track record on RES work upon joining the Institute
- Testing and development of solar water heating equipment, photovoltaics, wind energy research, wind farm design and installation, related environmental studies, energy efficiency for households and building applications are skills which many of IENE's founding members and staff possessed
- Over the years, IENE has conducted a whole series of conferences and workshops devoted to RES where wind featured prominently
- Those events included the 3 Delphi RES Symposiums, 23 annual Conferences on Energy and Development, more than 20 regional Conferences and Energy Dialogue Meetings where RES and wind were central to the agenda
- Summing up it is so no exaggeration to state that:
 - (a) IENE by promoting constantly and consistently the need for increased RES applications, and wind in particular, has to a certain extent influenced developments at policy level over the last 15 years.
 - (b) IENE through its various pro RES activities has been a catalyst for greater RES penetration in the country's energy mix.

SE Europe Energy Outlook is a major study prepared and published by the Institute since 2011



Newsletters

Issue No 119 - January 2014

SOUTH-EAST EUROPE ENERGY BRIEF

Market Insight

Published by the Institute of Energy for South East Europe

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Market Forces

An identification of the forces at play at both global and regional level is well before essential in understanding market behaviour and emerging trends. On the one hand we have certain weak and countervailing forces while on the other we witness a number of strong forces which have a tendency to accelerate developments and occasionally even unleash things. A summary of these forces is shown in the accompanying table. During the past Christmas and early New Year period there appeared to be a preponderance of weak forces. Their ubiquity is reflected on commodity prices, which at one and gas exhibiting clear downward trends, but with high price volatility.

Developments related to Iran and the historic deal between the P5+1 nations and Iran in Geneva on November 24 (as already reported in the last last issue of Market Insight) continue to dominate news related to the oil and gas markets and to act as a major countervailing force. However, the threat of US severe imposed sanctions while negotiations continue undermines the prospect of reaching a compromise agreement by March.

While in Davao for the annual World Economy Forum Iran's President Hassan Rouhani delivered a message of "flexibility, engagement, pragmatism and peaceful competition" on 23 January, signalling his country's intention to seek constructive engagement with the world. But many critics remain skeptical about Tehran's real intentions.

Nevertheless, Iran's oil and gas reserves are huge and coupled with Iran's Oil Minister Bijan Zangeneh held one of the world's top oil executives, including Italy's ENI, France's Total, Britain's BP, Russia's Lukoil and Gasprom/Naft, at Davao that

Issue No 117 - January 2014

SOUTH-EAST EUROPE ENERGY BRIEF

Market Watch

Published by the Institute of Energy for South East Europe

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REGIONAL NEWS

Croatia, Bosnia, Albania, Montenegro, Azerbaijan Signed Southern Gas Corridor Pact
Azerbaijan, Albania, Bosnia and Herzegovina, Croatia and Montenegro signed on December 17 a memorandum of understanding on the development of the so called Southern Gas Corridor, Zagreb-based oil-innovator HRT reported.

Also the Shah Deniz consortium announced the final investment decision (FID) for the second stage development of the Shah Deniz gas field in the Caspian Sea, offshore Azerbaijan.

The FID signers plans to expand the South Caucasus Pipeline through Azerbaijan and Georgia to build the Trans Anatolian Gas Pipeline (TAGAP) across Turkey and to build the Trans Adriatic Pipeline (TAP) across Greece, Albania and Italy. Together these projects, as well as gas transmission infrastructure in Bulgaria, will create a new Southern Gas Corridor to Europe. The Shah Deniz consortium said,

The Shah Deniz consortium an BP operator (28%), SOCAR (14.7%), Statoil (15%), Total (10%), Lukoil (9%), NICO (9%) and TRAF (9%) (15.5%). The TAGAP partners are to be SOCAR operator (85%), BOTAS (20%) and BP (12%), following the purchase of TAGAP interests by BOTAS and BP that we expected to be completed in 2014.

The TAP partners are SOCAR (20%), BP (20%), Statoil (20%), Total (18%), Total (18%), E.ON (9.0%) and Asoe (15.0%).

In June, the Croatian foreign ministry said the country participating in the TAGAP project as well as the initiative for the Ionian Adriatic Pipeline (IAP) would like, in cooperation with Azerbaijan, to enable the supply of Caspian and Azerbaijan gas to Europe and to connect TAP and IAP which would facilitate the gas supply to run from Greece to Albania and Italy and from Albania to the east coast of the Adriatic.

