



**User-Project Proposal:**

Use-Project Acronym	<b>RLICHARGE</b>
User-Project Title	Research of the Li-ion and Li-polymer storage charge and discharge for electro vehicles
Main-scientific field	Storage for electro vehicles
Specific-Discipline	Storage systems for electro vehicles with PV situated on the top and interconnected to the electricity grid

**Lead User of the Proposing Team:**

Name	<b>Svetlozar Kirilov Zahariev</b>
Phone	+359 877574214,+359988821468
E-mail	skzahariev@tu_varna.bg
Nationality	Bulgarian
Organization name, web site and address	TU-Varna, DTK-Dobrich, www.tu-varna.bg ,t Varna Studentska str. 2
Activity type and legal status* of Organization	Higher Education Institution
Position in Organization	assistant

\* 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	<b>Dimitar Ivanov Dimitrov</b>
Phone	+359 886057507
E-mail	prof_dimitrov@ abv.bg
Nationality	Bulgarian
Organization name, web site and address	TU-Varna, www.tu-varna.bg , Bulgaria, t Varna, Studentska str. 2
Activity type and legal status* of Organization	Higher Education Institution
Position in Organization	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)

**(Repeat for all Users)**

Date of submission	26.10.2011
Re-submission	YES _____ NO _____
Proposed Host TA Facility	CEA INES PRISMES
Starting date (proposed)	

**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)*

**In the proposal we include developing of mathematical and computer model of a photovoltaic system from an island type with Li-ion and Li-polymer accumulating batteries for electromobile vehicle. It includes modeling, simulating and researching of the characteristics of the managing controllers for the charging of the accumulating batteries. The task is defining of different charging-discharging characteristics in the electromobile and choosing an optimal charging-discharging regime.**

**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.*

**References**

*List relevant References*

- [1] R. Rao, S. Vrudhula and D. Rakhmatov, **Battery Modeling for Energy-Aware System Design**, *Computer*, Vol. 36, No. 12, pp. 77-87 Dec. 2003.
- [2] K. Lahiri, A. Raghunathan, S. Dey and D. Panigrahi, **Battery-driven system design: a new frontier in low power design**, *Proc. ASP-DAC*, pp. 261-267, Jan. 2002.
- [3] **TVLSI-00029-2003.R1 An Analytical Model for Predicting the Remaining Battery Capacity of Lithium-Ion Batteries** Peng Rong, *Student Member, IEEE* and Massoud Pedram, *Fellow, IEEE*
- [4] **Structured Silicon Anodes for Lithium Battery Applications** Mino Green,<sup>a,\*</sup>,z Elizabeth Fielder,<sup>a</sup> Bruno Scrosati,<sup>b,\*</sup> Mario Wachtler,<sup>b</sup> and Judith Serra Moreno <sup>b</sup>  
*a Department of Electrical and Electronic Engineering, Imperial College, London SW7 2BT, United Kingdom*  
*bDepartment of Chemistry, University of Rome "La Sapienza," 00185 Roma, Italy*
- [5] **EEE TRANSACTIONS ON COMPONENTS AND PACKAGING TECHNOLOGIES**, VOL. 25, NO. 3, SEPTEMBER 2002 495 Dynamic Lithium-Ion Battery Model for System Simulation, Lijun Gao, Shengyi Liu, *Member, IEEE*, and Roger A. Dougal, *Senior Member, IEEE*
- [6] **In-Vehicle Testing and Computer Modeling of Electric Vehicle Batteries**, B. Thomas, W.B. Gu, J. Anstrom, C.Y. Wang and D.A. Streit  
GATE Center for Advanced Energy Storage  
Pennsylvania Transportation Institute  
Pennsylvania State University  
338 Reber Building  
University Park, PA 16802  
Email: cxw31@psu.edu
- [7] **Modeling of Lithium-Ion Battery for Energy Storage System Simulation**, S.X. Chen, *SMIEEE*, K.J. Tseng, *SrMIEEE* and S.S. Choi, *MIEEE*  
Division of Power Engineerin  
School of Electrical and Electronic Engineering  
Nanyang Technological University, Singapore

