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# Addressing barriers to storage technologies for increasing the penetration of intermittent energy sources – **STORIES** INTRODUCTION

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## Scope:

**To increase RES penetration in remote, or non-interconnected areas through the adoption of energy storage methods**





## Project Partners

- **Centre for Renewable Energy Sources – Co-ordinator**
- **National Technical University of Athens**
- **Canary Island Institute of Technology**
- **Instituto de Engenharia Mecanica - Polo IST**
- **Regulatory Authority for Energy of the Hellenic Republic**
- **ISLENET**
- **European Renewable Energy Council**
- **SOFTECH TEAM**
- **University of Zagreb Faculty of Mechanical Engineering and Naval Architecture**
- **Cyprus Energy Regulatory Authority**





## Objectives of the project

- **address** electrical grid access and stability issues related to the low penetration of RES in islands
- **address** economic aspects such as internal and external costs related to hybrid RES-energy storage power systems
- **engage** local key market actors for the implementation of RES electricity installations in remote or outlying regions
- **assess** policy and legislative issues related to the distributed electricity generation
- **examine** the effect of adopting a favourable pricing framework for RES electricity installations integrated with storage technologies
- **communicate and disseminate** the results of the proposed action to the target groups
- **develop** a roadmap for the adoption of RES-energy storage technologies by policy makers





## Hybrid systems having been studied:

### Combination of RES (Wind and Solar) with:

- 1) Batteries,
- 2) Desalination technologies,
- 3) Hydrogen technologies,
- 4) Reversible pumped hydro





## Barriers having been addressed

The most important barriers that are addressed are:

- 1) grid capacity and management,
- 2) economic (including non-existing or ineffective tariff schemes for RES-energy storage power systems),
- 3) regulatory / legislative frameworks,
- 4) social (including public awareness and externalities) and
- 5) market issues





## Expected Results

- Increase exploitation of RES in islands by identifying all suitable solutions to increase renewable energies penetration
- Assessment and mapping of the national regulatory and legislative framework of all EU Member States applying in remote regions
- Quantifications of the social, economic and environmental benefits of energy storage applications and grid control systems
- Estimation of economic aspects such as costs of power generation from conventional fuels in comparison to RES-energy storage power systems
- Results from different tariff schemes for combined RES-energy storage power systems in various islands/remote regions all over Europe
- Development of a Roadmap including list of recommendations for the adoption of hybrid RES-energy storage power systems
- Communication and dissemination \ with the key target groups to increase public acceptance of RES-energy storage systems





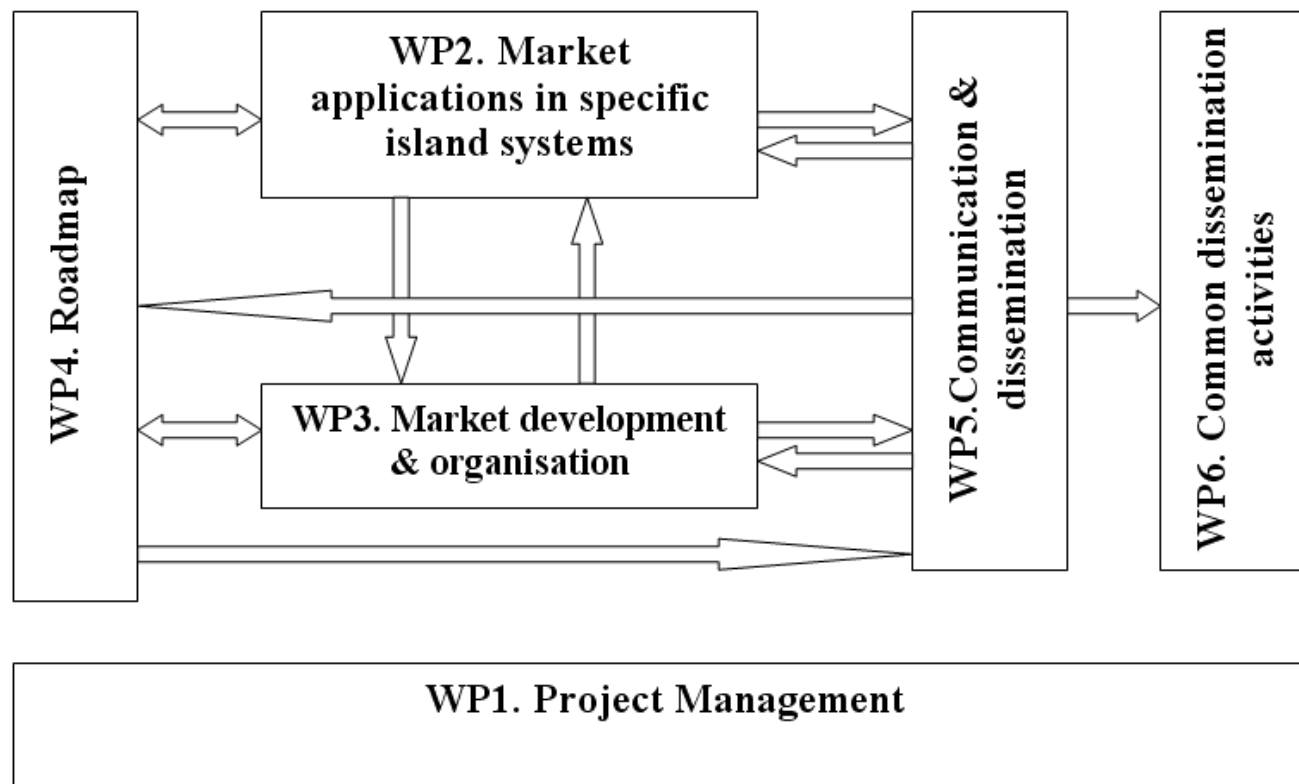
## Target Groups and Key Actors:

- Local energy policy makers and national regulatory authorities
- Utilities, RES developers and Researchers
- The public – local acceptance of solutions



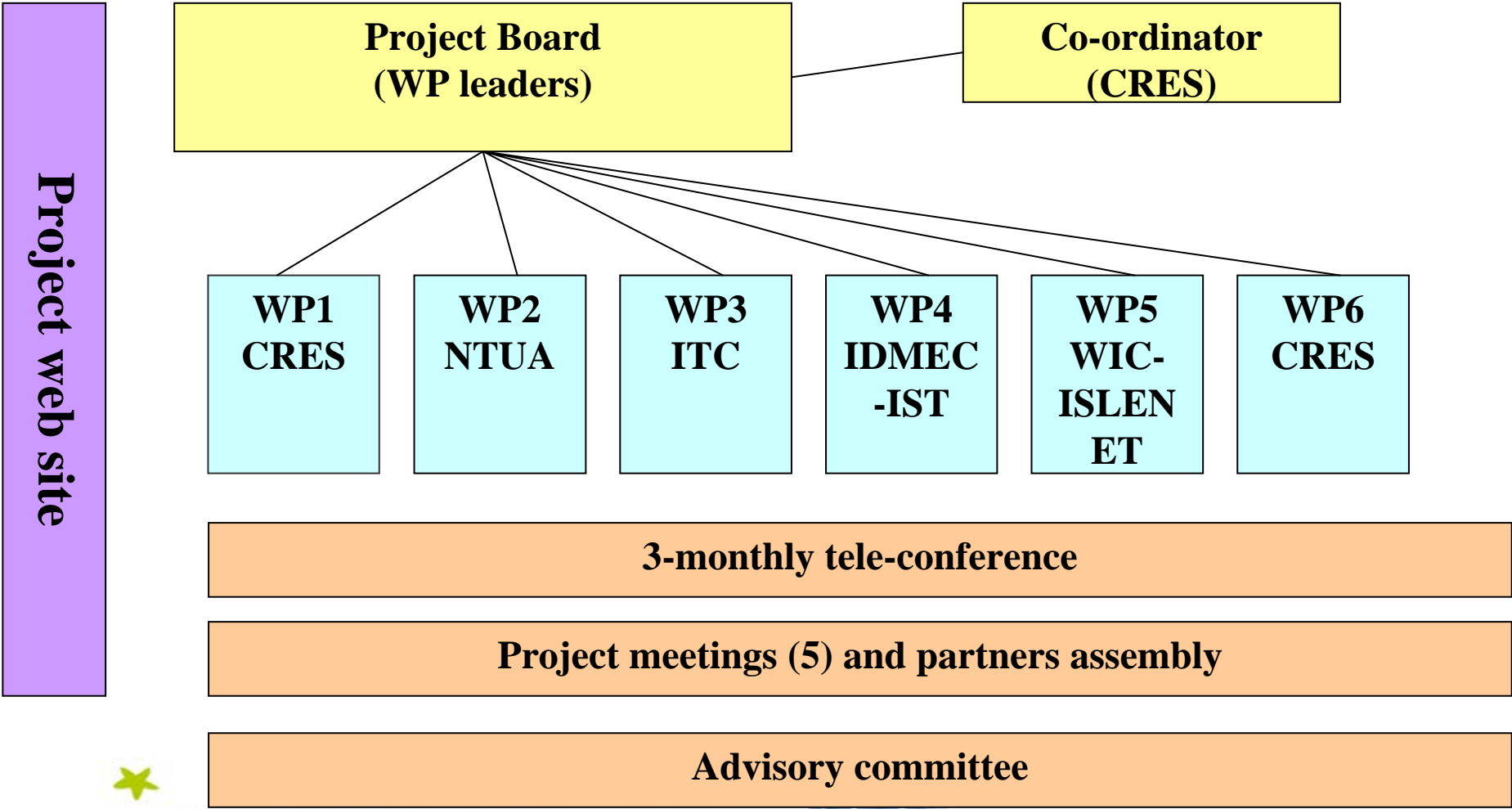


# Work Programme



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# Work Package 1: Project Management



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## Work Package 2: Market applications in specific island power systems

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- Task 2.1: Market applications for energy storage methods and RES units: Case studies
- Task 2.2: European regulatory and policy framework relevant to energy storage systems
- Task 2.3: Cost-benefit analysis



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## Task 2.1 - Subtasks

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- **2.1.1 Data collection (NTUA)**
- **2.1.2 Analyzing autonomous systems using battery technology (ITC)**
- **2.1.3 Analyzing autonomous systems using pump hydro technology (NTUA)**
- **2.1.4 Analyzing autonomous systems using H2 technology (CRES)**
- **2.1.5 Analyzing autonomous systems using desalination technology (NTUA)**



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## Which islands were selected for analysis?

<b>Country</b>	<b>Island</b>
<b>Spain</b>	<b>Canary islands - La Gracioza</b>
<b>Italy</b>	<b>Sardegna island-San Pietro</b>
<b>Greece</b>	<b>Cyclades complex- Island of Milos &amp; Ios</b>
<b>Croatia</b>	<b>Dalmatian sea island-Mljet</b>
<b>Portugal</b>	<b>Island of Corvo</b>
<b>Cyprus</b>	<b>The whole country</b>



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## Task 2.2 European Regulatory Framework - Conclusions

- Each country adopts different measures on promoting RES, depending on the RES type and the year of implementation
- Special support schemes for islands or overseas areas adopted by Greece and France
- No special legislation or policy framework for hybrid power plants with the notable exception of Greece