Issue No 130 - February 2014

SOUTH-EAST EUROPE ENERGY BRIEF

Market Watch Special Report

Published by the Institute of Energy for South East Europe

THE EAST EUROPEAN OIL & GAS SECTOR

Russia's Upstream Sector

Turkey is drilling for oil and natural gas with more vigour than any other European country and plans several new projects. For 2014/2015 in order to spend up exploration of energy resources for the fastest growing major economy after China. More than 3,000 wells have been drilled in the country since 2010, an increase over 77% have been in the southeast Turkey, 15% in the Thrace Basin (European part of Turkey) 7% in other parts of Turkey and 1.3% of these were offshore areas. In the offshore areas, a total of 35 exploration wells have been drilled, 13 in the Black Sea, 13 in the Aegean Sea, 3 in the Aegean Sea and 13 in the Eastern Mediterranean Sea. As a result of these activities 203 of and 28 gas fields (24 in the Thrace, in different sizes have been discovered.



Also of the Black Sea region is involved the state owned Turkish Petroleum Corporation (TPAO) has been exploring the country systematically since 1955 and has made several discoveries. Major oil fields are located in SE Turkey (Anatolia) in the northern extremities of the Anadolu Basin while the gas fields are located in the Thrace Basin. Also Adana and Tor Golu Basins

Issue No 131 - OCTOBER, DECEMBER 2013

SOUTH-EAST EUROPE ENERGY BRIEF

Market Fundamentals & Prices

Published by the Institute of Energy for South East Europe

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Part 1 - Oil

A - THE GLOBAL SCENE

The price gap between Brent and WTI will probably narrow in 2014 as U.S. exports of refined fuels reach a record and crude supply from the Middle East and North Africa increase. According to Commodities 4Q, WTI is expected to average \$2 a barrel less than Europe's benchmark in 2014. From 2011 \$14.5 a barrel to 2012, December, the estimated spread at Goldman Sachs Group Inc. is 26 cents between the Brent and WTI spread reached an eight-month high of \$2.26 on 27 November, but it has since narrowed by 50%.

Brent is more volatile than WTI to global supply disruptions. As supply disruptions from Libya and South Sudan

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Figure 1 - ICE Brent Futures price (dollars per barrel)

Issue No 135 - October, December 2013

SOUTH-EAST EUROPE ENERGY BRIEF

Fundamentals & Prices

Published by the Institute of Energy for South East Europe

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Issue No 131 - October, December 2013

SOUTH-EAST EUROPE ENERGY REVIEW

Published by the Institute of Energy for South East Europe

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EDITORIAL

European Commission Seeks Accommodation with Russia over Gas Supply

As the year was drawing to its close the battle which had been raging near the last few months between the European Commission in Brussels and Moscow over Russian gas supplies to Europe appeared set to ease. The European Commission's position is that the South Stream pipeline, a major infrastructure project of great strategic importance for the continent's energy security, becoming indubitably a contentious issue. Although a billigerent state of affairs had for some time now existed between Europe and Russia as a result of the probe which started in 2012, over Gasprom's gas pricing and marketing methods as applied to various European customers, the tempo intensified last year given Ukraine's fragile position and Europe's mounting pressure to be the country to the EU through a binding association treaty.

Gasprom's decision back in 2009 not to supply to Ukraine in a dispute over unpaid bills had not been forgotten either, as Europe further went sufficed considerably over a prolonged period. Gasprom's which is controlled by the Russian state, provides about a quarter of Europe's gas, to heat homes, fire industrial kiln and fast power stations, much of it via a pipeline through Ukraine. European utilities and regulators have since tried hard to reduce the Russian company's market power.

The main battle is now fought over the method of setting the price of gas together with access to Gasprom's extensive pipeline network. Gasprom has been that its European customers continue to buy expensive gas on long contracts, sometimes lasting decades, with prices linked to the cost of oil. Gasprom makes a nice profit on such

