



2nd International Energy Conference on Power Options for the Eastern Mediterranean Region

7 - 8 October 2013 | Nicosia, Cyprus

BOOK OF ABSTRACTS

POEM 2013

2ND INTERNATIONAL CONFERENCE ON
POWER OPTIONS FOR THE EASTERN MEDITERRANEAN REGION

HILTON CYPRUS HOTEL, NICOSIA | 7 - 8/10/2013



*Under the high patronage of H.E. the President of the Republic of Cyprus
Mr. Nicos Anastasiades*



BOOK OF ABSTRACTS

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PREFACE

The Eastern Mediterranean region currently is facing new developments in the field of hydrocarbon reserves and renewable energy sources (RES). These developments include the licensing of the Cyprus exclusive economic zone that Cyprus Government is negotiating with international key oil and gas companies. Also, Israel is now ready to proceed with the international marketing of its hydrocarbon reserves. Furthermore, seismic data acquisition searches in the exclusive economic zone of Lebanon have shown the probability of discovering large amounts of hydrocarbon reserves. In relation to this, the Cyprus Government has undertaken a diplomatic initiative for solving the political problem of the boundaries settlement between Lebanon, Israel and Cyprus exclusive economic zones. Moreover, the possibility of the development of natural gas liquefaction terminal in Cyprus in cooperation with Noble and Israel will strengthen the cooperation with Israel for exploiting its hydrocarbon reserves and make Cyprus and Israel key players in the international natural gas market. As a result, new industries are expected to be developed in Cyprus, such as chemical industries, by using natural gas as a raw material and this will result in the opening of new jobs with a positive impact in the Cyprus economy.

Regarding RES the new developments concern the discussion for the development of the EuroAsia submerged electric cable which will connect Israel with Cyprus and Europe via Greece that could help the further penetration of RES in the power generation systems of Israel and Cyprus by selling this excess electricity to Europe. Moreover, the introduction of net metering schemes for households will help the further penetration of photovoltaics in Cyprus and help households to reduce their high electricity bills.

In view of the above developments, the 2nd Conference on Power Options for the Eastern Mediterranean Region (POEM 2013) is already established as an important meeting point for ideas and knowledge sharing on the technical, economic and regulatory implications of energy production in the Eastern Mediterranean region. In an international dimension, the Conference

aims to act as a catalyst on the transfer of oil, gas and RES technology advancements and best practices from developed energy markets to the region. Moreover, the Conference hopes to facilitate the exploration of future business opportunities between international and regional energy sector enterprises, in the fields of oil and gas energy infrastructure and RES projects. Finally, the Conference aims to highlight the necessity of research and development in the further advancement of the energy sector in the Eastern Mediterranean region.

Focusing on a regional and local dimension, the Conference aims to provide insights into how local energy players can accommodate the sustainable use of the potential Eastern Mediterranean region's hydrocarbon reserves together with the penetration of solar energy systems in the power electricity generation industry. Moreover, local business representatives will have a chance to be updated on the latest developments in RES technologies, to evaluate the commercial and financial aspects of these technologies as well as to be updated on the energy projects which are expected to be developed in Cyprus during the following years.

Special sessions on solar energy technologies have been integrated within POEM 2013 Conference. These sessions, which are focusing on the cogeneration of desalinated water with renewable energy sources electricity production, are part of the research program STEP-EW that is funded by the Cross-border Cooperation Program Greece-Cyprus 2007-2013. These sessions include topics regarding desalination methods as well as operational plants in the Eastern Mediterranean region, thermal storage technologies with renewable energy sources and cogeneration techniques for desalination with renewable energy sources.

*Prof. Andreas Poulikkas
Nicosia, Cyprus
October 2013*

CONFERENCE COMMITTEES

Conference Chair

Conference Chairman

Prof. Poullikkas Andreas

American University of Sharjah and Electricity Authority of Cyprus

Secretary

Mr. Hadjipaschalis Ioannis

Electricity Authority of Cyprus

Treasurer

Mr. Kourtis George

Electricity Authority of Cyprus

Conference Steering Committee

- Dr. Christodoulides Christos, *Director, Transmission System Operator*
- Prof. Christofides Costas, *Rector, University of Cyprus*
- Mr. Christofides Costas, *Assistant Director General OEB*
- Dr. Efthimiou Venizelos, *Executive Networks Manager, Electricity Authority of Cyprus*
- Prof. Onoufriou Toula, *Vice Rector for Academic Affairs, Cyprus University of Technology*
- Prof. Papanastasiou Panos, *Dean of School of Engineering, University of Cyprus*
- Prof. Papanicolas Costas, *President, Cyprus Institute*
- Mr. Patsalis Antonis, *Executive Generation Manager, Electricity Authority of Cyprus*
- Mr. Shammass George, *Chairman, Cyprus Energy Regulatory Authority*
- Dr. Stylianos Stelios, *General Manager, Electricity Authority of Cyprus*

Conference Scientific Committee

- Dr. Bonanos Aris, *Cyprus Institute, Cyprus*
- Prof. Charalambides Alexandros, *Cyprus University of Technology Cyprus*
- Ms. Charalambous Anthi, *Cyprus Energy Agency, Cyprus*
- Prof. Charalambous A. Charalambos, *University of Cyprus, Cyprus*
- Prof. Christodoulou Christodoulos, *Frederick University, Cyprus*
- Prof. Demokritou Philip, *Harvard University, USA*
- Dr. Fokaides Paris, *University of Cyprus, Cyprus*
- Prof. Georghiades John, *University of Illinois, USA*
- Prof. Georghiou George, *University of Cyprus, Cyprus*
- Prof. Hadjiargyriou Nicos, *National Technical University of Athens, Greece*
- Prof. Kalogirou Soteris, *Cyprus University of Technology, Cyprus*
- Prof. Karageorgis George, *Frederick University, Cyprus*
- Prof. Kyriakides Elias, *University of Cyprus, Cyprus*
- Prof. Michaelides Ioannis, *Cyprus University of Technology, Cyprus*
- Prof. Mitsos Alexandros, *Aachen University, Germany*
- Dr. Peteves Efstathios, *Institute for Energy, Joint Research Center, EC*
- Prof. Sourkounis Constantin, *Ruhr-University of Bochum, Germany*
- Dr. Tzimas Evangelos, *Institute for Energy, Joint Research Center, EC*
- Dr. Tzamtzis George, *Cyprus Institute, Cyprus*
- Prof. Zachariades Theodoros, *Cyprus University of Technology, Cyprus*

Cyprus's Energy Strategy - The views of Cyprus Political Parties

- **Mr. Prodromos Prodromou**, Member of Parliament, Democratic Rally of Cyprus
- **Mr. Andros Kyprianou**, General Secretary of the Central Committee, Progressive Party for the Working People
- **Mr. Angelos Votsis**, Member of Parliament, Democratic Party
- **Mr. Pambis Christodoulides**, Member of Central Committee, Socialists Democratic Party
- **Mrs. Eleni Chrysostomou**, Press Officer, Cyprus Green Party
- **Mr. Demetris Syllouris**, President, European Party Cyprus
- **Mr. Doros Paphitis**, Deputy Spokesman, Citizens Alliance Party

Keynote Speakers

- **Prof. Mohamed Gadalla**, American University of Sharjah, UAE
The large scale integration of solar energy in UAE
- **Prof. Soteris Kalogirou**, Cyprus University of Technology, Cyprus
Building Integration of Solar Thermal Systems (BISTS)
- **Prof. Constantinos Sourkounis**, Ruhr University Bochum, Germany
Developments in power trains for wind energy converters
- **Dr. Stelios Stylianou**, Electricity Authority of Cyprus, Cyprus
EAC planning for renewable energy sources generation
- **Mr. Marios Tannousis**, Cyprus Investment Promotion Agency, Cyprus
Cyprus an attractive investment destination
- **Prof. Theodoros Zachariades**, Cyprus University of Technology, Cyprus
Analyzing energy policy options in Cyprus with a suite of energy-economy models

CONFERENCE PROGRAM

The Opening Ceremony and the main conference sessions will be held at BALLROOM A and the parallel session will be held at BALLROOM B meeting rooms.