- On going projects were identified in Finland, Germany and Ireland investigating technically feasible and economically viable methods to store RES energy produced from intermittent energy sources
- Construction and installation of hybrid power plants is also ongoing in Germany, Greece and the UK



## Task 2.3 Cost-Benefit Analysis

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- Evaluation of economic feasibility of various types of RES-energy storage power systems
- Give emphasis on increasing RES penetration
- Comparison to fossil-fuel based power systems
- Calculation of external costs
- Came up with a calculation of the Cost of Energy (COE, i.e. €/kWh) produced by each system configuration, including capital costs, O&M costs, replacement costs, fuel costs and externalities
- Task 2.1 has provided data on the most efficient configuration for each case study



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## **Work Package 3: Market development and organisation**

### **OBJECTIVES:**

- Identification of major stakeholders of RES-energy storage power systems
- Identification of barriers and ways to overcome them
- Investigation of tariff schemes for RES-energy storage
- Elaboration of proposals for the market organisation of autonomous electricity systems to support penetration of RES in isolated or remote areas



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## Work Package 3: Market development and organisation

### Task 3.1 Stakeholders identification

**Major stakeholders affected or actively participating in European energy planning and implementation process in remote or outlying regions, including European islands, have been identified.**

Stakeholders identified were mainly at national and regional level covering all the countries participating in STORIES consortium (Greece, Italy, Spain, Croatia, UK, Cyprus, Portugal and Belgium) and the specific regions of these countries that include islands.

