DERri
Distributed Energy Resources
Research Infrastructures

TEMPLATE FOR PROPOSAL UNDER DERRI

User-Project Proposal:

User-Project Acronym	OSMOTIC
User-Project Title	Optimal Smart MicrO grid management and Intelligent Control
Main-scientific field	Automation and control
Specific-Discipline	Energy management systems, Intelligent energy systems

Lead User of the Proposing Team:

Name	Luca Ferrarini
Phone	(+39)3204644464
E-mail	Luca.ferrarini@polimi.it
Nationality	Italy
Organization name, web site and address	Politecnico di Milano – Dipartimento di Elettronica e Informazione http://www.dei.polimi.it/index.php?&idlang=eng Via Ponzio 34/5 Milan – Italy
Activity type and legal status* of Organization	Higher Education Institute
Position in Organization	Full Professor

* Higher Education Institution (1) – Public research organization (2) – Private not-for-profit research organization (3) – Small or Medium size private enterprise (4) – Large private enterprise (5) – other (specify)

Additional Users in the Proposing Team:

Name	Giancarlo Mantovani
Phone	(+39)0223999610
E-mail	mantovani@elet.polimi.it
Nationality	Italy
Organization name, web site and address	Politecnico di Milano – Dipartimento di Elettronica e Informazione http://www.dei.polimi.it/index.php?&idlang=eng Via Ponzio 34/5 Milan – Italy
Activity type and legal status* of Organization	Higher Education Institute
Position in Organization	Ph.D. Student

Name	Rasoul Esmaeilzadeh
Phone	(+39)0223999610
E-mail	rasoul_zadeh@yahoo.com
Nationality	Iran
Organization name, web site and address	Politecnico di Milano – Dipartimento di Elettronica e Informazione http://www.dei.polimi.it/index.php?&idlang=eng Via Ponzio 34/5 Milan – Italy
Activity type and legal status* of Organization	Higher Education Institute

Position in Organization	Ph.D. Student

* Higher Education Institution (1) – Public research organization (2) – Private not-for-profit research organization (3) – Small or Medium size private enterprise (4) – Large private enterprise (5) – other (specify)

(Repeat for all Users)

Date of submission	April 26, 2013
Re-submission	YES_______ NO__X____
Proposed Host TA Facility	USTRAT, RISOE-DTU, TECNALIA-LAB
Starting date (proposed)	Summer 2013

Summary of proposed research (about ½ page)

Prepare a ½ page summary describing the relevance and the scope of the proposed work, and the expected outcome(s)

This project deals with the design and testing of an efficient strategy for end users – including industrial sites as well as cluster of small users and commercial districts - to improve their demand profile ensuring at the same time economic benefits, energy contribution to the power market and load balancing in micro grids.

The scenario we address in the present proposal is that of a private grid-connected smart micro grid encompassing a storage device, photovoltaic generators, smart buildings and wind turbines. The mentioned micro grid is connected to the main distribution grid by a switch. The scenario is typical in case of large consumers (large industries, airports, shopping districts, surrounded by neighbour villages, offices, schools. It is quite frequent all over the world.

The goal of this project proposal is to analyze and design a suitable control and management structure for properties owner at the micro-grid level to ensure the required demand in a more economic and reliable manner as well as contributing in power market. In particular, an optimal algorithm will be used for energy dispatching and management based on the devices operation constraints, on the user's requirements, predictions of consumption and production from renewables, and of course on the reliability and stability needs of the distribution grid, when the private micro-grid is connected.

From the demand side viewpoint the described approach will give the opportunity of decision making to the facility manager and would help industries and large consumers to contribute in power market and this will be another option of increasing benefits of industries and other commercial operators. On the other hand, such a decentralized approach, where users-producers group together to best optimize their own consumption and minimize unbalancing problems towards the main distribution grid, is beneficial also for the main distribution grid itself, especially for peak rebate and loss reduction in peak hours.