Issue No 13 - July 2013

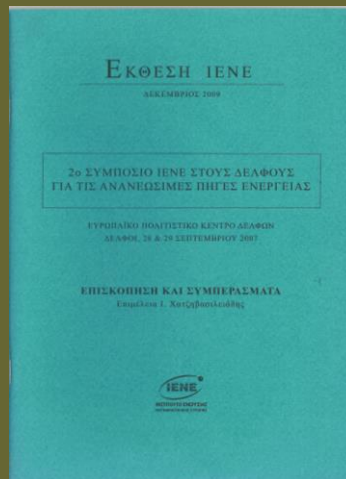
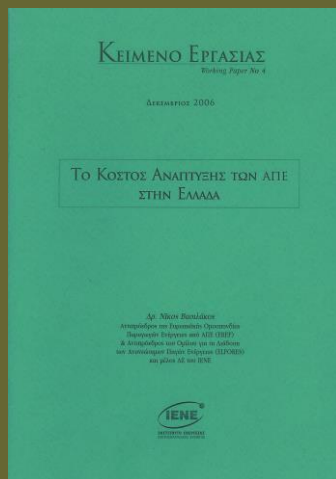
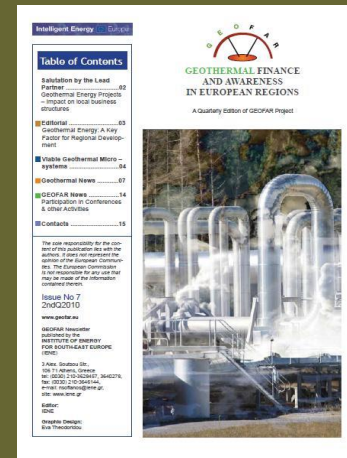
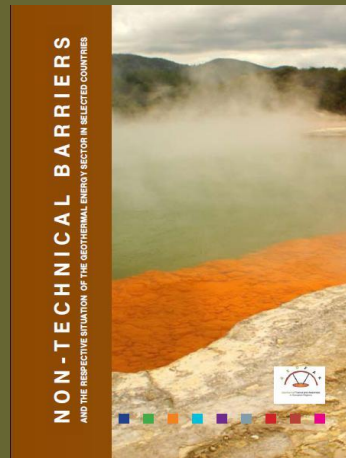
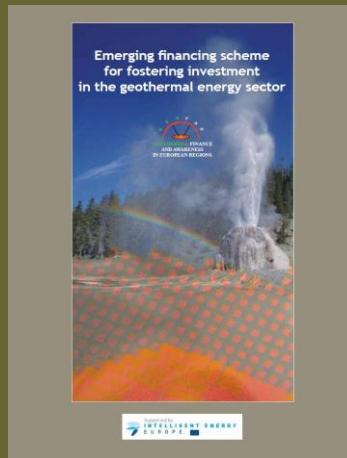
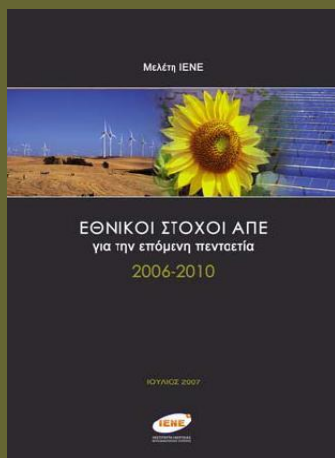
EVENTS BULLETIN

International and Regional Conferences and Events on Energy

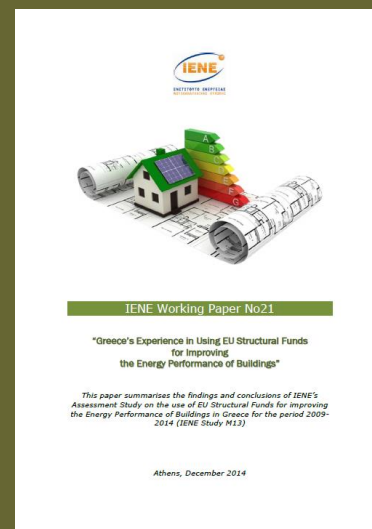
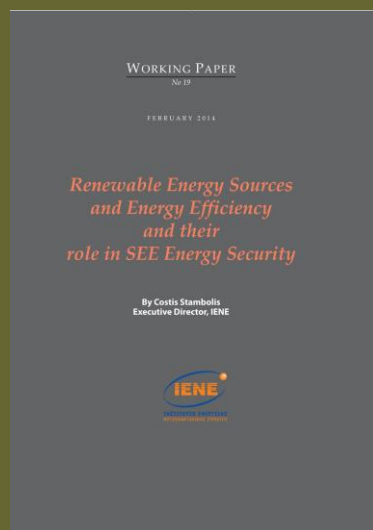
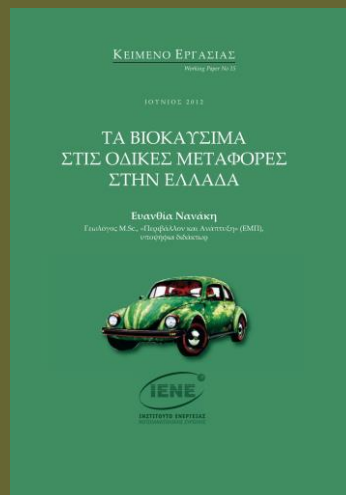
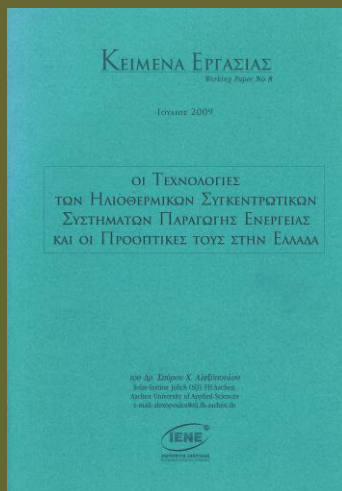
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Major Studies and Working Papers