- Local energy policy makers
- National regulatory authorities
- RES developers and installers
- Utilities
- Local and regional authorities
- Market actors



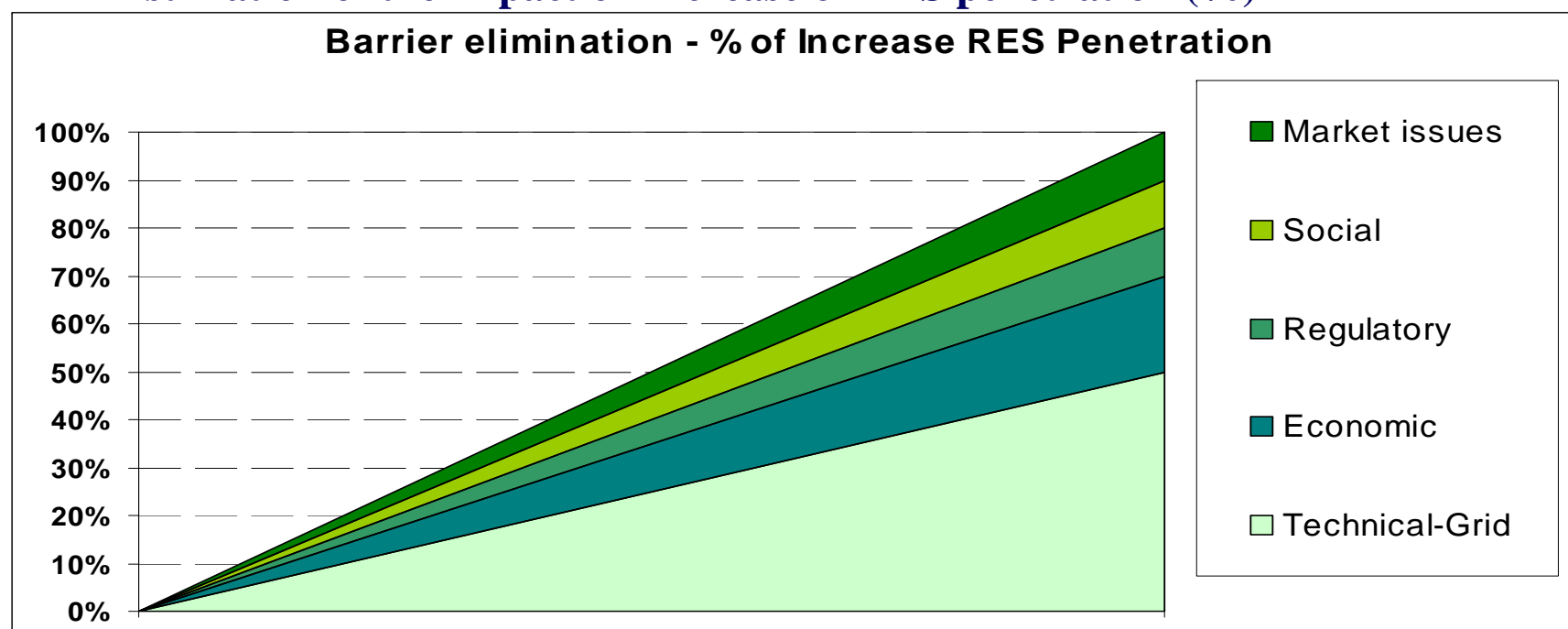
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## Task 3.2 Barriers assessment and recommendations to overcome them

- Identification of existing economical, political and social barriers to maximum renewable energy penetration.
  - Assessment of the cost of eliminating each barrier
  - Estimation of the impact on increase of RES penetration (%)