Different scenarios are drawn out for both economic and technical benefits analysis and the optimal strategy for each state is planned. In the first scenario, it is supposed that the property owner just have access to storage device and distribution grid connection. Also, there is a smart building and industry consumption. The problem is to give an optimal strategy for charging and discharging the storage to minimize the payment for energy consumption and load balancing. In the second scenario the problem is verified by a photo voltaic generator in place of the storage device. The third scenario is to find a strategy for reaching the goal with all photovoltaic and storage device from viewpoint of an industry owner.

Notice that the optimization algorithm can be applied also with other sources such as wind turbine.

State-of-the-Art (about 1 ½ page)

Describe in brief (in about 1½ pages) the current knowledge on the subject, citing recent relevant references. Identify any knowledge gaps and their relevance.

Nowadays, electric industry is not only facing with the delivery of required energy for industry, tertiary field, and end users, but also with the environmental pollution and energy saving in general. Smart micro grid is one of the most important infrastructure which brings lots of benefits in this challenge [7]. For the demand side, smart micro grid means that users may have intelligent management and control on their consumption to reduce the cost of electricity energy during a day, through integration of renewable energy sources, storage devices and online parameters and load monitoring [1]. For environmental experts smart micro grid means to use some technologies for helping solutions to prevent from harmful changes in water, air and environment to avoid from increasing different combination of carbon gasses. Also for electric industry experts, smart micro grids mean intelligent monitoring and energy flow control of grid. Finally, being the production distributed in micro-grids, close to the consumption, electrical losses decreases and similarly some unbalancing problems are solved locally, so that the national distribution grid is left with minor balancing problems to solve.

Smart micro grid is one of the world novel technologies for modernization of the public and private distribution grid for entering into digital data gathering century. The main purpose of smart micro grid is ensuring reliable energy responses for consumers demand increase with less penalties and environmental risks.

Briefly, some of main advantages of smart micro grids can be mentioned as:

- Peak rebate which is a result of ICT technologies and optimization techniques
- Drastic reduction in fossil fuel use as a result of peak rebate and loss reduction
- Significant decrease in end-user blackout as a result of precise load forecasting and also efficient action in happening blackouts
- Decreasing the investment for grid expansion as a result of load balancing
- Cost minimization for end-user because of using the optimization algorithms [16] for energy ensuring and switching from far distance
- Obstructing from market power appearance [15].

Preventing from blackout in industries and important organizations such as hospitals and trading centers is the most important goal not only from sight of distribution companies, but also from end-user point of view. With having the suggested strategies industries will have opportunity to experience more incomes, less blackout and better power quality and stability.

Smart micro grids will reduce the black out and will increase the power quality using the below mentioned tools such as:

- Fast control of distributed generations and energy management
- Readjusting the systems using automatic smart switches
- Real time determination of quantity and location of tripped loads
- Diagnosis of grid disconnection and fast reconnection

In different parts for the world the demand-response (DR) is a under precise study. The reason that these countries are interested in it is to find a suitable solution for system fluctuations considering that price and value of energy is variable during different hours. The price variation between peak hours and basic load condition is an acceptable witness for the mentioned statement. If the final market price be more than the value of consumer need, then it is preferable for consumer to reduce or improve its consumption in exchange of having the equal cost or even a little less than the equal cost. For a system operator there is no difference to pay money for energy generation to generator companies or pay the equal amount for consumer to reduce the energy consumption or disconnect from the grid. In both conditions, the required service for balancing load and generation will be created. Generally, this market mechanism, in peak hours or even energy generation fluctuations would be efficient. In fact, DR would enable the demand curve to be more flexible and also it will impact the price by reducing the need for reserve[2, 3, 4 and 5].