Monday, 7 October 2013

08:30	Registration
	Opening Ceremony
09:15	Welcome coffee and Welcome notes <i>Chairperson: Prof. Ioannis Michaelides</i>
	Mr. Constantinos Yiorkadjis, <i>Mayor of Nicosia</i> Mr. George Shammas, <i>Chairman of Cyprus Energy Regulatory Authority</i> Mr. Charalambos Tsouris, <i>Chairman of Board of Directors, Electricity Authority of Cyprus</i> Prof. Costas Papanicolas, <i>President, Cyprus Institute</i> Mr. Akis Ellinas, <i>President, Cyprus Wind Energy Association</i> Mr. Philios Zachariades, <i>Chairman of Cyprus Employers and Industrialists Federation</i> Prof. Andreas Poullikkas, <i>Conference Chairman, American University of Sharjah and Electricity Authority of Cyprus</i>
10:20	Plenary session I (Cyprus's Energy Strategy - The views of Cyprus Political Parties)
	<i>Chairperson: Prof. Christodoulos Christodoulou</i>
10:20	Mr. Prodromos Prodromou, <i>Member of Parliament, Democratic Rally of Cyprus</i>
10:35	Mr. Andros Kyprianou, <i>General Secretary of the Central Committee, Progressive Party for the Working People</i>
10:50	Mr. Angelos Votsis, <i>Member of Parliament, Democratic Party</i>
11:05	Mr. Pambis Christodoulides, <i>Member of Central Committee, Socialists Democratic Party</i>
11:20	Coffee Break
11:40	Plenary session II (Cyprus's Energy Strategy - The views of Cyprus Political Parties)
	<i>Chairperson: Prof. Christodoulos Christodoulou</i>
11:40	Mrs. Eleni Chrysostomou, <i>Press Officer, Cyprus Green Party</i>
11:55	Mr. Demetris Syllouris, <i>President, European Party Cyprus</i>
12:10	Mr. Doros Paphitis, <i>Deputy Spokesman, Citizens Alliance Party</i>
12:25	Lunch Break
13:30	Keynote lecture <i>Chairperson: Prof. George Karageorgis</i> EAC planning for renewable energy sources generation <i>Dr. Stelios Stylianou, Electricity Authority of Cyprus, Cyprus</i>

CONFERENCE PROGRAM

14:00	Plenary session III	
	Special session: Energy policy and security aspects in Eastern Mediterranean <i>Chairpersons: Prof. Achilles Emilianides, Prof. Paris Fokaides</i>	
14:00	Energy security in the Eastern Mediterranean regional security complexes (Paper No. POEM13/168) <i>C. Adamides, O Christou (Cyprus)</i>	
14:15	The Cypriot hydrocarbons and the European financial crisis (Paper No. POEM13/169) <i>C. Ioannou, A Emilianides (Cyprus)</i>	
14:30	The feasibility and impact of the Turkish-Israeli “Rapprochement” on the geopolitics of the Eastern Mediterranean (Paper No. POEM13/170) <i>T. Tsakiris (Cyprus)</i>	
14:45	Escapades at sea: sovereignty, legality and machismo in the Eastern Mediterranean (Paper No. POEM13/171) <i>C. Constantinou (Cyprus)</i>	
15:00	European roadmap for energy and the role of Cyprus hydrocarbons (Paper No. POEM13/173) <i>P. Fokaides (Cyprus)</i>	
15:15	Coffee Break	
15:45	Keynote lecture <i>Chairperson: Prof. Paris Fokaides</i> Cyprus an attractive investment destination <i>Marios Tannousis, Cyprus Investment Promotion Agency, Cyprus</i>	
16:15	Technical sessions	
	Special session: The use of data for power system monitoring and control <i>Chairperson: Prof. Elias Kyriakides</i>	Special session: Impacts of climate change on electricity needs in the Mediterranean <i>Chairperson: Prof. Manfred Lange</i>
16:15	From sensors and measurements, to data and applications in power systems (Paper No. POEM13/183) <i>I. Ciornei, P. Mavroeidis, G. Pieri, E. Kyriakides (Cyprus)</i>	Anticipated impacts of climate change of electricity demand of Athens, Greece (Paper No. POEM13/174) <i>C. Giannakopoulos (Greece)</i>
16:30	A power system controlled islanding scheme for emergency control (Paper No. POEM13/184) <i>J. Quirós-Tortós, V. Terzija (United Kingdom)</i>	Small scale thermal solar district units for Mediterranean communities - The STS-MED project (Paper No. POEM13/175) <i>N. Fylaktos (Cyprus)</i>
16:45	Measurement data aggregation in power systems – challenges and opportunities (Paper No. POEM13/185) <i>A. M. Dumitrescu, M. Calin, M. Albu (Romania)</i>	Climate change and expected enhanced urban heat-island effects (Paper No. POEM13/176) <i>P. Hadjinicolaou (Cyprus)</i>
17:00	Application of synchronized measurement technology in the Cyprus power transmission system (Paper No. POEM13/151) <i>M. Asprou, Y. Yiasemi, E. Kyriakides, Y. Ioannou, A. Petousis, M. Michael, S. Stavrinou (Cyprus)</i>	Assessment of increasing electricity demand for space cooling under climate change condition in the Eastern Mediterranean (Paper No. POEM13/177) <i>M. Lange (Cyprus)</i>
17:15	Dynamic fault studies of an offshore four-terminal VSC-HVDC grid utilizing protection means through AC/DC circuit breakers (Paper No. POEM13/186) <i>M. Hadjikypris, V. Terzija (United Kingdom)</i>	A review of innovative measures to reduce energy consumption in the urban built environment (Paper No. POEM13/178) <i>M. Santamouris (Greece)</i>
17:30	End of Day 1	

CONFERENCE PROGRAM

Tuesday, 8 October 2013

08:00	Registration	
08:45	Conference announcements	
09:00	Keynote lecture <i>Chairperson: Dr. Andreas Stavrou</i> Developments in power trains for wind energy converters <i>Prof. Constantinos Sourkounis, Ruhr-University of Bochum, Germany</i>	
09:30	Technical sessions	
	Special session: Solar thermal cogeneration of electricity and water: The STEP-EW project <i>Chairperson: Prof. Aris Bonanos</i>	Energy systems I <i>Chairperson: Prof. Theodoros Zachariades</i>
09:30	Design of a solar thermal co-generation demonstrator (Paper No. POEM13/179) <i>G. Tzamtzis (Cyprus)</i>	Impact of the Euro-Asia Interconnector project on the economic operation of Crete and Cyprus power systems (Paper No. POEM13/153) <i>A. Antoniou, N. Theodorou (Cyprus), A. Tsikalakis, K. Kalaitzakis, G. Stavrakakis (Greece)</i>
09:45	Optical design of an integrated receiver and storage system (Paper No. POEM13/180) <i>C. Marakkos (Cyprus)</i>	Action steps for refining the Cyprus national action plan on RES penetration for electricity generation – Should we reconsider? (Paper No. POEM13/158) <i>A. Nikolaidis, C. Charalambous (Cyprus)</i>
10:00	Cost-benefit analysis for the installation of cogeneration CSP technology in Cyprus (Paper No. POEM13/166) <i>A. Poullikkas, G. Kourtis, I. Hadjipaschalis (Cyprus)</i>	A software tool to evaluate the total ownership cost of distribution transformers (Paper No. POEM13/160) <i>A. Lazari, C. Charalambous (Cyprus)</i>
10:15	Techno-economic analysis of a co-generation solar thermal plant (Paper No. POEM13/181) <i>N. Fylaktos (Cyprus)</i>	Integration of quick charging stations for e-mobility in power grids of weak infrastructure and high impact of renewable energies (Paper No. POEM13/162) <i>C. Sourkounis, N. Becker, A. Broy, F. Einwächter (Germany)</i>
10:30	Thermal desalination performance analysis (Paper No. POEM13/182) <i>M. Georgiou (Cyprus)</i>	
10:45	Coffee Break	
11:15	Keynote lecture <i>Chairperson: Dr. George Tzamtzis</i> The large scale integration of solar energy in UAE <i>Prof. Mohamed Gadalla, American University of Sharjah, UAE</i>	