nosper@pmail.ntu.edu.sg, K.J.Tseng@pmail.ntu.edu.sg, esschoi

- [8] Michael Knauff, Jeffrey McLaughlin, Dr. Chris Dafis, Dr. Dagmar Niebur, Dr. Pritpal Singh , Dr. Harry Kwatny, and Dr. Chika Nwankpa  
**Simulink Model of a Lithium-Ion Battery for the Hybrid Power System Testbed**  
Singh, P., and A. Nallanchakravarthula. 2005.
- [9] **Fuzzy logic modeling of unmanned surface vehicle (USV) hybrid power system.**  
Proceedings of the 2005 Intelligent Systems  
Application to Power Systems, Arlington, VA,  
November 2005.
- [10] 504 **IEEE TRANSACTIONS ON ENERGY CONVERSION**, VOL. 21, NO. 2, JUNE 2006  
Accurate Electrical Battery Model Capable of  
Predicting Runtime and  $I$ - $V$  Performance  
Min Chen, *Student Member, IEEE*, and Gabriel A. Rincón-Mora, *Senior Member, IEEE*
- [11] S. Abu-Sharkh and D. Doerffel, **Rapid test and non-linear model characterization of solid-state lithium-ion batteries**, *J. Power Sources*, vol. 130, pp. 266–274, 2004.

**In the above literature view for the presented modeling, simulating and researching of Li-ion and Li-polymer accumulating batteries and controllers for charging- in automobile charging from PV photovoltaic modules. The used electro-engines in the electrical-transporting vehicles have specific starting, engine and generator's characteristics. The researching of the status of the accumulators is limited. There are no presented charging characteristics in different regimes- direct current, direct power, alternating of charging-discharging cycles in different algorithms. The task is defining of the-energy-effective regime for charging the accumulator.**

**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.*

- 1. Researching the working regime of Li-ion and Li-polymer accumulating batteries:**
  - charging of photovoltaic modules;
  - discharging in transport vehicles: power engines in different working regimes, controlling-measuring devices and others;
- 2. Developing of mathematical and computer models of Li-ion and Li-polymer accumulating batteries**
- 3. Researching the working regime of controller for managing the charging and**

**discharging of Li-ion and Li-polymer accumulating batteries in photovoltaic system of electromobile**

- 4. Defining the energy effectiveness of the electro engine system- Li-ion and Li-polymer accumulating batteries**
- 5. The expected result: implementing of comparative evaluation between the electrical measures of the different accumulating batteries and defining of the energy-effective regime of battery charging**
- 6. Characteristics of an automatized system for testing the electrical condition of Li-ion accumulating batteries and controllers for managing them**

**Expected results:** Defining the criteria for choosing a Li-ion accumulator and measuring the limiting working regimes in electro-transporting vehicle for electrical engine charging and controlling-measuring devices.

- 7. Defining the regimes for adjusting the controllers for charging an accumulating battery in photovoltaic system.**

#### **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.*

#### **Expected results:**

- Implementing of comparative evaluation between the electrical measures of the different accumulating batteries and defining of the energy-effective regime of accumulator's charging.
- Defining the criteria of choosing Li-ion accumulator and measuring its limiting regimes in its work in electro-transporting vehicle.
- As a result of a choice of more effective method for charging of accumulating battery in an electromobile increase the energy effectiveness of the system, decrease the time for charging; we reach less charging and increasing the life of the accumulator and the run of the electromobile with one charging.

#### **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.*

**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.*

**1. DERlab  
Network of Excellence (NoE) of DER Laboratories and Pre-Standardization**

Partner: AIT, CEA, Fraunhofer IWES, KEMA, NTUA, RSE, Risoe, TU Lodz, TU Sofia, TecNALIA, University of Manchester

Förderung: EU

Laufzeit: 01.11.2005 - 31.10.2011

Bearbeiter: [Thomas Degner \(Projektleiter\)](#), [Wolfram Heckmann](#), [Stefanie Schmidt](#), [Philipp Strauß](#)

**W-Charge  
Kabelloses Laden von Elektrofahrzeugen**

Partner: Audi Electronics Venture GmbH, Paul Vahle GmbH Co. KG, Volkswagen AG

Förderung: BMU

Auftraggeber: BMU

Laufzeit: 01.01.2010 - 30.09.2011

Bearbeiter: [Heike Barth](#), [Prof. Dr. Martin Braun \(Projektleiter\)](#), [Marco Jun](#)

**Sol-ion  
Erneuerbare Energie Systeme mit Lithium-Ionen-Energiespeichersystemen für die  
Anwendung im häuslichen Bereich und für kleine Gewerbebetriebe**

Partner: CEA-INES, E.ON Bayern, ISEA-RWTH Aachen, Saft, ZSW, tenesol, voltwerk electronics

Förderung: BMU

Auftraggeber: BMU

Laufzeit: 01.01.2008 - 30.06.2011

Bearbeiter: [Prof. Dr. Martin Braun](#), Kathrin Bündenbender, [Markus Landau \(Projektleiter\)](#)

**STROPA**

### **Stromparkplätze für Elektrofahrzeuge – Konzepte, Prüfstand und Pilot-Anlage**

Partner: Fröschl Systems GmbH, GIP Research Institute, imove - Institut für Mobilität und Verkehr an der TU Kaiserslautern , juwi R&D Research & Development GmbH & Co. KG