D. Crawlery and collegues [12] define a Zero Net Energy Building as a “building that offset all its energy use from renewable energy sources available within the footprint.” This imply that all this kind of buildings have to reduce their energy consumption at first and then produce on site at least as much electric energy as they require in a year using demand-side load control and renewable energy technologies, such as daylight heating, advanced HVAC, solar panels, insulation, ground-source heating pumps, ocean water cooling, evaporative cooling, etc. In this article it is pointed out that, even though many simulations and studies support the feasibility of a ZNEB, in general the majority of these dwellings achieve to be “near” to the zero-net energy buildings. This is mainly due to optimistic assumptions about the tenants’ lifestyle and the solar radiation level. The penetration of ZNEBs addresses also a stability issue on power networks because, during low solar radiation, the energy peak-consumption in ZNEBs is even more pronounced than in typical buildings. Therefore, energy storage facilities should be integrated to limit this problem.

References such as [13] and [14] offer an economic feasibility point of view of ZNEBs, presenting studies for Newfoundland and Florida regions respectively, while [10] summarizes the state-of-the-art in regulations and active projects on ZNEBs. This latter reference is particularly interesting because it is up to date with the latest information coming from the 2010 European Commission directives on Smart Buildings.

J. McDonald pointed out that the Smart Grid was essentially a control problem including [6]: Delivery optimization, Demand optimization, Assets optimization, Reliability optimization and Renewable sources integration and optimization.

In several EU Countries, combination of market liberalization and DG diffusion is promoting innovative schemes: Italy, for example, is studying a measure such that photovoltaic plants (PV) with a “predictable exchange profile” will get a +20% incentive for their energy production [7].

The EC Recommendation C(2009) 7604 “asks for a closer cooperation between the ICT sector and building and construction sector to improve the environmental and energy performance of new and existing buildings, and to address the existing barriers to the wider use of ICT tools and their relevant applications” In order to reach these objectives and to achieve a global efficiency in tertiary employ, a complex strategy including not only energy and gas prices but also their specific exploitation, customer preferences and external parameters as seasonal temperature change is required. This strategy may better monitor and control energy performance of buildings, where local generation must be included [8, 9], especially because it could imply a power flow towards the network instead of consumption. In addition, local storage units could improve flexibility in energy management, while their economic benefits should be still identified.

References

[1] V. Pothamsetty and S. Malik, “Smart Grid: Leveraging Intelligent Communications to Transform the Power Infrastructure”, *CISCO Systems Whyte Paper*, February 2009

[2] P. Stluka, D. Godbole, T. Samad, “Optimization and Control for Demand Management in Smart Grid”, *Honeywell Corp., CDC Conference, IEEE CDC 2010 Conference*, Atlanta, 15-17 December 2010

[3] J. Mc Donald, “Leader or follower: developing the Smart Grid Business Case,” *IEEE Power and Energy Magazine,* Vol. 6, November-December 2008, pp. 18-90.

[4] M. Milligan, M. Schwartz and Y. Wan, “*Statistical Wind Power Forecasting Models: Results for U.S. Wind Farms”*, to be presented at Wind Power 2003 Austin, Texas May 18-21, 2003.

[5] Palsson, M.P, Toftevaag, T., Uhlen, K. and Tande, J.O.G. *“Large-scale Wind Power Integration and Voltage Stability Limits in Regional Networks”,* Power Engineering Society Summer Meeting, IEEE, Vol. 2, pp. 762 – 769, 2002.

[6] J. Kleissi and Y. Agarwal, “Cyber-Physical Energy Systems: Focus on Smart Buildings,” ***Annual** ACM/IEEE Design Automation Conference,* January 6, 2010, pp. 749-754

