IITB-Monash Research Academy

An Indian-Australian research partnership

Indian Institute of Technology Bombay | MONASH University

Project Title:	**Electric Vehicle Charging System with Grid Support Features**	
Project Number	**IMURA0997**	
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IITB Department:	Department of Energy Science and Engineering	

Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? *(Please nominate JUST **one.** For more information, see www.iitbmonash.org)*		**Highlight which of the Academy's Theme(s) this project will address?** *(Feel free to nominate more than one. For more information, see www.iitbmonash.org)*	
1	*Material Science/Engineering (including Nano, Metallurgy)*	***1***	*Artificial Intelligence and Advanced Computational Modelling*
2	*Energy, Green Chem, Chemistry, Catalysis, Reaction Eng*	2	*Circular Economy*
3	*Math, CFD, Modelling, Manufacturing*	3	*Clean Energy*
4	*CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control*	4	*Health Sciences*
5	*Earth Sciences and Civil Engineering (Geo, Water, Climate)*	5	*Smart Materials*
6	*Bio, Stem Cells, Bio Chem, Pharma, Food*	6	*Sustainable Societies*
7	*Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Engineering*		
8	*HSS, Design, Management*		

The research problem

Define the problem :

The global Electric Vehicle (EV) fleet is poised to increase exponentially in what has been dubbed as the electric mobility revolution. The push for EVs is driven by the global climate agenda established under the Paris Agreement to reduce carbon emissions to limit global warming. Importantly, not only would a switch from internal combustion-engine (ICE) vehicles to EVs lead to lower emissions, but it would also result in reduction of air pollution. In addition, the deployment of EVs is also driven by national agendas to reduce oil demand and as such dependence on oil imports, as well as the encouragement of a local EV manufacturing industry for job creation. On the other hand, through several grid support services, EVs are expected to strengthen the grid and help in maintaining secure and stable grid operation.

While EV charger space is rapidly evolving in technology, power level, and functionalities, yet there are various challenges including grid interaction of EVs, standardisation, and regulations that needs to be addressed. On the other hand, the paradigm shift of the transportation sector from conventional ICE based vehicles to electric mobility introduces various challenges to the grid operator in managing the grid under high EV penetration. Therefore, there is a push for grid friendly EV charging infrastructure to help in secure and stable operation of high EV and RE penetrated grid system. Although the primary application of an EV charger is to charge up the EV battery to satisfy the EV user's transportation needs, EVs can potentially perform a range of grid support services by controlling the charging of EV or by allowing bidirectional flow of power. From the perspectives of transmission and the distribution operators, EVs can be utilized as a mobile storage unit to benefit the different grid operators. An EV charger with adequate features can provide different grid support services, such as frequency and voltage support services. In this backdrop, the aim of this project is to develop EV charging infrastructure with advanced grid support functionalities, and demonstrate how such EV charging system can address various grid related issues. This project will include both hardware and simulation studies.

Project aims

1. Study and analyse the EV charging technology, EV integration with the distribution system, and potential grid support services from EVs
2. Develop an EV charger with advanced grid support features
3. Modelling and analysis of an EV charging station based on EV charger developed under point-2 above.
4. Demonstrate grid support services of the developed EV chargers with V2G features

Expected outcomes

1. Develop an EV charger with grid support features
2. Propose, demonstrate and validate intelligent control methodologies for grid support services from the developed EV charging system
3. Propose a tool to analyse and quantify the grid support services from EV charging system
4. Perform techno-economic feasibility analysis of the developed EV charging system

Capabilities and Degrees Required

A highly motivated applicant with background in Electrical Power engineering and strong commitment to quality research. Masters in electrical power or related area is preferred, however, an outstanding undergraduate applicant will also be considered.

Select up to **(4)** keywords from the Academy's approved keyword list **(available at http://www.iitbmonash.org/becoming-a-research-supervisor/)** relating to this project to make it easier for the students to apply.

Energy, Energy Storage, Electric vehicle charging, Systems Analysis and Control