STRATEGIC BUSINESS PLAN (SBP)

IEC/TC or SC	Secretariat	Date
TC 82	US	2010-02

Please ensure this form is annexed to the Report to the Standardization Management Board if it has been prepared during a meeting, or sent to the Central Office promptly after its contents have been agreed by the committee.

Title of TC

Solar photovoltaic energy systems

A Background

TC 82 was established in 1981. Its scope reads as follows:

To prepare international standards for systems of photovoltaic conversion of solar energy into electrical energy and for all the elements in the entire photovoltaic energy system.

In this context, the concept "photovoltaic energy system" includes the entire field from light input to a solar cell to and including the interface with the electrical system(s) to which energy is supplied.

NOTE 1: It is recognized that there is some common interest between TC 47 and TC 82, therefore these two Committees shall maintain liaison.

NOTE 2: Solar cells, except those used in the generation of power, which are specified as components for purposes of direct trade are excluded from the scope of TC 82.

A detailed list of other committees with which TC 82 maintains expertise sharing is listed below. The rapidly growing and highly competitive global marketplace mandate TC 82 coordination and resource leveraging with organizations outside of the IEC. To that end, TC 82 has established liaisons with the European Union's PV Joint Research Centre (JRC) at Ispra (Category A), the International Energy Agency (IEA) PVPS (photovoltaic power system) co-operation programme (Category A), and the Global Approval Program for Photovoltaics (PV GAP) (Category A).

TC 82 also maintains loose liaisons with other TC/SCs such as: TC 8 Systems aspects for electrical energy supply, TC 21 Secondary cells and batteries, SC 23E Circuit-breakers and similar equipment for household use, SC 32B Low-voltage fuses, TC 34 Lamps and related equipment, SC 37A Low-voltage surge protective devices,SC 48B Connectors, TC 64 Electrical installations and protection against electric shock, TC 57 Power systems management and associated information exchange, and SC 77A Low frequency phenomena.

B Business Environment

B.1 General

Photovoltaic (PV) technology is a relatively new technology that challenges the conventional approach to energy sources and power systems (e.g. fossil fuel powered generators, transmission lines and grid extensions). It is a technology that has within the last few years begun to receive world-wide acceptance. PV has already proven itself cost effective in many off-grid applications. It is also an industry sector where R&D still plays an important role as it is a hybrid of the semiconductor and energy related industries. Development of new technologies within the PV sector is continuing in the search for greater efficiencies and lower cost.

International development funding agencies are increasingly incorporating PV systems into their aid projects for many applications including lighting, water pumping, vaccine cold chain facilities, communications and rural electrification.

Stand-alone PV systems are being deployed throughout the industrialised and developing world on a commercial scale. PV grid connected systems are rapidly increasing in numbers supported by government sponsored programmes in Australia, Europe, Asia and the USA. The bulk of these grid-connected systems are located on residences and public/commercial/industrialised applications.

Installations of large scale centralized grid-connected PV power stations, typically owned or operated by utilities or other power providers, are increasingly entering the market. It is this portion of the market that will be the driver of PV systems in the future.

Total PV modules delivered annually, expressed in peak watts, is the industry measure. For the calendar year 2009 expected total manufactured output is in the range of 9 GWatts. Depending on whose figures one looks at, output by 2012 may be in the range of 18 GWatts. Other forecasters show greater optimism.

The majority of PV sales in 2009 are in Europe, where several countries have enacted feed-in-tarrifs making use of alternate energies production advantageous, such as Germany, Spain and Greece. The United States had been a major player and will become a much larger force in the next five year period. Asia, with Japan as the prior leader, is also a market force, with China becoming a major supplier of PV products as well as a consumer.

Standards demand – It should be noted that basic standards written within the TC are for design qualification and type approval of flat-plate modules and concentrator PV devices. These basic standards are used by qualification testing laboratories throughout the world in testing product submitted by manufacturers who wish to enter the PV market place. Included in the basic standard realm are safety standards associated with flat-plate modules and Concentrator PV (CPV) systems. Obviously, manufacturers in the PV sector are customers who purchase these standards as well as the supporting standards that determine methods of testing, simulater spectrum requirements, and the like. Included in users are teaching and research universities and colleges, government laboratories, and others with an interest in the PV technologies.