[7] Decree 129/2010 published 24th August 2010, art 10.
[8] Luca Ferrarini, Marco Pernice, "Modeling and Control of a Thermal Energy System in a Building Automation Scenario" *INDIN 2009*, Cardiff, 24-26 June, 2009.
[9] M. de Chirico, S. Esposito, L. Ferrarini, P. Magni, C. Montecucco, S. F. Nicolodi, S. Radaelli, "Bringing efficiency through energy management: The UTILTEC Project", *ANIPLA2006, 1st ANIPLA International Congress on Methodologies for Emerging Technologies in Automation*, 13-15 Nov. 2006, Roma, Italy, paper T115.
[10] E.Musall et al., "Net Zero Energy Solar Buildings: An Overview and Analysis on Worldwide Building Projects", University of Wuppertal, Department of Architecture, Wuppertal (Germany), 2010.
[11] G.T.Costanzo, J.Kheir and G.Zhu, "Peak-Load Shaving in Smart Homes via Online Scheduling", *IEEE International Symposium on Industrial Electronics, Gdansk (PO)*, June 27-30, 2011
[12] D.Crawlery et al., "Getting to Net Zero", National Research Laboratory, Journal Article NREL/JA-550-46382.
[13] M. Iqbal, "A feasibility study of a zero energy home in Newfoundland." Renewable Energy Review n.29, Elsevier, pp. 277-289.
[14] S. Kadam, "Zero net energy buildings: are they economically feasible?" Technical report, Massachussets Institute of Technology.
[15] R.Esmaeilzadeh, H. Eskandari, M. Amjadi and M. Farrokhifar, " *Effective Detection, Identification and Measurement Strategies of Market Power Market and Their Comparison*", International review of control and automation , 2012.
[16] M. Farrokhifar, M. B. Sharifian and R.Esmaeilzadeh*"A Novel Method for Optimal Location and Expansion of Subtransmission Substations Considering Existing Medium-Voltage Distribution Feeders"*, American Journal of Applied Sciences, Vol. 6, No. 3, pp: 368-379, 2009.

Detailed Description of proposed project : Objectives – Expected Outcome – Fundamental Scientific and Technical value and interest (2-3 pages)

Provide a detailed description of the objectives of the proposed activity, the way these objectives will be fulfilled through the proposed work, as well as indications on the expected outcome and the fundamental scientific and technical value and interest of the proposal. Specify the type of TA infrastructure (distributed generation simulator; domotic house; etc.) and the test setup. With the understanding that these aspects will be discussed with the TA infrastructure after approval of the proposal and specified in the Agreement to be signed between the TA infrastructure and the User team, indicate the number of tests to be carried out and their sequence, the response quantities to be measured through the instrumentation, etc. Describe any special requirements for equipment, standards, safety measures, etc. Point out any shortcomings, uncertainties and risks for the fulfillment of the project objectives, as well as the means to mitigate relevant risks.

Nowadays, electricity energy needs in all sectors, from domestic one, to trading and commercial centers, agriculture and industries, are growing rapidly. Traditionally, electricity energy cycle is based on three basic phases:

1. Energy generation section which have the authority of electricity generation such as power plants.
2. Energy transmission and sub transmission section which has the responsibility of energy transmission from power plants to distribution grids and consumers.
3. Power distribution section which has the responsibility of energy distribution for domestic, commercial, agricultural and industrial usage.

Although usually electricity should be produced in main power plants and transmitted by transmission, sub-transmission and distribution grids for end-users, the optimal strategy is to reduce electricity transmission losses and congestions by ensuring the energy demand in a place as near as possible to consumers. This idea gives the opportunity to not only save large amount of electricity losses in transmission, sub transmission and distribution grids, but also reduce the congestion of grids, which comes to enhance the capacity of grid without investment and economic benefits from end-user points of view.

Distributed generations (DG) means to produce energy in the place of consumption or in a place near to consumption to avoid any losses and congestions. Usually the antecedent of using the DG comes back to 40 years ago. Their generation capacity is less than 25MW and typically they are connected to distribution grids.