Major Studies and Working Papers





Studies, Research Notes and Briefing Notes



IENE Briefing Note No2
Revised Edition
An Overview of the South Corridor Gas Pipeline Projects

July 2013

IENE Briefing Note No1
Global and Regional Natural Gas Developments


December 2012


EUROPE'S NATURAL GAS SUPPLY PROSPECTS, THE SOUTH CORRIDOR AND THE ROLE OF GREECE

An IENE Study Project (M 10)

January 2012,
Athens, Greece





A REVIEW OF HYDRAULIC FRACTURING



By Vasilis Nicolopoulos

IENE Research Associate and Managing Director of Natural Resources GP
(www.naturalresources.gr)
Member of the Steering Committee and past President, Euroenergy
Director, Pirene Magnesia LLC
Member of the Board, Thrace Gold Mines.

Athens, October 2012






"PROJECT HELIOS": CAN SOLAR ENERGY BE EXPORTED?
AN ASSESSMENT STUDY

An IENE Study Project (M11)

By John Chadjvassiliadis and Costis Stambolis

Athens, February 2012






THE ROLE OF GREECE AS A SUPPLY ROUTE TO EUROPE IN VIEW OF THE LATEST GAS DISCOVERIES IN THE EAST MEDITERRANEAN

BY COSTIS STAMBOLIS & NICHOLAS SOPHIANOS

IENE RESEARCH NOTE No. 3

December 2012
ATHENS, GREECE






THE CASPIAN BASIN: THE SUCCESS STORY OF ASSESSING PRECISELY SITUATION AND FUTURE PERSPECTIVES IN THE OIL AND GAS EXPLORATION
A CASE STUDY

By Maria Karayannaki
Caspan Energy Expert Demetrios, University of Thessaly, Dept of History, Language and Civilization of the Black Sea countries.

IENE Research Note No.1

Athens, July 2012

ΣΤΡΑΤΗΓΙΚΗ ΜΕΛΕΤΗ ΗΛΕΚΤΡΙΚΩΝ ΔΙΑΣΥΝΔΕΣΕΩΝ ΣΤΗ ΝΑ ΕΥΡΩΠΗ ΚΑΙ Ο ΚΡΙΣΙΜΟΣ ΡΟΛΟΣ ΤΗΣ ΕΛΛΑΔΑΣ

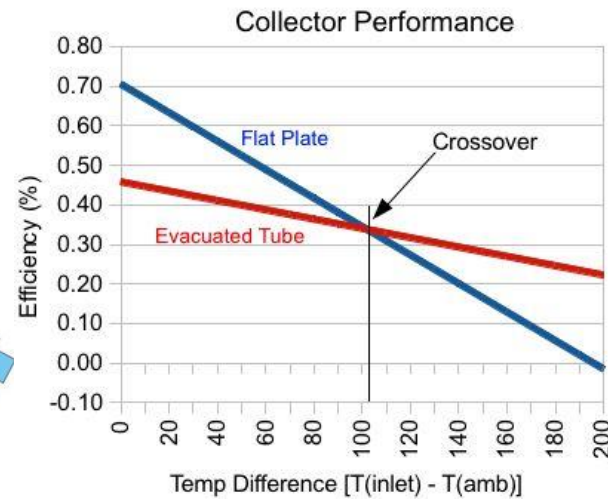
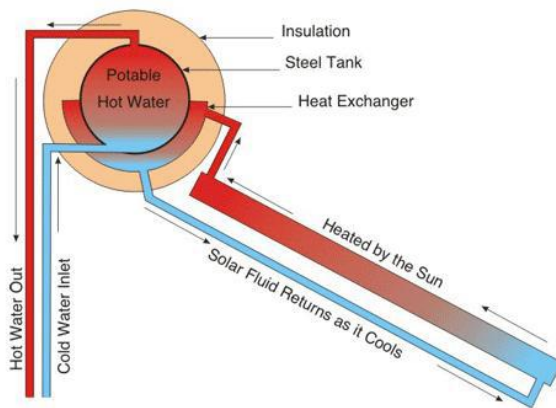
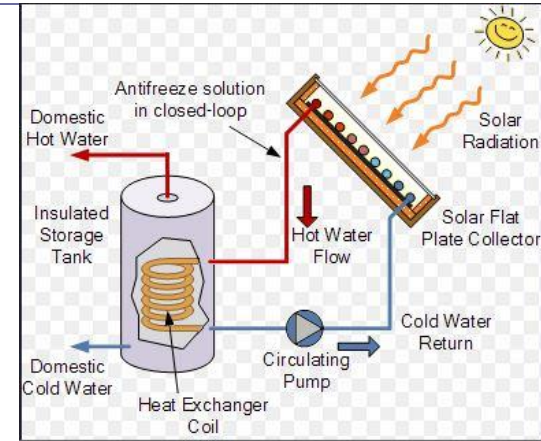
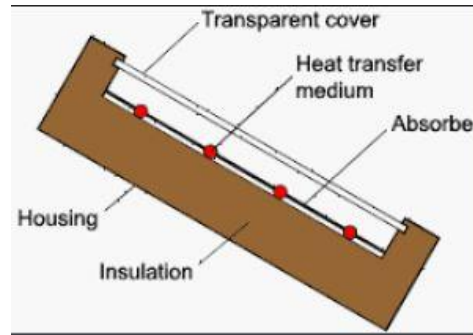
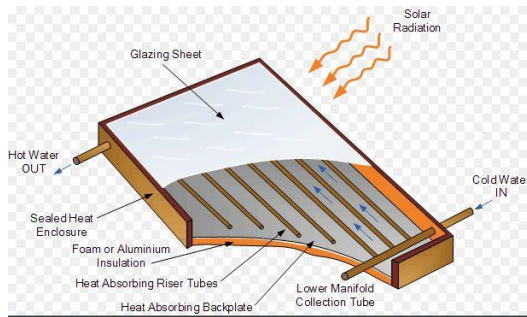
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ΑΘΗΝΑ