CONFERENCE PROGRAM

11:45		Technical sessions
	Special session: Current research at Archimedes solar energy laboratory <i>Chairperson: Prof. Soteris Kalogirou</i>	Energy Systems II <i>Chairperson: Prof. Alexandros Charalambides</i>
11:45	Experimental investigation of the thermosiphonic phenomenon in domestic solar water heaters (Paper No. POEM13/187) <i>S. Kalogirou, G. Panayiotou, G. Florides, G. Roditis, N. Katsellis, A. Constantinou, P. Kyriakou, Y. Vasiades, A. Michaelides (Cyprus), T. Parisis (Greece), J. E. Nielsen (Denmark)</i>	Design rules for autonomous hybrid energy supply systems for various types of buildings in central Europe (Paper No. POEM13/163) <i>A. Broy, I. Vasileva, C. Sourkounis (Germany)</i>
12:00	Theoretical study of the application of Phase Change Materials (PCM) on the envelope of a typical dwelling in Cyprus (Paper No. POEM13/188) <i>G. Panayiotou, S. Kalogirou, S. Tassou (Cyprus)</i>	Concept of energy extraction from sludge of a clarification plant (Paper No. POEM13/161) <i>N. Becker, C. Sourkounis (Germany)</i>
12:15	Experimental evaluation of Phase Change Materials (PCM) for energy storage in solar water heating systems (Paper No. POEM13/189) <i>S. Kalogirou, G. Panayiotou, V. Antoniou (Cyprus)</i>	Storage solutions for power quality problems of the distribution network (Paper No. POEM13/165) <i>A. Poullikkas, S. Papadouris, G. Kourtis, I. Hadjipaschalis (Cyprus)</i>
12:30	Experimental investigation of the performance of a parabolic trough collector (PTC) installed in Cyprus (Paper No. POEM13/190) <i>S. Kalogirou, G. Panayiotou (Cyprus)</i>	Technical and feasibility analysis of gasoline and natural gas fuelled vehicles (Paper No. POEM13/154) <i>C. Chasos, G. Karagiorgis, C. Christodoulou (Cyprus)</i>
12:45	Optimization of Thermosiphon Solar Water Heaters working in a Mediterranean Environment (Paper No. POEM13/191) <i>S. Kalogirou, R. Agathokleous (Cyprus)</i>	
13:00	Evaluation of the solar cooling and heating system of the CUT mechanical engineering laboratories (Paper No. POEM13/167) <i>S. Kalogirou, F. Francou, G. Florides (Cyprus)</i>	
13:15	Lunch Break	
14:30	Keynote lecture <i>Chairperson: Prof. Constantinos Sourkounis</i> Analyzing energy policy options in Cyprus with a suite of energy-economy models <i>Prof. Theodoros Zachariades, Cyprus University of Technology, Cyprus</i>	

CONFERENCE PROGRAM

15:00	Keynote lecture <i>Chairperson: Prof. Constantinos Sourkounis</i> Building Integration of Solar Thermal Systems (BISTS) <i>Prof. Soteris Kalogirou, Cyprus University of Technology, Cyprus</i>	
15:30	<i>Technical sessions</i>	
	RES systems <i>Chairperson: Prof. Charalambos Chasos</i>	Special session: Current research at Cyprus Energy Agency <i>Chairperson: Anithi Charalambous</i>
15:30	On the power control techniques of DFIG: From conventional to a novel BELBIC scheme (Paper No. POEM13/155) <i>M. Valikhani, C. Sourkounis (Germany)</i>	Increase of energy efficiency in 25 low income houses in Cyprus – a holistic approach (Paper No. POEM13/192) <i>G. Panayiotou, A. Charalambous, S. Vlachos, O. Kyriacou, E. Theofanous, T. Filippou (Cyprus)</i>
15:45	Operation of wind energy conversion systems with Doubly-Fed induction generators during asymmetrical voltage dips (Paper No. POEM13/159) <i>P. Tourou, C. Sourkounis (Germany)</i>	Promotion of PV energy through net metering optimization (Paper No. POEM13/193) <i>M. Hadjipanayi (Cyprus)</i>
16:00	Over-irradiance due to the presence of clouds (Paper No. POEM13/152) <i>R. Tapakis, A. Charalambides (Cyprus)</i>	Production of biodiesel from microalgae in selected Mediterranean countries (Paper No. POEM13/194) <i>A. Charalambous (Cyprus), N. Gamal (Egypt)</i>
16:15		Towards low carbon homes through energy renovations (Paper No. POEM13/195) <i>G. Panayiotou, M. Ioannidou, A. Charalambous (Cyprus)</i>
16:30	<i>End of Day 2</i>	

Special sessions on solar energy technologies will be integrated within POEM 2013 Conference. These sessions, which are focusing on the cogeneration of desalinated water with renewable energy sources electricity production, are part of the research program STEP-EW which is funded by the Cross-border Cooperation Program Greece-Cyprus 2007-2013.

The STEP-EW project (www.step-ew.eu) examines the possibility of cogeneration of desalinated water and electricity. In detail, the project's objective is to build a pilot solar thermal cogeneration unit in Cyprus, which will be based on a feasibility study already carried out by the Cyprus Institute for a similar plant. The construction will confirm the technical feasibility of the innovative idea of cogeneration of desalinated water and electricity by using concentrated solar energy on a small scale and realistic environmental and operating conditions. The proposed technology is extremely important, particularly for areas that are isolated from continental electricity networks and with limited water resources, such as the Mediterranean islands. The cogeneration unit will have the ability to reliably and consistently produce water and electricity according to specific needs. The construction and operation of the unit will confirm that the technology is mature enough to be commercially used and will highlight potential need in subsystems that need further development.

The Special Sessions are:

- Energy policy and security aspects in Eastern Mediterranean
- Impacts of climate change on electricity needs in the Mediterranean
- Solar thermal cogeneration of electricity and water: The STEP-EW project
- The use of data for power system monitoring and control
- Current research at Archimedes solar energy laboratory
- Current research at Cyprus Energy Agency



CONFERENCE SUBJECT AREAS

- Advanced seismic data acquisition, processing and interpretation techniques
- Advances in oil and gas separation
- Carbon capture and storage technologies and enhanced oil recovery for deepwater
- Concentrated solar power technologies
- Conventional and non-conventional hydrocarbons energy development
- Deepwater drilling and completions technologies
- Deepwater structures and system integration
- Desalination methods
- Distributed generation
- Energy economics
- Energy policy issues
- Energy storage systems
- Environment and climate change issues
- Exploration geohazards and sea bed service
- Global natural gas market outlook
- Hydrogen production, storage and use
- Hydrocarbons exploration strategies
- Natural gas liquefaction technologies
- Natural gas pipeline transportation technologies
- Natural gas policy issues
- Oil and gas reserves and economics by region
- Oil and gas transportation cost and infrastructure development
- Photovoltaic technologies
- Power generation technologies
- Power system economics
- Renewable energy sources technologies
- Renewable generation scheduling
- Subsea completions and well testing and economics
- Sustainable cities and regions
- Wind technologies