In electric industry the DG, renewable energy sources and storages are in center of governors attentions for some general reasons such as:

1. Need for restructuring in electric power industry
2. Power quantity and reliability
3. Growing world economy and population
4. Technology enhancement and adoption of high efficiency devices
5. Air and water pollutions and environmental aspects
6. Reduction of energy consumption

Especially, at the side of end-user there can be mentioned a lot of technical and economic advantages for suggesting the DG's, such as:

1- Reliability enhancement in electricity generation
2- Producing required energy in a place near to consumption
3- Producing energy with higher power quality and less harmonics
4- Increasing system efficiency by some local applications such as simultaneous use for heating and electricity generations
5- Capability for energy cost reducing
6- Capability for energy ensuring where the grid expansion is not physically or economically available

On the other hand DG and renewable energy resources have other advantages from grid side as follows:

1. Decrease of need for grid (and related assets) capacity enhancement
2. Easy foundation and operation of DG
3. High quality energy generation using CHP systems
4. Optimal use of energy (loss reduction)
5. Loss reduction and grid capacity enhancement
6. Peak rebate
7. The possibility of use of biogas, natural gas etc.
8. High reliability for end user especially in industries, hospitals etc.
9. Reducing spread of environment contamination

Also, in many countries the number of industrial suburbs around cities is growing and the majority of these suburbs are founded in area approximately more than 50 hectares. The power demand for such areas volume is around 7 - 8 MW, and in some cases it can be evaluated to be up to 200 MW. For, majority of industries who need demand around 10 to 25 MW , it is suggested to prepare different types of DGs or renewable energy sources to have an acceptable response for their demand and benefit from their advantages such as high reliability, better power quality and especially economic benefits from contributing in power market.

Thus, it is suggested for industries who their demands are more than 1 MW to have the required property for producing their electricity request.

In the future the contribution of variety of industries who ensure their power demand from a sort of shared distributed energy sources according their special time and conditions, will be presented and their economic and technical advantages will be proved.

It is clear that the rate of electricity during a day is variable. The most expensive price for electricity, the least reliability and power quality usually belongs to peak hours. As a simple scenario it is assumed a micro smart grid with a switch connection to the distribution gird.

This micro grid contains storage device beside a smart building whose consumption can be controlled (can be reduced up to 60 percent of maximum demand for emergency lighting an heating needs etc.) and smart industry building. Optimization approach and algorithms will manage to charge and discharge the storage in such a way to minimize the energy bill for end user. Smart buildings give the possibility of controlling energy consumption which is important especially in peak period.

In the other scenarios optimization algorithm should manage smart micro grid with all devices and generators such as wind turbine, photovoltaic system and storages (as shown in Fig.1). All important constraints will be included inside the optimization method to lead both the end user and grid less cost and better power quality. The Fig.2 and Fig.3 show the load profile and average market price, respectively.