Solar and Wind Applications designed by IENE partners



Research and Applications on Flat Plate Solar Collectors undertaken by IENE partners



Solar Water Heating Applications engineered by IENE partners



Solar Photovoltaic Installations designed and installed by IENE partners

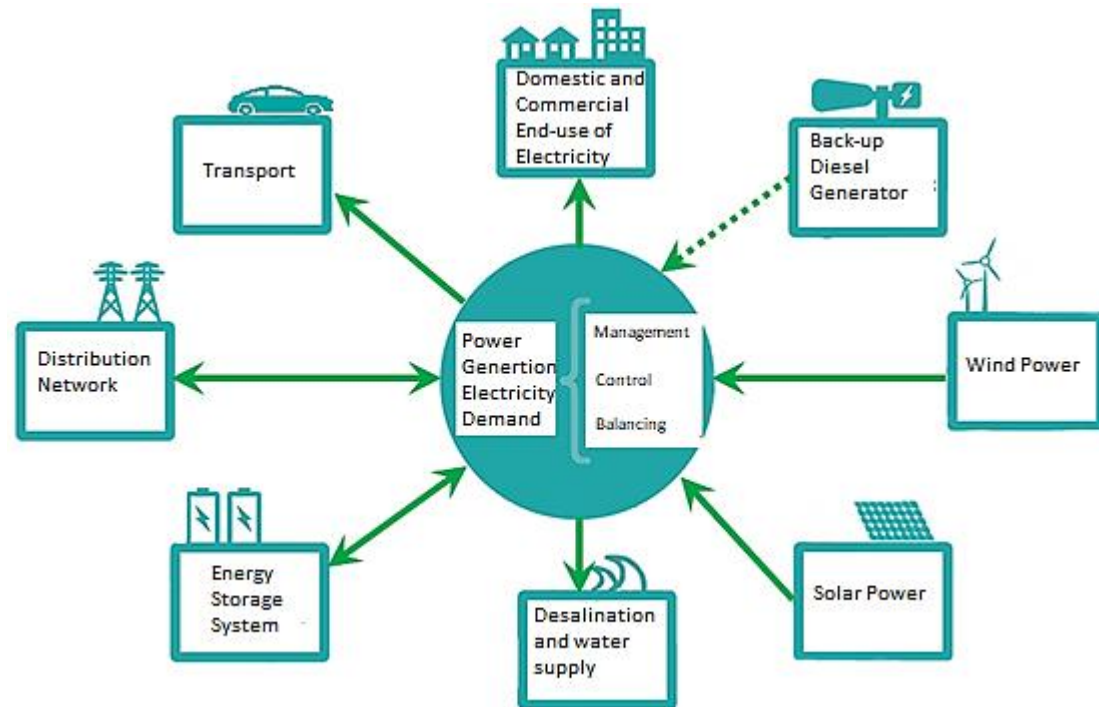


A major IENE Study (M45) on the Energy Transition of the Island of Kastellorizo recently completed

