TRANSNATIONAL ACCESS
USER PROJECT FACT SHEET

USER PROJECT	
Acronym	**ECOSMIC**
Title	**Developing and Evaluating an Economic Assessment Framework for Microgrids -- Based on the Concept of Economies of Scope**
ERIGrid Reference	
TA Call No.	**2**

HOST RESEARCH INFRASTRUCTURE 1			
Name	**Distributed Generation Laboratory (DG-Lab)**		
Country	**Greece**		
Start date	**16.10.2017**	**Nº of Access days**	**5**
End date	**20.10.2017**	**Nº of Stay days**	**8**

HOST RESEARCH INFRASTRUCTURE 2			
Name	**Distributed Energy Resources Test Facility (RSE DER-TF)**		
Country	**Italy**		
Start date	**11.12.2017**	**Nº of Access days**	**5**
End date	**15.12.2017**	**Nº of Stay days**	**7**

HOST RESEARCH INFRASTRUCTURE 3			
Name	**SYSLAB and ICL**		
Country	**Denmark**		
Start date	**22.01.2018**	**Nº of Access days**	**5**
End date	**26.01.2018**	**Nº of Stay days**	**7**

HOST RESEARCH INFRASTRUCTURE 4	
Name	**Oulu Smart Grid Laboratory (SG-Oulu)**
Country	**Finland**

Start date	**5.02.2018**	**Nº of Access days**	**5**
End date	**9.02.2018**	**Nº of Stay days**	**6**

USER GROUP	
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1. USER PROJECT SUMMARY (objectives, set-up, methodology, approach, motivation)

The ECOSMIC User Group from University of Antwerp, Belgium submitted a research proposal during the 2nd call for applications for Transnational Access (TA) with ERIGrid, and the access to four research facilities was approved. The four visits have been carried out by the User Group representative Iolanda Saviuc between Oct 2017 and Feb 2018 at CRES (Greece), RSE (Italy), DTU (Denmark) and VTT (Finland).

The **objective of the project** was to carry out a techno-economic analysis (TEA) of the microgrid (MG) set-ups found on site. The motivation for the multiple visits was to enable comparison between set-ups, driven by questions such "how would a system optimized for Greek conditions perform (economically) in a different environment?". The four facilities proposed for visiting were therefore selected so as to be different in both climate and economic/ policy conditions, e. g. to have different incentive schemes for photovoltaic panels.

Each visit was one week long and involved a series of experiments for a residential load profile typical for the location of the respective facility, served by renewable energy sources supported by storage as well as a connection to the main grid and/or a generator based on fossil fuels. The configurations of the MG components (Table 1) and the operation scenarios for each experiment set (Table 2) have been developed with the facility representatives before each visit; each scenario corresponded to one experiment (usually 24h long), and during each visit an experiment set was completed, consisting of 4-5 experiments, using the same equipment configuration.

The output of each experiment consisted of the recorded values of electricity production, storage and consumption. Each set of 4-6 experiments has had its own **objective of the experiment set** that informed the variations between scenarios. For example based on the knowledge that in Denmark the nights are windy in January (when the TA visit took place) it is interesting to record the energy storage and the exchange with the main grid in case the battery happens to be discharged in the evening and ready to store the excess electricity produced overnight, or in case the battery happens to be full and so the excess energy needs to be put on the main grid. The variations of the initial SoC of the battery determined the different experiments in the set; the investigation of different outputs was the objective of this experiment set which were therefore descriptive in nature (as opposed to validation/ verification objectives).

	ΚΑΠΕ CRES	RSE Ricerca Sistema Energetico	DTU Technical University of Denmark	VTT
Load	4,2 kW	9 kW	25 kW	2,33 kW
PV	4,2 kW	9 kW	10 kW	7,2 kW
Storage	Lead-acid 40,2 kWh	Li-Ion 12,5 kWh	Vd-redox/ Tesla W 27 kWh	Lead-acid 58 kWh
Wind	---	---	11 kW	5,5 kW
Grid	Yes	---	Yes	Yes
Diesel	Diesel generator 10 kW	CHP, natural gas 33 kW	---	---

Table 1: Overview of the configurations used in MG set-ups for the ECOSMIC experiments

ΚΑΠΕ CRES	RSE Ricerca Sistema Energetico	DTU Technical University of Denmark	VTT
Grid-connected, heavy load, buy-priority	Summer generation, summer load profile, with base load	Initial SoC at minimum, PV unit connected	Battery first to charge/ discharge; grid next
Grid-connected, heavy load, sell-priority	Summer generation, summer load profile, no base load	Initial SoC at median value, PV unit connected	Discharge primarily during peak hrs, charge first
Grid-connected, light load, buy-priority	Winter generation, winter load profile, with base load	Initial SoC at minimum, PV unit disconnected	Discharge during peak hrs, charge when profitable
Grid-connected, light load, sell-priority	Winter generation, winter load profile, no base load	Initial SoC at median value, PV unit disconnected	Battery first to charge, EV second; battery first to discharge
Island mode, heavy load			
Island mode, light load			

Table 2: Overview of the scenarios carried out at each of the four facilities

In parallel with the running experiments economic data on the equipment was collected: equipment brands, purchase prices, time of purchase. The data was recorded via HOMER software in that each configuration was separately modelled as a MG.

The main motivation of the project is to improve the knowledge on methods for techno-economic assessment available for practitioners who seek to evaluate smart grid projects.

2. MAIN ACHIEVEMENTS (results, conclusions, lessons learned)

Based on analyses carried out by HOMER it was possible to first evaluate each system individually – e.g.: For the CRES case the most economically efficient alternative is to use only the PV unit along with the main grid, as this offers the lowest net present cost; For VTT, any option including the PV unit yields a levelized cost of energy significantly lower than the options without PV; Also, in the case of RSE it is remarkable that the option selected as most effective also yields a negative levelized cost of energy.

In a second step it is very informative to make comparisons – e.g. the investment in the most efficient set-up at RSE also pays back in fewer years (4.2) than the most efficient set-up at CRES; the negative operating cost (i.e.: the revenue) can be very high in Finland for certain configurations. These kind of comparisons enable then further a study of what causes differences between the performances, and this is the main goal of my research.

3. PLANNED DISSEMINATION OF RESULTS (journals, conferences, others)

User Group is considering publishing these results in open-access journals such as Energies and to disseminate them at academic workshops and conferences.
The results of this work will also be used in the courses taught on ‘Energy economics’ and 'Electrici-ty economics’ at the Applied Economics faculty of Universiteit Antwerpen.
Individual dissemination methods can include individual e-mails, blogs, newsletters, policy briefs.