LIST OF PAPERS

Paper Ref. No.	Author(s)	Title
POEM13/151	Markos Asprou, Yiasoumis Yiasemi, Elias Kyriakides, Yiannakis Ioannou, Antreas Petousis, Michalis Michael and Stavros Stavrinos	<i>Application of synchronized measurement technology in the Cyprus power transmission system</i>
POEM13/152	Rogiros Tapakis and Alexandros Charalambides	<i>Over-irradiance due to the presence of clouds</i>
POEM13/153	Antonis Antoniou, Nikolas Theodorou, Antonis Tsikalakis, Kostantinos Kalaitzakis and George Stavrakakis	<i>Impact of the Euro-Asia Interconnector project on the economic operation of Crete and Cyprus power systems</i>
POEM14/154	Charalambos Chasos, George Karagiorgis and Chris Christodoulou	<i>Technical and feasibility analysis of gasoline and natural gas fuelled vehicles</i>
POEM13/155	Mona Valikhani and Constantinos Sourkounis	<i>On the power control techniques of DFIG: From conventional to a novel BELBIC scheme</i>
POEM13/158	Alexandros Nikolaidis and Charalambos Charalambous	<i>Action steps for refining the Cyprus national action plan on RES penetration for electricity generation - Should we reconsider?</i>
POEM13/159	Pavlos Tourou and Constantinos Sourkounis	<i>Operation of wind energy conversion systems with doubly-fed induction generators during asymmetrical voltage dips</i>
POEM13/160	Antonis Lazari and Charalambos Charalambous	<i>A software tool to evaluate the total ownership cost of distribution transformers</i>
POEM13/161	Nora Becker and Constantinos Sourkounis	<i>Concept of energy extraction from sludge of a clarification plant</i>
POEM13/162	Constantinos Sourkounis, Nora Becker, Alexander Broy and Fredrik Einwächter	<i>Integration of quick charging stations for e-mobility in power grids of weak infrastructure and high impact of renewable energies</i>
POEM13/163	Alexander Broy, Izabella Vasileva and Constantinos Sourkounis	<i>Design rules for autonomous hybrid energy supply systems for various types of buildings in Central Europe</i>
POEM13/165	Andreas Poullikkas, Savvas Papadouris, George Kourtis and Ioannis Hadjipaschalis	<i>Storage solutions for power quality problems of the distribution network</i>
POEM13/166	Andreas Poullikkas, George Kourtis and Ioannis Hadjipaschalis	<i>Cost-benefit analysis for the installation of cogeneration CSP technology in Cyprus</i>
POEM13/167	Soteris Kalogirou, Foivos Francou and Georgios Florides	<i>Evaluation of the solar cooling and heating system of the CUT mechanical engineering laboratories</i>
POEM13/168	Constantinos Adamides and Odysseas Christou	<i>Energy security in the Eastern Mediterranean regional security complexes</i>
POEM13/169	Christina Ioannou and Achilles Emilianides	<i>The Cypriot hydrocarbons and the European financial crisis</i>
POEM13/170	Theodoros Tsakiris	<i>The feasibility and impact of the Turkish-Israeli "Rapprochement" on the geopolitics of the Eastern Mediterranean</i>

LIST OF PAPERS

Paper Ref. No.	Author(s)	Title
POEM13/171	Costas Constantinou	<i>European roadmap for energy and the role of Cyprus hydrocarbons</i>
POEM13/173	Paris Fokaides	<i>Parameters of European energy policy framework related to the hydrocarbons exploration in Cyprus</i>
POEM13/174	Christos Giannakopoulos	<i>Anticipated impacts of climate change of electricity demand of Athens, Greece</i>
POEM13/175	Nestoras Fylaktos	<i>Small scale thermal solar district units for Mediterranean communities - The STS-MED project</i>
POEM13/176	Panos Hadjinicolaou	<i>Integration of quick charging stations in power grids of weak infrastructure areas</i>
POEM13/177	Manfred Lange	<i>Assessment of increasing electricity demand for space cooling under climate change condition in the Eastern Mediterranean</i>
POEM13/178	Manthos Santamouris	<i>A review of innovative measures to reduce energy consumption in the urban built environment</i>
POEM13/179	George Tzamtzis	<i>Design of a solar thermal co-generation demonstrator</i>
POEM13/180	Christos Marakkos	<i>Optical design of an integrated receiver and storage system</i>
POEM13/181	Nestoras Fylaktos	<i>Techno-economic analysis of a co-generation solar thermal plant</i>
POEM13/182	Marios Georgiou	<i>Thermal desalination performance analysis</i>
POEM13/183	Irina Ciornei, Petros Mavroeidis, Georgia Pieri and Elias Kyriakides	<i>From sensors and measurements, to data and applications in power systems</i>
POEM13/184	Jairo Quirós-Tortós and Vladimir Terzija	<i>A power system controlled islanding scheme for emergency control</i>
POEM13/185	Ana Maria Dumitrescu, Mihai Calin and Mihaela Albu	<i>Measurement data aggregation in power systems – challenges and opportunities</i>
POEM13/186	Melios Hadjikypris and Vladimir Terzija	<i>Dynamic fault studies of an offshore four-terminal VSC-HVDC grid utilizing protection means through AC/DC circuit breakers</i>
POEM13/187	Soteris Kalogirou, Gregoris Panayiotou, Georgios Florides, George Roditis, Nasos Katsellis, Andreas Constantinou, Paraskevas Kyriakou, Yiannis Vasiades, Thomas Parisi, Alexandros Michaelides and Jan Erik Nielsen	<i>Experimental investigation of the thermosiphonic phenomenon in domestic solar water heaters</i>
POEM13/188	Gregoris Panayiotou, Soteris Kalogirou and Savvas Tassou	<i>Theoretical study of the application of Phase Change Materials (PCM) on the envelope of a typical dwelling in Cyprus</i>

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Paper Ref. No.	Author(s)	Title
POEM13/189	Soteris Kalogirou, Gregoris Panayiotou and Vasiliki Antoniou	<i>Experimental evaluation of Phase Change Materials (PCM) for energy storage in solar water heating systems</i>
POEM13/190	Soteris Kalogirou and Gregoris Panayiotou	<i>Experimental investigation of the performance of a parabolic trough collector (PTC) installed in Cyprus</i>
POEM13/191	Soteris Kalogirou and Rafaela Agathocleous	<i>Optimization of Thermosiphon Solar Water Heaters working in a Mediterranean Environment</i>
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Application of synchronized measurement technology in the Cyprus power transmission system

Markos Asprou, Yiasoumis Yiasemi, Elias Kyriakides, Yiannakis Ioannou, Antreas Petousis,
Michalis Michael and Stavros Stavrinos

Abstract

Synchronized Measurement Technology (SMT) is rapidly deployed in the measurement layer of the electric utilities as the real time monitoring and control of the power systems operation becomes an imperative need. The key element of SMT is the Phasor Measurement Unit (PMU) that provides, among other quantities, synchronized voltage and current phasor measurements at high reporting rates. The capabilities of PMUs can enhance the accuracy and robustness of several contemporary applications of the power system control center and lead to the evolution of the conventional control center to a Wide Area Monitoring and Control (WAMC) center. In this paper, the benefit of including PMUs in the Cyprus power system for enhancing state estimator performance will be discussed. Further, potential PMU placements in the transmission system of Cyprus will also be shown for minimizing state estimator variance.

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Over-irradiance due to the presence of clouds

Rogiros D. Tapakis and Alexandros G. Charalambides

Abstract

During the transition of solar radiation through the atmosphere of the earth, the intensity of solar irradiance is attenuated due to the absorption and scattering by atmospheric particles. Thus, during cloudy conditions, the presence of clouds results to the attenuation of global irradiance that result to a respective decrease in the power output of Photovoltaic (PV) modules and the Electricity Generation of PV Parks. However, it is observed that when suitable conditions of partial cloudy sky exist, the positive correlation of different factors can enhance the value of solar irradiance instead of attenuating it. This paper presents measurements of enhanced global irradiance from data obtained in Cyprus (latitude 34.75° N, longitude 32.62° E), during the spring and summer of 2010. In seven different occasions during five days of May and June 2010, the measured value of global irradiance exceeded 1500W/m² that corresponds to almost 150% of the theoretical value computed by Bird and Hulstrom clear sky computational model for those specific occasions. Moreover, it is noteworthy that in more than 20 days of April, May and June, the one minute and sometimes even the ten minute average global horizontal irradiance exceeded 1200W/m² (enhanced by 125% compared to the theoretical ensembled averaged value for those specific occasions) showing a long lasting period of the effect. These long periods of over-irradiance, along with the temperature drop due to clouds (approximately 15-20°C compared to 30-40°C in the summer period of Cyprus) might boost the performance of photovoltaic modules and cause irreparable damage to photovoltaic inverters. However, although this additional power output is desirable, it may be rejected by the inverter if it is larger than the inverter's AC rating or if the value of the Current-Voltage exceeds the operating range of the inverter.

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Impact of the Euro-Asia Interconnector project on the economic operation of Crete and Cyprus power systems

Antonis Antoniou, Nikolas Theodorou, Antonis Tsikalakis, Kostantinos Kalaitzakis and George Stavrakakis

Abstract

Cyprus and Crete are the largest autonomous power systems in the Mediterranean Sea. Euro-Asia Interconnector project is about to interconnect both power systems with Israel and in future with the Mainland Greece. The impact on the economic operation of both power systems, the expected flow between these two power systems and the final savings stemming from their interconnection are presented in this paper.