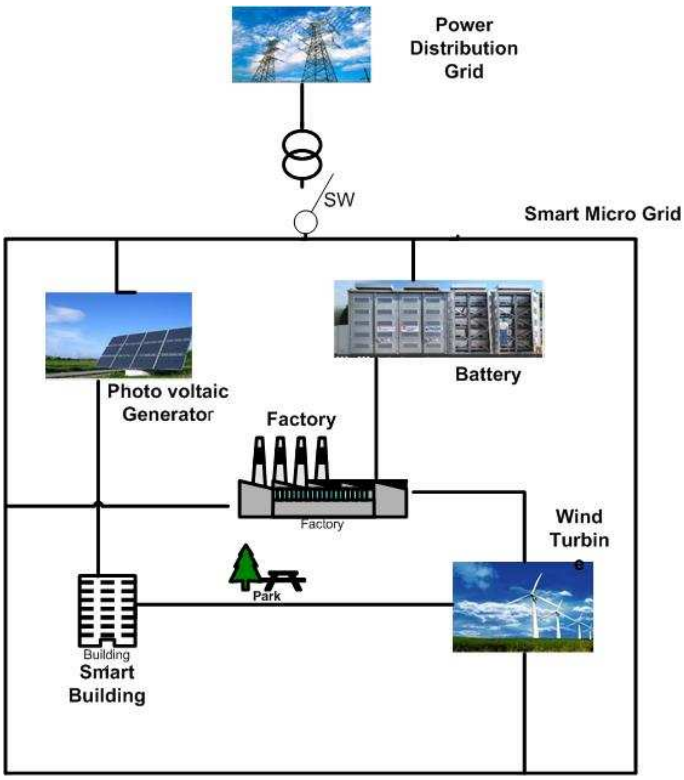

Fig.1 General Schematic of a Smart Private Micro Grid

Fig.2. Load profile of grid in 24 hours duration

Fig.3. Average market price of grid in 24 hours duration

Studying the above figures shows that there is an essential need for an optimization algorithm to enhance the benefits from power market contributions and cost reduction. Optimization can no more be left to intuition and approximate reasoning. Optimal control algorithms will give the strategy to smart micro grid operator to know when the smart grid should be connected to distribution grid and how the properties should be operated due to this goal. In particular, we will test and compare optimization approaches from model predictive control too .

Also, the controllability of the smart building should be come into play in order to help the manager for energy sources dispatching and market contribution.

On top of that, the reason to apply to DERri is to have the possibility to test the algorithm and problem approach into a real micro grid with smart buildings and demand/response energy pricing system.

More precisely, the specific objectives of this work include:

- Study and design of a new optimization algorithms for micro grid energy management
- Smart Micro grid modeling with renewable sources, storage and smart buildings
- Optimal load flow through the grid
- Price-based Demand/response optimization
- Run simulation with different scenarios and optimizing cost functions
- Assess the direct benefits of this architecture compared to actual grid management policies and power dispatching algorithms through experimental implementation.

The test facilities we need are:

- Micro grid installation with renewables
- Buildings test facilities with the possibility to remotely control the electrical loads
- Demand/Response simulator or environment
- A real time simulation environment for power grid, possbily
- Suitable communication network
- Platforms to implement the (distributed) energy management system
- Some thermal and electrical energy sources (HVAC, micro-CHP, micro turbines, PV, etc...)
- Data analysis facilities

Clearly, some of the above feature may be missing. The experiments themselves do not present high risks since they are not dealing with high voltage equipment and transmission lines. The fulfillment of the objectives present uncertainties related to the efficiency of the algorithms: in simulations results may be better or worse than in real life since fluctuating behaviour of users would be difficult to model.

Originality and Innovation of proposed research – Broader Impact (1-2 pages)

Demonstrate the originality and innovation of the proposed work and the impact the expected results will have on current and future research or practice, public safety, European standardization, competitiveness, integration and cohesion and on sustainable growth.

The strategy and optimization algorithm is quite new as a general technique for cost minimization, reliability enhancement and load-peak shaving policies. An efficient algorithm is shown in [11]. Besides the scheduling approach for energy management, the other contribution of this research work aims at is a systemic view of Smart Grids, renewable energy sources and storage integration in a private micro grid where ICT, power grid, appliances, RES/DG and user interfaces interaction can be treated within the same framework.

In particular, model predictive techniques and other less conventional optimization techniques are seldom used in the electricity framework. The present proposal intends to investigate and test the feasibility of such advanced techniques.

In addition, optimization models and techniques will be integrated with the scheduling approach. This latter would allow variety of industries to share their own energy generators according to their technical constraints and specific characteristics as well as contribution in power markets and restructured space.

The used general model will enables distribution grids in congestion optimization and loss reduction as well as enabling end-user to experience the least possible black outs.

Proposed Host TA Infrastructure/Installation – Justification (about one page)

Specify the type of TA infrastructure (e.g. distributed generation simulator; domotic house; etc.) and if possible which one of the 13 TA Infrastructures in DERri may better serve the scope of the proposed research. Justifications should be provided on the grounds of the test set-up, testing method, equipment, past experience in relevant subject, etc. State whether the TA User team intends to deliver to the premises of the TA Infrastructure parts or components to be tested at the TA User's expense and responsibility, or to cover the whole or part of the construction/adaptation cost of the specimens to be tested.

After an analysis of DERri partners, the laboratories that offer facilities that best match our needs are:

-USTRAT (United Kingdom) – Possibility to test the logics on a small grid in islanding mode or connected to the grid. More details on the devices should be provided.

