

DC in the Home
Industry Connections Activity Initiation Document (ICAID)
Version: 1.2, 12 June 2013

IC13-005-03 Approved by the IEEE-SA 24 July 2015

Instructions

- Instructions on how to fill out this form are shown in red. It is recommended to leave the instructions in the final document and simply add the requested information where indicated.
- **Shaded Text** indicates a placeholder that should be replaced with information specific to this ICAID, and the shading removed.
- Completed forms, in Word format, or any questions should be sent to the IEEE Standards Association (IEEE-SA) Industry Connections Committee (ICCom) Administrator at the following address: industryconnections@ieee.org.
- The version number above, along with the date, may be used by the submitter to distinguish successive updates of this document. A separate, unique Industry Connections (IC) Activity Number will be assigned when the document is submitted to the ICCom Administrator.

1. Contact

Provide the name and contact information of the primary contact person for this IC activity. Affiliation is any entity that provides the person financial or other substantive support, for which the person may feel an obligation. If necessary, a second/alternate contact person's information may also be provided.

Name: Ernst Wiebe

Email Address: isenginc@gmail.com

Phone: (204) 898-0974

Employer: Innovative Solutions Engineering Inc.

Affiliation: Innovative Solutions Engineering Inc.

2. Type of Activity

Specify whether this activity will be entity-based (participants are entities, which may have multiple representatives, one-entity-one-vote), or individual-based (participants represent themselves, one-person-one-vote).

Individual-Based

3. Purpose

3.1. Motivation and Goal

Briefly explain the context and motivation for starting this IC activity, and the overall purpose or goal to be accomplished.

The goal is to clarify the work that needs to be done to ensure that DC electricity can be safely and conveniently accessed in the home eliminating the wasteful conversion of AC to DC in the home and in many cases, DC to AC prior to entering the home.

Photovoltaic (PV) systems produce DC power, electric vehicles, consumer electronics, computers, and many other household devices consume DC power.

The losses from conversion are estimated by NREL at 23-28 percent for conversion from rooftop PV to alternating current and by the EPA at between 17 and 35 percent converting AC to direct current power.

In the case of some PV to EV situations as much as 40 percent of the power produced on the roof is lost in power conversion to AC and back to DC.

Most storage devices will also operate on DC power, again adding to the losses that the home owner sees from installing and operating distributed energy resources.

The goal is to determine:

- 1) What the actual losses are
- 2) The value of those losses (e.g. create a business case for DC)
- 3) Determine what research should be done on DC in the home
- 4) Identify experiments and research topics that will advance the state of the art
- 5) Make a preliminary recommendation on whether DC should be a separate system or combined with AC on the same conductors
- 6) Determine what standards should be considered:
 - a. Outlet design
 - b. Switches and breakers
 - c. Distribution equipment
 - d. Power supplies
 - e. Voltage regulators
 - f. Safety equipment
 - g. Conductor design and insulation
 - h. Whole building power conversion systems
 - i. Control systems
 - j. Transformers

3.2. Related Work

Provide a brief comparison of this activity to existing, related efforts or standards of which you are aware (industry associations, consortia, standardization activities, etc.).

There have been a few scattered demonstrations of DC wiring, including a dedicated PV to stationary battery to electric vehicle charger systems that at least two manufacturers are working on.

Dow has just introduced in 4 states, solar PV shingles that are direct replacements for the existing asphalt shingles that cover most roofs in the US and Europe. These shingles do not have the efficiency of dedicated PV systems, but are also cheaper to install and have a dual purpose and are almost visually indistinguishable from common roofing materials.

Delft University in the Netherlands has done some preliminary work on DC in the home, and has some interesting results and observations.

Some related work is also being done in the IEEE 802.3 Power Over Ethernet (PoE) Study Group.

But in general this is a topic that is under-researched and discussed in the professional community.

3.3. Potential Markets Served

Indicate the main beneficiaries of this work, and what the potential impact might be.

If solar shingles take off and the DOE estimates for electric transportation are reached, and the current trend for the increase in consumer electronics and small appliances continues unabated, then probably 40% of the residences in North American and 20 percent globally may profit from DC in the home in the time period of 2020 to 2025. Given the push to reduce carbon and to make the grid more resilient to survive storms these may drive the numbers higher. The use in commercial buildings is also a high probability, some Computer Data Centers are already going pure DC.

4. Estimated Timeframe

Indicate approximately how long you expect this activity might take to achieve its proposed results (e.g., number of weeks/months/years). Also indicate when you expect this activity to be reviewed by ICom for completion or possible extension (maximum two years).

It is expected that a final draft report will be issued by the end of 2016. A final report will be issued by June of 2017.

Expected Completion/Review Date: 06/2017

5. Proposed Deliverables

Outline the anticipated deliverables and output from this IC activity, such as documents, proposals for standards, conferences and workshops, databases, computer code, etc., and indicate the expected timeframe for each.