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Technical and feasibility analysis of gasoline and natural gas fuelled vehicles

Charalambos Chasos, George Karagiorgis and Chris Christodoulou

Abstract

There is recent interest for the utilisation of natural gas for empowering the internal combustion engines (ICE) of vehicles. The production of novel natural gas ICE for vehicles, as well as the conversion of existing gasoline fuelled ICE of vehicles to natural gas fuelled ICE are new technologies which require to be analysed and assessed. The objective of the present study is to examine the adaptation of natural gas as vehicle fuel and carry out a technical analysis and an economical feasibility analysis of the two types of ICE vehicles, namely gasoline and natural gas fuelled vehicles. The technical model uses the physical properties of the two fuels and the performance factors of internal combustion engines including brake thermal efficiency. The resulting exhaust gas emissions are also estimated by the technical model using combustion calculations which provide the expected levels of exhaust gas emissions. Based on the analysis with the technical model, comparisons of the two types of engines are performed. Furthermore, the estimated performance characteristics of the two types of engines, along with local statistical data on annual fuel imports and annual fuel consumption for transportation and data on the vehicles fleet for the case study of Cyprus are used as input in the economical model. For the base year 2012, data of natural gas price is also used in the economical model. The economical model estimates the capital cost, the carbon dioxide emissions avoidance of fines, the net present value and the internal rate of return of the investment of large scale adaptation of natural gas fuelled vehicles for the case study. From the results and comparisons, conclusions are drawn and recommendations are provided for the adaptation of natural gas vehicles which can provide improved performance with reduced pollutant emissions.

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On the power control techniques of DFIG: From conventional to a novel BELBIC scheme

Mona Valikhani and Constantinos Sourkounis

Abstract

Many hard and soft control techniques have been presented for the DFIG-based systems, in which vector control (VC) and direct power control (DPC) methods have been analyzed and applied widely. This paper deals thus with a comparative study of the common DFIG conventional control techniques. A multilevel control scheme is developed which covers the most challenging and common control and modulation strategies: PWM-based-VC, Hysteresis-based-VC, Rotor flux position-based-DTC. Modern control strategies including artificial intelligent methods have been also successful especially in nonlinear structures but they demand fast computer processing besides lacking a complete solution for stability and robustness issues. In recent years, a new artificial intelligent controller has been introduced which imitates the brain emotional learning computational process, called BELBIC in the literature. This paper develops a novel BELBIC-based model as a complement of PWM-based-VC for the DFIG power control and remarkable results have been obtained.

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Action steps for refining the Cyprus national action plan on RES penetration for electricity generation - Should we reconsider?

Alexandros I. Nikolaidis and Charalambos A. Charalambous

Abstract

The Cyprus power system has certain peculiarities arising from its isolated nature, the geographic concentration of its conventional power plants and the use of underground cables, in high proportion. These specific conditions dictate certain operational and controlling challenges with regards to voltage and frequency stability of the system. Moreover, the system is expected to face major technical and financial challenges when integrating substantial proportions of Renewable Energy in the generation mix. Thus, this paper investigates past and current trends in power system planning processes and discusses possible action steps in order to ensure a secure and effective integration of Renewable Energy. The discussion accounts for the specifics of the power system in Cyprus.

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Operation of wind energy conversion systems with doubly-fed induction generators during asymmetrical voltage dips

Pavlos Tourou and Constantinos Sourkounis

Abstract

Asymmetrical voltage conditions in the grid can have significant negative effects on the performance of wind energy conversion systems (WECS) equipped with doubly-fed induction generators (DFIG). Transient peaks as well as steady-state second-order and higher frequency harmonics are introduced in the active and reactive output powers, in the Dclink voltage and in the torque produced by the WECS. These effects can decrease the lifetime of the system and in extreme cases they can lead to violation of the grid code requirements as the system will not be able to ride-through the fault. Therefore protective measures must be taken so that the WECS remains connected to the grid and fulfills the (low voltage ride-through (LVRT) requirements, without putting the reliability of the system at risk. In this paper the dynamic behavior of the DFIG-based WEC in the case of asymmetrical voltage dips is analyzed. A control strategy is presented, which minimizes the negative effects of the voltage dips on the WECS and enables it to 'ride-through' the fault safely. With this strategy the WEC can support the voltage recovery during and after the fault and it can fulfill the relevant grid code requirements.

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A software tool to evaluate the total ownership cost of distribution transformers

Antonis L. Lazari and Charalambos A. Charalambous

Abstract

The software tool described in this paper reflects on a holistic management approach to accurately appraise the energy and the demand component of the cost of losses for Electricity Authority of Cyprus (E.A.C). The demand (D - €/kW) and the energy (E - €/kWh) components are utilised in evaluating the Total Ownership Cost (T.O.C) of distribution transformers. Specifically, the tool is used to dynamically evaluate the levelized annual cost of losses of transformers, by incorporating actual financial data and system characteristics through built-in techno-economic models as well as statistical evaluations for future fuel pricing.

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Concept of energy extraction from sludge of a clarification plant

Nora Becker and Constantinos Sourkounis

Abstract

Along with the increasing quality of life, the demand of fresh water grows continuously which may result in a shortage of water in warmer regions. In summer times, the water demand is particularly raised by the tourism. The consequence is that clarification plants become overloaded which leads to odor nuisance for townships and holiday villages. In order to avoid this, investigations have been made on the energy extraction from organic sludge particles on the basis of digestive processes.

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Integration of quick charging stations for e-mobility in power grids of weak infrastructure and high impact of renewable energies

Constantinos Sourkounis, Nora Becker, Alexander Broy and Fredrik Einwächter

Abstract

The social acceptance of electro-mobility increases as the capacity of electric vehicle batteries is improved and technical solutions for a short charging time become available. For this reason, the charging of even a few number of electric vehicles may pose a significant additional load on the respective grid section. In the case of a grid load near the nominal capacity by the households and industry or in case of remote low-supply areas, the increased power demand can lead to an overload. Besides the voltage variations, unwanted harmonics can be emitted into the grid. Therefore examinations have been carried out to investigate the installation of quick charging stations in remote low-supply areas together with the necessary grid integration. In this context, different concepts for the grid integration of quick charging stations in low-supply regions have been taken into consideration.

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Design rules for autonomous hybrid energy supply systems for various types of buildings in Central Europe

Alexander Broy, Izabella Vasileva and Constantinos Sourkounis

Abstract

The autonomous supply of buildings with renew-able energies is a great challenge. The main topic is the link between the demand- und the supply side at any time. Renew-able generated electricity is subjected to the natural fluctuation. On the other hand there is the bad predictability of the user. To ensure a secure supply, the use of energy storage systems is required. In this paper, a guideline is developed to design an autonomous hybrid system based on renewable energies and an energy storage system for buildings. The guideline is applicable for every type of building and considers the user load, the location with its solar- and wind conditions, as well as economic aspects.

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Storage solutions for power quality problems of the distribution network

Andreas Poullikkas, Savvas Papadouris, George Kourtis and Ioannis Hadjipaschalis

Abstract

In this work, a prediction of the effects of introducing energy storage systems on the network stability of the distribution network of Cyprus and a comparison in terms of cost with a traditional solution is carried out. In particular, for solving possible overvoltage problems, several scenarios of storage units' installation are used and compared with the alternative solution of extra cable connection between the node with the lowest voltage and the node with the highest voltage of the distribution network. The results indicated that the performance indicator of each solution depends on the type, the size and the position of installation of the storage unit. Also, as more storage units are installed the better the performance indicator and the more attractive is the investment in storage units. The best solution, however, still remains the alternative solution of extra cable connection between the node with the lowest voltage and the node with the highest voltage of the distribution network, due to the lower investment costs compared to that of the storage units.

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Cost-benefit analysis for the installation of cogeneration CSP technology in Cyprus

Andreas Poullikkas, George Kourtis and Ioannis Hadjipaschalis

Abstract

The purpose of this work is to investigate whether the installation of an innovative cogeneration of electricity and desalinated water (DSW) with concentrated solar power (CSP) technology in Cyprus is economically feasible. The study takes into account the following generating technologies, (a) CSP-DSW technology 4MWe, (b) CSP-DSW technology 10MWe, (c) CSP-DSW technology 25MWe and (d) CSP-DSW technology 50MWe with or without CO₂ trading for two different cases of electricity purchasing tariff. For all above cases the electricity unit cost or benefit before tax, as well as internal rate of return and payback period are calculated. The results indicate that for plants of 25MWe and 50MWe, such cogeneration technology is economically attractive even without any subsidy.