-RISOE-DTU (Denmark) – “The SYSLAB research facility is a full scale distributed laboratory for experimental testing of distributed intelligent power systems with real power system components in a safe and flexible environment”.

- TECNALIA-LAB (Spain) - The facility of the Centre for Development and Demonstration of DER technologies deals with the connection, integration and validation of technologies related to DER including EV, as well as with the operation and control strategies of the entire microgrid.

Synergy with ongoing research (about ½ page)

Provide information on any concurrent research project with the same or similar subject with the one proposed. Describe the synergy (if any) that will be sought between the existing and the proposed project.

The proposed project is in synergy with the following projects

- CASSANDRA Eu Project (2011-2014). It aims to build a platform for the realistic modeling of the energy market stakeholders, also involving small-scale consumers. CASSANDRA main outcomes will be the aggregation methodology and the framework of key performance indicators for scenario assessment, as well as an expandable software platform that providing different energy stakeholders with the ability to model the energy market, in order to assess scenarios for their own purposes
- UTILTEC. The aim is the design and development of an innovative ICT-based low-cost infrastructure for electrical energy management, monitoring and remote load control for public utilities, residential customers and tertiary field.
- ENERTEC. The aim is the design and development of a management system for any kind of energy sources and exploitations at customer side, including distributed generation, demand response, load control, and safety issues
- ENERGETICA MENTE [http://www.energetica-mente.biz/pagine/pagina.aspx?&L=IT]. The aim is to design and implement an ICT solution for the management and control of the centralised heating system of apartment buildings endowed with distributed accounting system for heat consumption.
- Fifth energy research program of German federal Government toward zero emission buildings, [http://www.bmwi.de/BMWi/Navigation/Energie/energieforschung.html]
- Latest European Commission directives on energy performance of buildings, [EU (2010), The Directive 2010/31 of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast). Official Journal of the European Union, accessed 24/06/2010], from [11]

.

Dissemination – Exploitation of results (about ½ page)

Describe the means through which the results to be obtained from the proposed project will be diffused and made broadly known.

- Technical paper for international conferences/symposia organized by IEEE, such as SmartGridComm, CDC, ISIE, INDIN, and by IFAC.
- National publication in Italian journals and participation to symposia organized by ANIPLA (National Italian Organization for Automation)

Time schedule (about ½ page)

Activity/Month	**0**	**1**	**2**	**3**	**4**
State-of-the-art	x				

Requirement analysis		X			
Designing		x	X		
Testing			x	X	
Dissemination				x	X

Provide an indicative time-schedule for the proposed work and a target starting date.

Description of the proposing team (as long as needed)

Give a short description of each member (organization and persons) of the proposing team including publications, experience in test campaigns and role in the proposed project.

The proposing team is made up of:

- Professor Luca Ferrarini (Full Professor, Politecnico di Milano)
- Giancarlo Mantovani (Ph.D. Student, Politecnico di Milano)
- Rasoul Esmaeilzadeh (Ph.D. Student, Politecnico di Milano)

Luca Ferrarini

Luca Ferrarini received the "Laurea" Degree in Electrical Engineering (summa cum laude) from the Politecnico di Milano, Milan, Italy, in 1988, and a post-Laurea degree in Industrial Process Control, from the Master School CEFRIEL in 1990. In 1994 he was a visiting researcher in Kyoto University, Kyoto, Japan. Since 1990, he has been with the Dipartimento di Elettronica e Informazione, Politecnico di Milano, where he is full professor since 2004, teaching courses on industrial automation and discrete event systems.