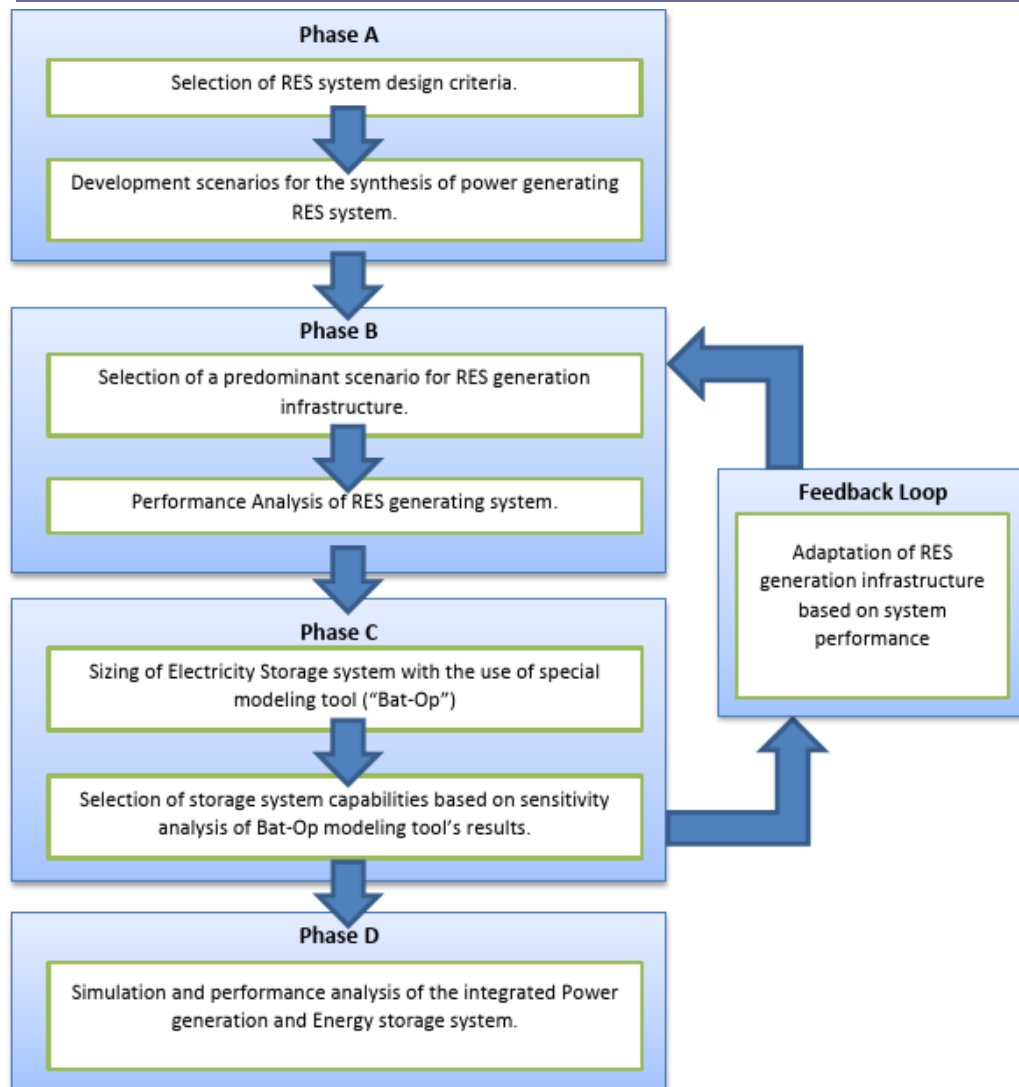


The Design of a New Energy System for the Island of Kastellorizo

- ▣ **High Penetration of available RES in the energy mix:** Solar and Wind power
- ▣ **Uninterrupted electricity supply for all consumers:** Domestic and Commercial Consumption
- ▣ **Uninterrupted water supply:** uninterrupted coverage of electricity demand for desalination facilities (flexibility through demand response)
- ▣ **Electric Mobility:** coverage of EV charging demand
- ▣ **Improvement of Energy Efficiency:** Utilization of non-electric RES (solar thermal) applications, more energy efficient end-use devices, more efficient lamps for lighting of public spaces.
- ▣ **Use of Energy Storage system:** to achieve high RES penetration while ensuring security of supply. Lithium-ion battery storage systems were the primary focus due to their continuously decreasing cost, fast response (immediate high power supply) and sufficient storage capacity.