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Evaluation of the solar cooling and heating system of the CUT mechanical engineering laboratories

Soteris Kalogirou, Foivos Francou, Georgios Florides

Abstract

The main objective of this paper is to describe and analyze the experimental system of solar cooling and heating, installed at the Mechanical Engineering laboratories of the Cyprus University of Technology (CUT). For this purpose, the behavior and performance of the system was studied over a period of one year, both for the cooling and heating modes using the Building Management System records. Furthermore, the performance of absorption chillers during the summer months was examined, and suggestions are made to reduce further the power consumption and to increase the overall efficiency of the system. The mean value of the coefficient of performance of the chiller was 0.68, which is quite high, even though the water entering the chiller was at a relatively low average temperature of 68°C. From the measurements it was also observed that there was excessive indirect energy consumption. Its main cause was related to the general pump over-sizing and the management of the un-used solar energy. Suggestions are given to reduce this consumption. The results of this study are very important because through our suggestions it is possible to increase efficiency, reduce energy consumption and make the system economically attractive to users.

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Energy security in the Eastern Mediterranean regional security complexes

Constantinos Adamides and Odysseas Christou

Abstract

This paper utilizes Regional Security Complex Theory (RSCT) in order to analyze developments in the trilateral securitization relations among Turkey, Israel and Cyprus. We use this set of relationships as a case study of the effects of energy as a referent object of securitization and as an exogenous parameter influencing the three states' securitization and security relationships. Furthermore, this paper argues that the increasing energy securitization dynamics among the three states poses a challenge for the RSCT. The emergence of patterns of security interdependence as a result of energy securitization among the three regional actors - Turkey, Israel and Cyprus - satisfies the criteria of subcomplex, yet violates the condition that a subcomplex is firmly embedded within a larger RSC. In fact, the triangle exists at the interstices of two RSCs and a major insulator state.

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The Cypriot hydrocarbons and the European financial crisis

Christina Ioannou and Achilles Emilianides

Abstract

The aim of this paper is to address the significance of the Cypriot hydrocarbons within a European framework, identify the political challenges associated with the exploration of Cypriot hydrocarbons and argue that the Cypriot hydrocarbons, or indeed any credible European policy on hydrocarbons, may be a source of tackling future financial crises, only if the Union aims at further political integration, rather than merely integration at a monetary and technical level.

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The feasibility and impact of the Turkish-Israeli “Rapprochement” on the geopolitics of the Eastern Mediterranean

Theodoros Tsakiris

Abstract

The aim of this paper is to address the significance of the Cypriot hydrocarbons within a European framework, identify the political challenges associated with the exploration of Cypriot hydrocarbons and argue that the Cypriot hydrocarbons, or indeed any credible European policy on hydrocarbons, may be a source of tackling future financial crises, only if the Union aims at further political integration, rather than merely integration at a monetary and technical level.

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Escapades at sea: sovereignty, legality and machismo in the Eastern Mediterranean

Costas Constantinou

Abstract

The latest episode of the Cyprus conflict - a dispute over the exercise of sovereignty at sea and the delimitation of sea zones between Turkey and Cyprus - highlights the role of political machismo in the practice of sovereignty, disregarding international law and further undermining prospects for a peaceful settlement of the conflict. The Cyprus conflict is rapidly spreading to the seas. Clashing cartographies and owner-ship claims have begun circulating through the mass media. Natural-gas-speak is in the air. Accusations, protestations, veiled and naked threats abound. Noble Energy has begun drilling in Cypriot Sea Block 12 (south of the island), renamed Aphrodite, by positioning an extraction platform that goes by the name of Homer. Political reality is intertwined with mythology; epic narratives are about to unfold. Politicians are preparing themselves to do heroic deeds for 'our' sake and once again take up the role of 'our' mythical guardians.

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European roadmap for energy and the role of Cyprus hydrocarbons

Paris Fokaides

Abstract

The recent developments in the exploitation of hydrocarbons in Cyprus are growing the need for strategic targeting of the actions of the Republic in this field. The Republic of Cyprus need to determine in a clear way the context in which the procedure of the exploitation of its mineral wealth must proceed. Having joined the European Union in 2004 mainly for security reasons, the Republic of Cyprus should consider at this stage the basic principles governing the European policy on energy, understand the origin of these principles and lead its strategy as a member Union towards a compatible target. This article aims to present the basic principles governing the European strategy on energy issues. Through the directives and regulations of the European Union, this article aims to present the main focus of Europe's energy policy, as well as the specific quantitative and qualitative targets to achieve them. A comprehensive assessment of the opportunities both for Cyprus and for Europe the potential exploitation of Cyprus deposits is also attempted. This study comes up with concrete strategy suggestions in relation to the proposed targeting of Cyprus' policy on the exploitation of its mineral deposits.

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From sensors and measurements to data and applications in power systems

Irina Ciornei, Petros Mavroeidis, Georgia Pieri and Elias Kyriakides

Abstract

This work is a comprehensive overview from sensors and measurements to data and applications in power systems. The focus lies on current technologies in the market, the penetration range at present in the power industry, as well as the trends for different types of technologies. Various sensors will be presented in terms of their characteristics, measurement quantities and ICT capabilities. Special attention will be given to the data produced by these sensors and measurements, and the applications built on top of them. The latter, are related to the operation, monitoring and control as well as power quality in distribution and transmission systems. In addition to traditional measurements, such as current and voltage transformers, new technologies have emerged, such as optical measurements and satellite measurement technologies. On top of that, the nature of the new ICT enabled capabilities will be demonstrated and their effect on applications from state estimation to post-mortem analysis will be presented. Future trends of measurements and applications development and deployment are discussed from an engineering perspective.

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A power system controlled islanding scheme for emergency control

Jairo Quirós-Tortós and Vladimir Terzija

Abstract

During major system disturbances, uncontrolled separation of the power system may take place, leading to further network stability degradation and likely a large-scale blackout. Intentional controlled islanding has been proposed as an effective approach to split the power system into several sustainable islands and prevent cascading outages. This paper proposes a novel methodology that determines suitable islanding solutions for minimal power imbalance or minimal power flow disruption while ensuring that only coherent generators are in each island. It also enables system operators to exclude any branch from islanding solutions, i.e. from its disconnection. In real applications, the actual power flow data and the prior-identification of the coherent groups of generators are required. The proposed methodology is illustrated using the IEEE 9-bus test system. Simulation results demonstrate the effectiveness and practicality of the proposed methodology to determine an islanding solution.

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2nd Conference on Power Options for the Eastern Mediterranean Region
07-08 October 2013, Nicosia, Cyprus (Paper No. POEM13/185)

Measurement data aggregation in power systems – challenges and opportunities

Ana Maria Dumitrescu, Mihai Calin and Mihaela Albu

Abstract

Despite the increased use of distributed energy resources and of the active distribution networks, power systems are still modeled as operating in steady state at quasi-constant frequency, with bulk generation and constant power loads. For achieving a real time control, enabling a higher efficiency of energy transfer, a detailed model is required together with associated algorithms for information retrieval. Measurements are presently able to give insight to such details, communication channels are in place but the information has to be structured in a new way. Presently there are in use aggregation algorithms inherited from power quality standards like the IEC 61000-4-30 set. A discussion of the time- and spaceaggregation is proposed in the paper, based on an analysis performed on voltages and frequency measurements; recommendations for the data aggregation algorithms are given for quantities which are not presently commonly considered for power systems monitoring. Data delivered by PMUs with a reporting rate of 50 frames per second is used to highlight the effect of aggregation algorithms.