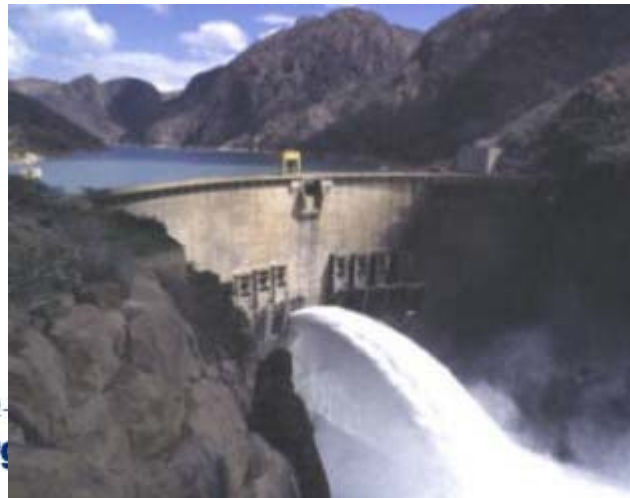
The objective is to characterize the cost-benefit of eliminating each barrier, in order to proposed optimum strategy for maximizing RES penetration at a minimum economic cost.

## Work Package 3: Market development and organisation

### Task 3.3 Investigation of tariff schemes for RES-storage systems

Tariff schemes have demonstrated to be a successful instruments for promotion of RES. Existing pricing frameworks are being analyzed and the impact of adopting them assessed, for electricity produced from RES installations that are integrated with energy storage devices

- Batteries
- Hydrogen
- desalination units
- pumped hydro



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## Work Package 3: Market development and organisation

### Task 3.4 Market organization of autonomous electricity systems

Relevant experiences will be studied to propose market organization scheme of autonomous electricity systems, and two case studies will be carried out:

- RES installations on an autonomous system in Greece
- RES installations on an autonomous system in the home country of another STORIES participant.



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## Work Package 3: Market development and organisation

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### OUTCOME OF WP 3:

- Given the need to reduce dependency on costly and polluting fossil fuels, the energy regulatory framework of European Islands will move towards ever more ambitious goals regarding RES share of the global energy mix
- Technological development of energy storage solutions will condition future development of RES in island regions. It is necessary an R&D effort to overcome existing technical restrictions imposed by weak and small island grids
- A key issue is the correct assessment of elimination cost and benefits of all identified barriers
- An effective strategy for maximizing RES penetration in islands will need the consensus and support of all involved stakeholders



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## Work Package 4: Roadmap for the introduction of hybrid RES-Energy storage power systems

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- Task 4.1: Assessment of parameters
- Task 4.2: SWOT analysis
- Task 4.3: Roadmap for the introduction of hybrid RES-energy storage power systems (1<sup>st</sup> draft completed, 2<sup>nd</sup> draft circulated to all stakeholders and feedback from them was collected, Final document is now available)



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## Work Package 5: Communication and Dissemination

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- Task 5.1: Development and operation of web-site ([www.storiesproject.eu](http://www.storiesproject.eu))
- Task 5.2: Dissemination material (brochures and leaflets, electronic newsletters, publications in international conferences, journals, technical magazines, newspapers)
- Task 5.3: Events (3 workshops, bilateral meetings, European conference)



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# PROJECT WEBSITE

## [www.storiesproject.eu](http://www.storiesproject.eu)

- operational since March 2008
- regularly updated
- information to date
- all deliverables and reports are available
- website statistics improving



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## **NEWSLETTERS**

### **6 Electronic issues**

- **First issue January 2008**
- **Second issue October 2008**
- **Third issue May 2009**
- **Fourth issue September 2009**
- **Fifth issue March 2010**
- **Widely circulated through the ISLENET mailing list**
- **Uploaded on the project website**



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## Project Brochures

- 6 page Leaflet (triptych)-14<sup>th</sup> month + 16 page Technical Brochure – 22<sup>nd</sup> month
- Leaflet to make audience aware of project work + contacts
- Leaflet to be distributed to project events + local targeted campaigns
- Roadmap including recommendations to energy policy makers



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## Events

- **3 Local workshops**
  - Cyprus, Nicosia: 8 May 2008
  - Canary Islands: 3 December 2008
  - Dubrovnik: 2 October 2009
  - Presentations available on the website
- **EU conference in Portugal**
- **Local targeted campaigns**
  - 6 campaigns – 6 partner countries (GR, CRO, UK, SP, PT, IT)
  - Draft Plans and Results – 9<sup>th</sup> month
  - Each campaign focuses on
    - Characteristics of each island community
- **Bilateral meetings**
- **Meetings with EU stakeholders** (utilities, regulators, RES developers)





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**THANK YOU!**