Deliverables:

- 1) Actual Losses White Paper, technical paper – Draft is complete
- 2) Loss value white paper for North America (US and Canada) will be created on the heels of the Actual Losses white paper. This paper will be done in draft form by Oct 2015. The working group will encourage every IEEE region to create their own Loss Value report based on the template done for North America. The goal is to complete those white papers by the end of 2015.
- 3) Business case white paper, regionally the business case will be developed by the IEEE regions that choose to do so. Each region will set their own timeline. The goal is to complete all of the regions by the end of 2015.
- 4) Research needed white paper, this white paper will be done in parallel with the prior deliverables, the urgency of having the white paper leads the team to target delivering it by the end of December 2015. Drafts were discussed in a combo session at the IEEE T&D show in 2014.
- 5) Recommendations White Paper draft, to combine or to make separate as an interim and long term strategy. The recommendations white paper will make it clear where the issues are that need to be solved, much of this will be based on the research topics (but not the final research results) from Deliverable #4. This deliverable is due in January of 2016.
- 6) White paper that recommends what standards should be considered:
 - a. Outlet design
 - b. Switches and breakers
 - c. Distribution equipment
 - d. Power supplies
 - e. Voltage regulators
 - f. Safety equipment
 - g. Conductor design and insulation
 - h. Whole building power conversion systems
 - i. Control systems
 - j. Transformers

6. Funding Requirements

Outline any contracted services or other expenses that are currently anticipated, beyond the basic support services provided to all IC activities. Indicate how those funds are expected to be obtained (e.g., through participant fees, sponsorships, government or other grants, etc.). Activities needing substantial funding may require additional reviews and approvals beyond ICom.

At the present time no funding requirements have been identified. Assistance with draft review on the deliverables, is needed because of the potential far reaching impacts of these documents. They may drive government level (internationally) research priorities, as well as IEEE standards activities.

7. Management and Procedures

7.1. IEEE Sponsoring Committee

Indicate whether an IEEE sponsoring committee of some form (e.g., an IEEE Standards Sponsor) has agreed to oversee this activity and its procedures.

Has an IEEE sponsoring committee agreed to oversee this activity?: Yes

If yes, indicate the sponsoring committee's name and its chair's contact information, and skip the remaining parts of this section (skip 7.2 and 7.3, below).

Sponsoring Committee Name: IEEE PES IGCC

Chair's Name: Steve Pullins

Chair's Email Address: spullins@horizonenergygroup.com

Chair's Phone: +1- 865-300-7395

The IGCC (Intelligent Grid Coordinating Committee) is the longest serving group in IEEE focused on smart grid and grid modernization. The leadership of the group are all seasoned engineers with a strong background in the IEEE and how it operates. The IGCC was the starting point for the GridVision activities that IEEE SA just sponsored.

7.2. Activity Management

If no IEEE sponsoring committee has been identified in 7.1 above, indicate how this activity will manage itself on a day-to-day basis (e.g., executive committee, officers, etc).

NA

7.3. Procedures

If no IEEE sponsoring committee has been identified in 7.1 above, indicate what documented procedures will be used to guide the initial operations of this activity (e.g., the *Industry Connections Activity Baseline Procedures*).

NA

8. Participants

8.1. Stakeholder Communities

Indicate the stakeholder communities (the types of companies or other entities, or the different groups of individuals) that are expected to be interested in this IC activity, and will be invited to participate.

- Any home appliance or consumer electronics company
- Any research university with a power systems or power electronics program
- Any major electrical equipment manufacturer
- Any government energy or sustainability ministry
- Any power systems researcher

8.2. Expected Number of Participants

Indicate the approximate number of entities or individuals expected to be actively involved in this activity.

The core committee will probably have an active participating group of between 15 and 25 individuals, sub-groups for the deliverables will vary from 3 to 8 individuals, plus regional representatives. The “interested, following” group will probably number in the hundreds, a list server is already setup to support up to 16,000 followers of the work.

Here is where the original ICAID form was wrong, more than 550 people are now involved from 53 countries and more than 300 organizations. The list server now has 10 lists on it with various levels of activity. The number of participants, while good, has driven coordination and timelines out from what we originally expected.

8.3. Initial Participants

Provide a list of the entities or individuals that will be participating from the outset. It is recommended there be at least three initial participants for an entity-based activity, or five initial participants (each with a different affiliation) for an individual-based activity.

Individual	Contact Information	Employer	Affiliation
Doug Houseman	Doug@enernex.com	Enernex	EnerNex
Georges Simard	Georges@simardsmartgrid.com	Simard Smart Grid	Simard Smart Grid
Steve Pullins	spullins@horizonenergygroup.com	Horizon Energy Group	Horizon Energy Group
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Luis Arnedo Martinez Ph. D	arnedol@utrc.utc.com	United Technologies	United Technologies
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