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Dynamic fault studies of an offshore four-terminal VSC-HVDC grid utilizing protection means through AC/DC circuit breakers

Melios Hadjikypris and Vladimir Terzija

Abstract

The concept of utilization of multi-terminal DC grids is a promising solution for integrating distant renewable energy sources and offshore wind farms into onshore AC networks. Protection of such networks is one of key factors ensuring their reliability and continuity of service. This paper addresses the dynamic behavior and sensitivity of a typical multi-terminal DC grid under faulty conditions, observing the severe impacts these could have on the entire hybrid AC-DC system. Protection measures will be introduced in the form of DC circuit breakers (CBs) to isolate the faults and recover system's normal operation. The study concludes the feasibility in using DC-CBs in a multi-terminal VSC-HVDC network serving as fault protection and stability recovery tool when DC-CBs are located in an optimally distributed way. The simulation work depicting the various scenarios has been performed using DigSILENT PowerFactory environment.

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2nd Conference on Power Options for the Eastern Mediterranean Region
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Experimental investigation of the thermosiphonic phenomenon in domestic solar water heaters

Soteris A. Kalogirou, Gregoris P. Panayiotou, Georgios A. Florides, George Roditis, Nasos Katsellis, Andreas Constantinou, Paraskevas Kyriakou, Yiannis Vasiades, Thomas Parisis, Alexandros Michaelides and Jan Erik Nielsen

Abstract

The deeper understanding of the 'thermosiphonic phenomenon' and the identification of the key parameters affecting it, is the main aim of a research project currently in process in Cyprus. In this work a review of the existing standards and scientific knowledge concerning domestic solar water heaters is presented. The first preliminary results of the experimental investigation of the 'thermosiphonic phenomenon' in domestic solar water heaters are also presented. For this purpose a special test rig was set up and equipped with all sensors necessary to measure all parameters that are most likely to affect the 'thermosiphonic phenomenon'. All tests were conducted according to ISO 9459-2:1995(E). At first, the solar collector was tested according to EN12975-2:2006 in order to determine the thermal performance characteristics at a flow and operation conditions specified by the standard. Consequently, the efficiency of the collector operating thermosiphonically was calculated based on quasi-dynamic approach. Finally, a series of correlations were attempted using the data acquired when the collector is operating themosiphonically which are the following: (i) the temperature difference of the water at the outlet and the inlet of the collector (ΔT) with the solar global radiation, (ii) the water mass flow with the solar global radiation, (iii) the water mass flow with the temperature difference of the water at the outlet and the inlet of the collector (ΔT). The results of the data analysis showed that these parameters are very well correlated between them since the coefficient of determination (R^2) is over 0.91 in all cases.

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2nd Conference on Power Options for the Eastern Mediterranean Region
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Theoretical study of the application of Phase Change Materials (PCM) on the envelope of a typical dwelling in Cyprus

Gregoris P. Panayiotou, Soteris A. Kalogirou and Savvas A. Tassou

Abstract

In this work the application of Phase Change Materials (PCM) on the envelope of a dwelling in Cyprus is evaluated for the first time. The simulation process is carried out for a typical meteorological year using TRNSYS. Two types of simulations were carried out; the energy rate control and the temperature level control. The energy savings achieved by the addition of PCM compared to the base case (no insulation) ranged between 21.65-28.59%. When the PCM was combined with a common thermal insulation topology the maximum energy savings per year was 66.17%. In the second test the constructions containing PCM showed a better behaviour during summer conditions. Finally, the results of the optimum PCM case and the combined case were evaluated using Life Cycle Analysis. The results show that the PCM case is not yet considered to be very attractive due to the high initial cost.

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2nd Conference on Power Options for the Eastern Mediterranean Region
07-08 October 2013, Nicosia, Cyprus (Paper No. POEM13/189)

Experimental evaluation of Phase Change Materials (PCM) for energy storage in solar water heating systems

Soteris Kalogirou, Gregoris Panayiotou and Vasiliki Antoniou

Abstract

In this paper the use of Phase Change Materials (PCM) in solar storage tanks is evaluated experimentally. Hot water storage tank is one of the main components of any solar water heating system. It is important to increase the storage capacity. The experimental investigations of the operation of the storage tank were carried out both during heating up and draw off phases. In all experiments the tanks with PCM show better performance than the tank without PCM. For the 50l tank used, two PCM canisters showed the optimum performance and a draw off profile up to 3 l/min. An additional experiment was performed with intermitted withdrawal of water from the storage tank so as to simulate the actual use. The results were also positive. It is concluded that the use of PCM improves storage capacity of such systems during draw-off.

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2nd Conference on Power Options for the Eastern Mediterranean Region
07-08 October 2013, Nicosia, Cyprus (Paper No. POEM13/190)

Experimental investigation of the performance of a Parabolic Trough Collector (PTC) installed in Cyprus

Soteris A. Kalogirou and Gregoris P. Panayiotou

Abstract

In this paper the performance of a Parabolic Trough Collector located at the Archimedes Solar Energy Laboratory is evaluated. It has an aperture area of 14.4m^2 , a concentration ratio of 13.7 and can be operated up to 200°C . The collector aperture is 1208mm and the receiver pipe is stainless steel 304 L with a diameter of 28mm, coated with selective coating (absorptance: 0.93, emittance: 0.18). The collector is orientated with its axis in the E-W direction tracking the sun in the N-S direction. The advantages of this tracking mode are that very little collector adjustment is required during the day and the full aperture always faces the sun at noon. A programmable tracking system is responsible for keeping the collector focused at all times. The collector is connected to a 300 liters hot water storage tank. The water is pressurized to avoid boiling in the receiver. The performance obtained is very satisfactory and agrees with the performance curve given by the manufacturer.

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2nd Conference on Power Options for the Eastern Mediterranean Region
07-08 October 2013, Nicosia, Cyprus (Paper No. POEM13/191)

Optimization of Thermosiphon Solar Water Heaters working in a Mediterranean Environment

Soteris A. Kalogirou and Rafaela A. Agathokleous

Abstract

Cyprus is currently the leading country in the world with respect to solar water heaters installations. The increase of the thermosiphon solar water heaters usage over the last years makes this subject to be very important for further investigation. The main objective of this study is to investigate the parameters affecting the system's performance in order to find the optimum design to increase the performance of the system. For this purpose, a number of riser and header tube diameters were considered ranging from 6mm to 35mm, slopes from latitude from 20° to 90°, distances between the top of the collector to the bottom side of the storage tank ranging from -30 to +20cm and the vertical or horizontal tank position. The system is modelled using TRNSYS and simulated with the Typical Meteorological Year (TMY) of Nicosia, Cyprus. It was observed that, the current typical system is not the optimum case and its operation can be further improved. The optimum system obtained from the simulations has a flat plate collector with header pipe of 22mm and 20 riser pipes of 8mm diameter, sloped at 40° and the distance between the top of the collector and the bottom of the storage tank is - 20cm. These findings should prove valuable for the collector and systems designers and manufacturers.

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2nd Conference on Power Options for the Eastern Mediterranean Region
07-08 October 2013, Nicosia, Cyprus (Paper No. POEM13/192)

Increase of the energy efficiency of 25 low-income houses in Cyprus - a holistic approach

Gregoris Panayiotou, Anthi Charalambous, Savvas Vlachos, Orestis Kyriacou, Elisavet Theofanous and Thomas Filippou

Abstract

ELIH-Med project aims to identify and implement innovative technical solutions to improve energy efficiency in low-income housings in the Mediterranean area. In this study the results of the Cyprus pilot projects concerning 25 houses all over Cyprus are presented. The specific objective of this project is to achieve at least 30% decrease in energy consumption or at least improvement of the energy class by two categories in all houses. Initially, an onsite energy audit was carried out and accordingly energy efficiency measures were proposed for each house. Additionally, a smart meter is installed in all houses while in several cases netmetering PV systems are installed for the first time in Cyprus. The results are in perfect compliance with the aim of the project. It is important to note that the first results of the netmetering PV systems reveal a very promising perspective for the application of these systems in Cyprus since a reduction of >95% is achieved on the net electricity consumption.