Sizing Methodology for the RES – Energy Storage system for Kastellorizo Island I



- Evaluation of available RES potential
- Selection of reference RES technologies
- Formulation of RES installed capacity scenarios
- Scenario Performance Analysis
- Sizing of Electricity Storage system with the use of special modeling tool (“Bat-op”).
- System simulation and performance analysis

System’s Performance Optimizations

- Demand Side management (DSM) performed for desalination energy demand.
- Reduction of electricity demand by replacing electric water heaters with solar thermal systems

Figure 7.7 Flow diagram for the design process of the autonomous RES-storage system for the island of Megisti (Kastellorizo)

Sizing Methodology for the RES – Energy Storage system for Kastellorizo Island II

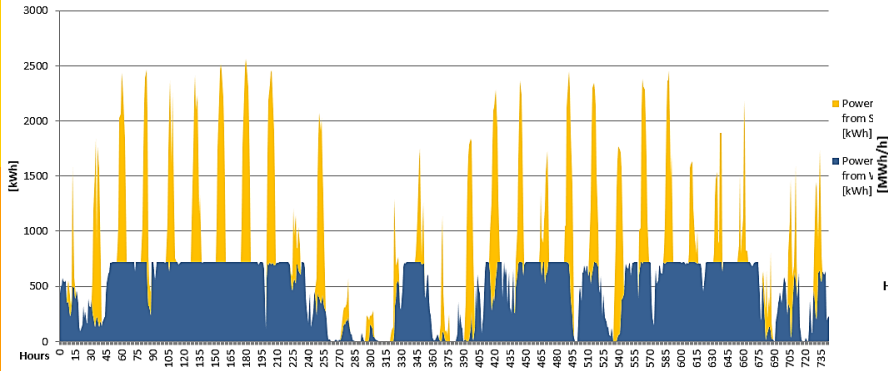


Figure E1: Hourly Power Generation from RES for the selected scenario in January [kWh]

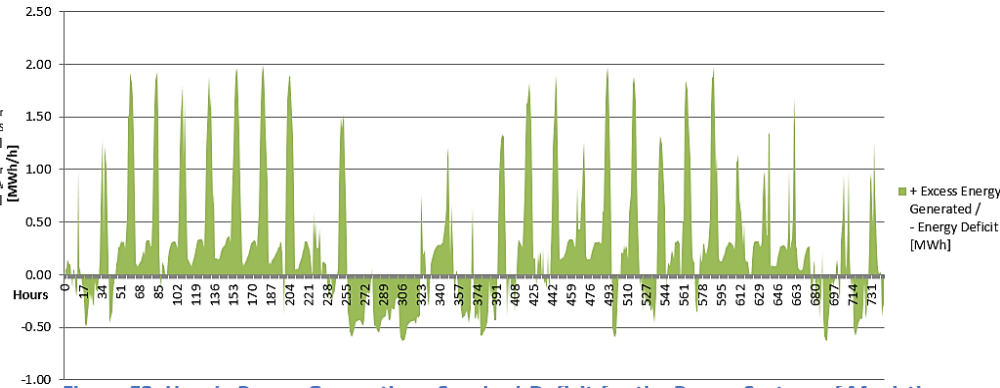


Figure E2: Hourly Power Generation +Surplus/-Deficit for the Power System of Megisti (Kastellorizo) (2025) for the selected scenario in January [MWh]

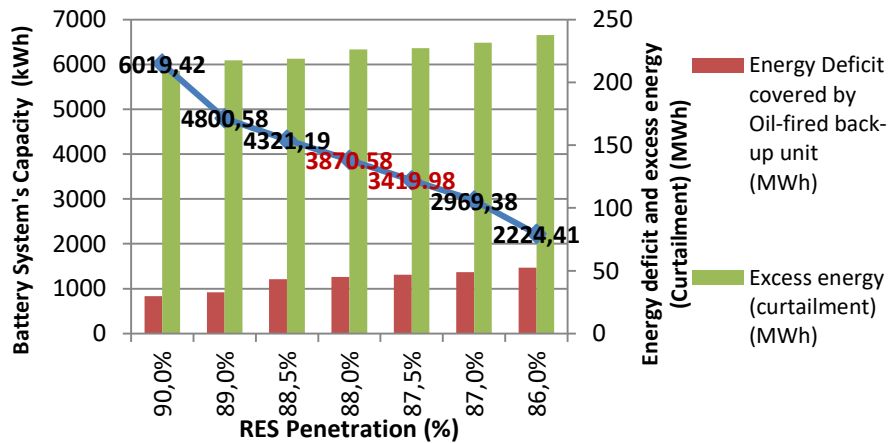


Figure E3: Results of the optimal required (minimum) system battery capacity, and the System's Deficits and Energy Curtailment [kWh] for specific RES penetration [%] using the Bat-Op software for January