Förderung: BMWi

Auftraggeber: BMWi

Laufzeit: 01.08.2009 - 31.08.2011

Bearbeiter: [Florian Ackermann](#), Jürg Arnold, [Prof. Dr. Martin Braun \(Projektleiter\)](#), Fabian Bätz-Oberhäuser, Hauke Einfeld, [Roy Emmerich](#), [Jochen Giebhardt](#), Roman Horff, [Winfried Lesser](#), Antonio Notholt Vergara, [Sina Pezeshki](#), [Matthias Puchta](#), [Stefan Ritter](#)

### **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.*

**Participation in national and international scientific conferences. Publishing in national scientific magazines.**

### **Time schedule (about ½ page)**

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

**05.08.2012-19.08.2012**

### **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.*

#### **Team Members**

1. **Svetlozar Kirilov Zahariev** -assistant , TU-Varna,DTK-Dobrich- over 20 publications in the fields of power electronics and electrical appliance
2. **Dimitar Ivanov Dimitrov**- professor, TU-Varna, over 150 publications in the field of electrical appliance

#### **Projects:**

- 1.**Investigation and modeling the technological processes with application in the agriculture technology and technique**

Project leader Assoc. Prof. PHD Radko Mihaylov,

Proceedings of the technical university-Varna book11,2009,pp85-88

**2. Investigation and optimization the parameters of the devices and technologies applied in agriculture**

Project leader Assoc. Prof. PHD Radko Mihaylov,2010.

**3.Scientific applied laboratory creating for inculcating the innovations and training on mehatization and electrification in agriculture**

Project leader Assoc. Prof. PHD Radko Mihaylov,2009-2010.

**PUBLICATIONS:**

**1. Control Algorithm of programming current source for storage-batteries charging,**

Svetlozar Zahariev, Yavor Dimitrov 2008

[http://www.zone4science.com//index.php?option=com\\_content&task=view&id=22&Itemid=32](http://www.zone4science.com//index.php?option=com_content&task=view&id=22&Itemid=32)

**2. A Device and Algorithm of effective storage-batteries charging with processor control”**

Zahariev Svetlozar, Dimitrov Dimitar

Proceedings of the technical university-Varna book1,2008,paje110-116, ISSN:1311-896X

**3.The current transformers measurement errors defining by the digital oscilloscope,**

Zahariev Svetlozar ,Nikolova M., Res.Commun. of U.S.B. branch Dobrich (Electronic version),vol.11:1-7,2009y.

[http://geocities.com/usb\\_dobrich11/091.pdf](http://geocities.com/usb_dobrich11/091.pdf)

**4. Investigation of programming current source for metal electroextraction**

Svetlozar Zahariev , Dimitar Dimitrov

Proceedings of the technical university-Sofia,Volume 59,book2,2009,paje301-308

**5. Investigation of the battery charger in photovoltaic system of insular type**

Svetlozar Zahariev, Dimitar Dimitrov Proceedings of the Ruse university 2010, book49, seria3.1,6-66.

**Dobrudza College of Technology**, Dobrich was established with the Government decree No.16 January1997,“State gazette” issue 10 from 4 February1997,like college within the structure of the TU Varna in the following fields:

- Agriculture Technique and technology
- Machine building Technique and Technology
- Electronics
- Automation, Information and Control Techniques

The study course is three years. The college subjects of activity are summarized in the next. Preparation specialists with the higher education on educational qualification degree “Professional bachelor” on the above mentioned subjects.

- *Research activity, project-constructive and introducing activity;*
- *Studying for increasing the qualification of the diplomas students.*

Thus who takes diploma for “Professional bachelor” with the middle rate of Good /4/ and higher can go on by documentary competition in the “master” degree in the subjects of same professional direction for higher education in TU Varna.

**The Technical University of Varna** was established in 1962 by the Council of Ministers of Bulgaria and the Decree of the National Assembly in order to ensure the training of engineering staff in the field of shipbuilding, transportation, mechanical engineering, electrical energetics



DERri  
Distributed Energy Resources  
Research Infrastructures

and communication technics necessary for developing industrial complexes in northeastern Bulgaria in the field of chemistry, shipbuilding and ship repairing, engine building, transportation, electric energetics, electronics and communications.

At present structure of Technical University-Varna includes 6 faculty, 2 college:

- Faculty of Mechanical Engineering and Technologies
- Faculty of Shipbuilding
- Faculty of Electrical Engineering
- Faculty of Electronics
- Faculty of Computing and Automation
- Faculty of Marine Sciences and Ecology
- College at the Technical University of Varna
- Dobrudja College of Technology (and Agriculture)