He is author of 7 patents (5 Italian and 2 European) in the design and testing of industrial automation systems field, for large complex production plants. He is senior member of IEEE and collaborates with IEC, ISA, IFAC and ANIPLA (Associazione Nazionale Italiana Per L'Automazione), the Italian National Association for Automation of which he was national president in 2003 and 2004. He's author of around 160 scientific contributions, including 4 books, 4 book chapters, 25 journal papers. He has been tutor of 4 PhD students, and a hundredth of Laurea degree final projects (tesi). His research interests include discrete-event systems and Petri nets; control system development methodology for industrial distributed control and automation systems; modeling, simulation and control of manufacturing processes; monitoring and control of electro-thermal energy systems.

Giancarlo Mantovani

Giancarlo Mantovani received a MSc summa cum laude in Automation Engineering at Politecnico di Milano (July 2010), a MSc in Mechatronic Engineering at Politecnico di Torino (June 2011) and the Alta Scuola Politecnica (ASP) Diploma (June 2011), the school of excellence of Politecnico di Milano and Torino. He has been employed for six months in Enertech Solution, a start-up born from Politecnico di Milano, where he worked on the development of innovative monitoring systems for energy management. He is now a PhD Student at Politecnico di Milano, working in the field of ICT technologies for energy efficiency for end users and demande response programs in smart grids.

Rasoul Esmaeilzadeh

Rasoul Esmaeilzadeh received the B.Sc (1999) in the field of Electrical Engineering-Electronics and M.Sc. degrees (2003) in the field of Electrical Engineering-Control from University of Tabriz. He has been working as an academic staff from 2005 to 2008 and as an expert consultant of power market and smart metering office of electric company from 2008 to 2012 in Tabriz, Iran. His research interests are in the application of optimization theories on energy management, power system control, power market, energy bidding and renewable energies sources expanding. He was supervisor of more than three research projects and author of several conference papers and journal articles around his interested fields. Currently, he is Ph.D student in Politecnico di Milano, Italy, and working on optimization algorithms for integration of renewable energy sources in smart private micro grid.

Publications

Luca Ferrarini, Marco Pernice, "Modeling and Control of a Thermal Energy System in a Building Automation Scenario" INDIN 2009, Cardiff, 24-26 June, 2009.

M. de Chirico, S. Esposito, L. Ferrarini, P. Magni, C. Montecucco, S. F. Nicolodi, S. Radaelli, "Bringing efficiency through energy management:The UTILTEC Project", ANIPLA2006, 1st ANIPLA International Congress on Methodologies for Emerging Technologies in Automation, 13-15 Nov. 2006, Roma, Italy,paper T115.

Luca Ferrarini and Carlo Veber (editors), "Modeling, Control, Simulation and Diagnosis of Complex Industrial and Energy Systems", ISA series on Distributed Industrial Automation 2008, Product ISBN/ID: 978-1-934394-90-8. www.isa.org/modeling.

L. Ferrarini, J. Carneiro, "Preventing thermal overloads in transmission circuits via model predictive control" , IEEE Transactions on Control System Technology, to be published, 2010.

L. Ferrarini, J. Carneiro, "Reliability Analysis of Power System based on Generalized Stochastic Petri Nets" PMAPS2008, IEEE International Conference on Probabilistic Methods Applied to Power System, Puerto Rico, 25-29 May 2008.

G. T. Costanzo, A. M. Kosek, G.Zhu, L. Ferrarini, M.Anjos and G.Savard, “An Experimental Study on Peak-Load Shaving in Smart Homes by Means of Online Admission Control”, paper submitted for ACC2012 – American Control Conference, June 27-29, 2012, Montreal (CA).
R. Esmaeilzadeh, H. Eskandari, M. Amjadi and M. Farrokhifar, ” Effective Detection, Identification and Measurement Strategies of Market Power Market and Their Comparison”, International review of Automatic Control , Vol. 5, No. 3, pp: 921-930, 2012.

M. Farrokhifar, M. B. Sharifian and R. Esmaeilzadeh”A Novel Method for Optimal Location and Expansion of Subtransmission Substations Considering Existing Medium-Voltage Distribution Feeders”, American Journal of Applied Sciences, Vol. 6, No. 3, pp: 368-379, 2009.