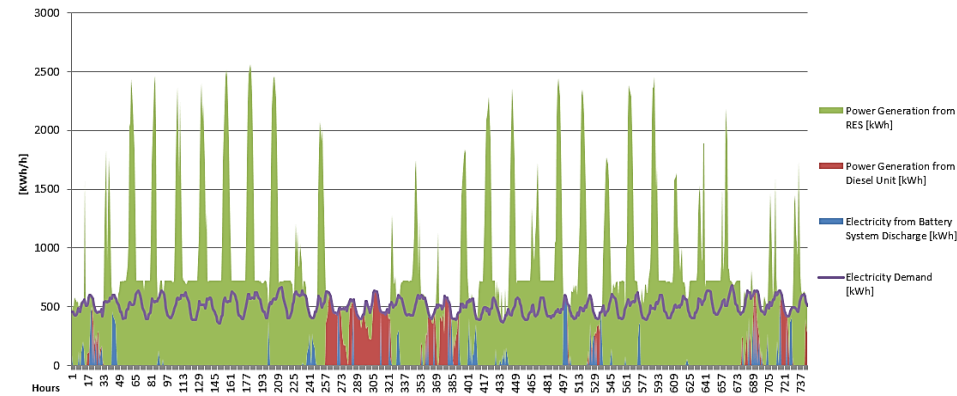


Figure E4: Performance of Integrated RES - Electricity Storage Power Sources for January

The New Energy System for the Island of Kastellorizo I

Proposed RES Power Generating Units

- (a) Wind turbines (WT): 750 kW (3x 250kW)
- (b) Photovoltaic Stations (PV): 2,300 kWp (monocrystalline PV)
- (c) Back up diesel generators 1,000 kW (2 X 500 kW/600KVA)
- (d) Li-ion Battery Energy Storage Systems 2 X 2.000 kWh/1.000 kW (C-rate 0.5)

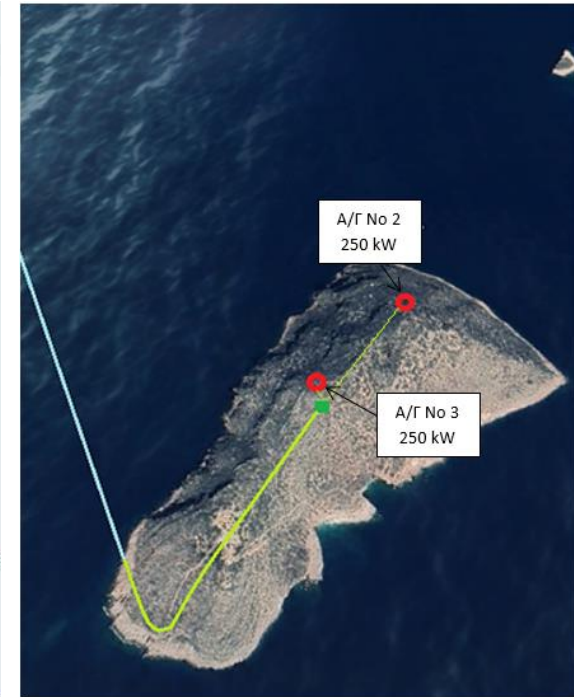
Annual Electricity Demand and Power Generation of the Proposed System

- 4.722,3 MWh for 2025 (higher demand during the period June - October)
- Annual Windpower Generation: 4.165 MWh
- Annual Solar Power Generation: 3.882 MWh
- Energy from RES utilized to cover the demand : 3.974,95 MWh
- Electricity discharged from battery system : 433,49 MWh
- Energy Curtailment of the RES system: 3.638 MWh (including battery charge/discharge losses)
- Back-Up Diesel Generator: 312,9 MWh

RES Penetration

- **93.37%** annually, with energy storage and DSM techniques for electricity demand for water desalination

The New Energy System for the Island of Kastellorizo II



- Currently Installed MV Power distribution network
- MV distribution network extension
- Substations
- Electricity Storage System
- Automated Control Center
- Solar PV Station
- Wind Turbine
- Backup Diesel Generator Unit
- MV Submarine Cable



Conclusions – Key points of the study

- The problem of high electricity costs and high greenhouse gas emissions of electricity supply in Kastellorizo Island can be addressed.
- This solution is characterized by high CAPEX (5.5m) but also by **very low running costs, stable generation costs over a long period of time and higher security of energy supply.**
- High installed capacity of RES (3.05 MW) for the island's proposed system compared to the current diesel power plant (1.45 MW). Li-ion Battery Energy Storage deals with the problem of intermittent generation from RES by utilizing excess RES generation covering timely for low RES performance and therefore increases penetration of RES (93.37%). The high solar potential and the steady moderate wind profile indicated PV and Wind Turbines as the main generating units of the island.
- Energy Storage **mainly exploits the excess solar power generation of the day during the night hours**, a phenomenon that is mainly enhanced in the summer months, in which wind turbines in their rated output cannot meet the increased night demand, while it also contributes covering electricity demand during short periods of low wind and cloudiness.
- Regarding the adaptations of the **legal framework** for NII energy systems, these should include specific studies for each island separately, focusing on security of supply, oil dependence, high RES penetration (70% - 90%) and thereby drastically reducing greenhouse gas emissions.



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**Thank you for
your attention**

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