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2nd Conference on Power Options for the Eastern Mediterranean Region
07-08 October 2013, Nicosia, Cyprus (Paper No. POEM13/195)

Towards low carbon homes through energy renovations

Gregoris Panayiotou, Maria Ioannidou and Anthi Charalambous

Abstract

In this paper a description of the ERACOBUILD "Countdown to Low Carbon Homes" project along with the current progress to date in Cyprus is presented. This project began in 2012 and involves partners from three EU countries: Cyprus Energy Agency (Cyprus), Aristotle University of Thessaloniki (Greece), and Severn Wye Energy Agency (United Kingdom). Cyprus Energy Agency is undertaking this project in order to develop a one stop service for the sustainable energy retrofit of homes in Cyprus. This service aims to support anyone wishing to improve the energy efficiency of their home, by showing them low cost methods to maximise their return on investment, with long term benefits for the environment and their own family budget. In Cyprus twenty-one case studies of domestic sustainable energy retrofit have been selected while also two support groups have been created: the Regional Advisory Group and the Local Installers Group. Both groups meet on a regular basis to exchange information and opinions on the progress, implementation and outcomes of the project.

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TRAVEL INFORMATION

For all tourist information concerning sites of interest; visit the official webpage of Cyprus Tourism Organization (www.visitcyprus.com).

Travelling Around Nicosia

Please visit 'OSEL Buses' website at www.osel.com.cy to find routes, timetable and maps that match your preferences.

For ease of reference, Routes 116 and 121 starts from Nicosia main station (Dionisios Solomos Square) and pass close by Hilton Cyprus Hotel – VENUE (Archiep. Makariou Avenue).

- One Way Ticket: €1.50
- Nightly Ticket (23:00 – 04:00): €2.50
- Daily Ticket: €5.00

Public Buses

Please visit the official website of Cyprus By Bus: www.cyprusbybus.com.

Intercity routes - Intercity Buses: www.intercity-buses.com

Nicosia inner-city routes - OSEL Buses: www.osel.com.cy

Larnaca inner-city routes - ZINONAS Buses: www.zinonasbuses.com

Limassol inner-city routes - EMEL Buses: www.limassolbuses.com

Paphos inner-city routes - OSYPA Buses: www.pafosbuses.com

Famagusta inner-city routes - OSEA Buses: www.oseabuses.com

Local Taxi Services

- Akis Taxi: +357 99 463463
- Columbia Taxi: +357 22 780444

You also can ask the Reception desk of your hotel to call a taxi for you.

Getting Back to the Airport

Private Transportation

If you require a transfer to Larnaca or Paphos Airport, you can contact a member of staff at the onsite Conference Registration Desk who will be pleased to reserve a taxi for you.

Public Transportation

To Larnaca International Airport:

The service from Larnaca Airport to Nicosia and reverse is provided by KAPNOS AIRPORTS SHUTTLE. Please visit their webpage for more information: www.kapnosairportshuttle.com.

Step 1: Use a taxi to get from your accommodation hotel to Kapnos airport Shuttle bus station. Alternatively, you can visit 'OSEL Buses' website at www.osel.com.cy to find a route and timetable of your preference to reach Kapnos airport Shuttle bus station.

Step 2: Afterwards, you can take the direct service to Larnaca Airport handled by KAPNOS AIRPORTS SHUTTLE. You may visit www.kapnosairportshuttle.com to check the timetable that matches your flight.

To Paphos International Airport:

Step 1: Use a taxi to get from your accommodation hotel to Nicosia main bus station (Dionisios Solomos Square). Alternatively, you can visit 'OSEL Buses' website at www.osel.com.cy to find a route and timetable of your preference to reach Nicosia main bus station (Dionisios Solomos Square).

Step 2: From Nicosia main bus station (Dionisios Solomos Square) use the public bus company "Intercity Buses": www.intercity-buses.com to get to Paphos City (Pervola – Karavela Station).

Step 3: From Pervola – Karavela Station you can use the public bus route 613 to reach the Paphos Airport. Please visit 'OSYPA Buses' website at www.pafosbuses.com/en to find map and timetable.

USEFUL CONTACT NUMBERS

Country code prefix:	+357
Directory Enquiry Service:	11892

Emergency Numbers

Private Doctors on Call:	90 901432
Ambulance & Police:	112 or 199
Pharmacies (after hours):	90 901412
Nicosia's General Hospital:	22 603000

Other Useful Contact Numbers

Airports

Larnaca and Paphos International Airports:	77 778833
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Hotel Details

Hilton Cyprus Hotel - 5* – VENUE

98 Archbishop Makarios III Avenue, Nicosia, 1516, Cyprus

Phone: +357 22 377777 | Fax: +357 22 377788

Email: hilton.cyprus@hilton.com.cy

Centrum Hotel - 3*

15 Pasikratous street, Eleftherias Square, 1011 Nicosia, Cyprus

Phone: +357 22 456444 | Fax: +357 22 873560

Email: info@centrumhotel.net

Local Coordinator



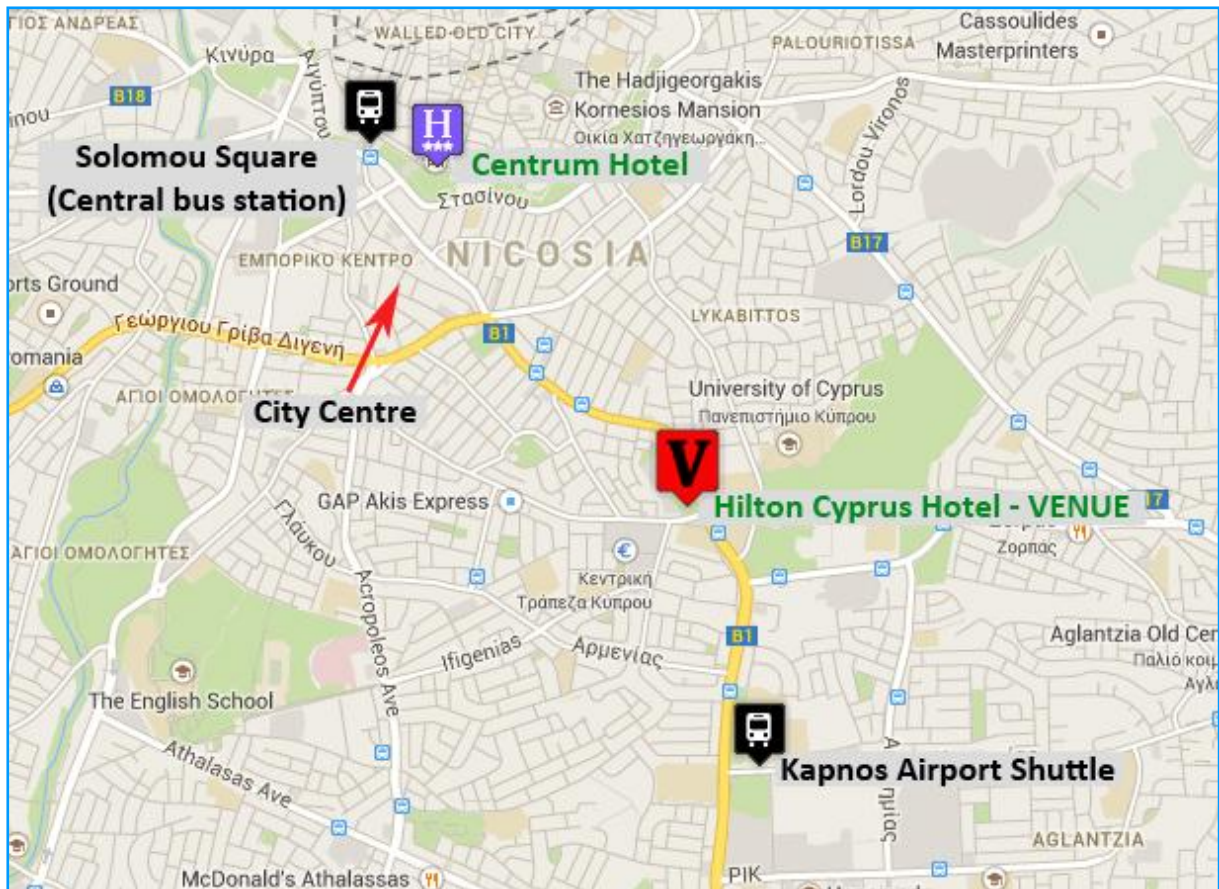
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If at any given moment during your trip to Cyprus, or at any time throughout your stay, you find that you require assistance, please contact Mr. Petros Stratis at +357 99 653444.

VENUE AND HOTELS MAP





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