Standards are also written for balance of systems components—such as inverters and charge controllers—and for grid safety when operating dc to ac inverter systems connected to the utility grid. Customers for these standards fall into the same group as above, i.e, testing laboratories, balance of system manufacturers, universities and colleges, government laboratories, systems integrators, and utilities.

Systems standards are also written for use by systems integrators in commissioning of small and large photovoltaic generating systems.

Technical specifications are also written for use in specifying, commissioning and operating PV and hybrid stand-alone systems or microgrids in developing countries. Customrs here are systems integrators, system owners, utilities, World Bank and governments that provide funding for such systems.

Competing standards organizations include various national standards writing organizations, to include VDE in Germany; in the United States NEC, ASTM, ANSI and especially the IEEE 1547 series of standards that defne distributerd generation and the use by utilities. Japan has its own set of national standards for the PV industry as does China.

B.3 Trends in technology

Crystalline silicon photovoltaic modules are still the dominant commercial type, but thin film photovoltaic modules have improved considerably and have established a substantial market. Recently, investments into thin-film PV production facilities increase at growth rates exceeding those of crystalline technologies.

Many types of thin film amorphous silicon and other compounds such as CdTe, CIS and CuInSe2 are now available. Applications for these include building facades, which serve as architectural features as well as power producing elements, and other types of Building Integrated PV product. Also, large utility scale installations feature more often than before thin-film products, in particular where the installation area required is not a major constraint.

Beyond the PV module, there are also host of trends involving the other components and overall system design required to translate the power produced from the module into useable power for the application. They include:

- More often than not, the source of problems in fielded systems is either inadequate system design or failure in the power electronics (e.g. balance of systems components). Most crystalline modules have established a respectable track record, and many thin-film technologies prove their reliability also in industrial applications

- Technological trends in power electronics, data monitoring and energy storage all provide opportunities for more efficient, diverse, cost-effective and “dispatchable” PV systems.

- Combined with technological developments and standards, trends in higher quality power requirements, cleaner sources of power and distributed generation also provide opportunities for an increased number of PV based applications.

- Indications of a shift from small individual solar home systems in the developing world to larger “mini” or community power plants with the potential for creating mini-grids that in turn can be networked.

Major industrial firms have recently recognised the industrial potential of PV and are vastly increasing usage, integration into their product portfolio and/or construction of major production facilities. This complemented by a high degree of commitment for support of photovoltaic technology by continued commercial and government support. This increase in the global PV demand and production capacity indicates an industry poised for sustained, significant growth and contribution to the global economy. To become this reality is dependent in large part on the industry’s ability to sufficiently address key “barriers” (e.g. interconnection, trained workforce) and avoiding major pitfalls (e.g system failures, safety issues).

B.4 Market trends

The photovoltaic market, as has been mentioned previously, is exploding. Annual growth is between 25 and 40%, depending on whose numbers one uses. The year 2009 was rather traumatic because of the financial crisis, but all indication are that subsequent years will continue with outstanding growth rates.

Crystalline silicon will continue to be the dominating technology of annual sales. However, thin films will make their marks in overall sales simply because their costs continue to push the crystalline manufacturers out of the picture in many cases. Other technologies, such as organic and dye sensitized PV cells are just coming out of the research stage and will be developing quite nicely in future years. Nanotechnology with its entry into the manufacture of modules will assist in increasing efficiencies and lower manufacturing costs--all in the quest to reach grid parity.

B.5 Ecological environment

The operational impact of PV systems on the natural environment is generally minimal and considered benign. PV is one of the most attractive of the renewable energy sources from the environmental point of view as the PV systems have no moving parts and create no waste effluent or residue for disposal in their daily operation.

The processing of the PV devices and the disposal of storage batteries and some PV devices (such as those containing compounds of Cadmium) are the main environmental hazards to be considered in the technology. Recycling processes for current technology batteries, both lead-acid and nickel cadmium are already well established and would appear to require no special consideration. New storage technologies may require special treatment and will be assessed as they are introduced.

The issue of toxicity in the production process and recycling of dangerous products will need to be addressed. In addition, the issues of environmentally acceptable packaging materials, visual pollution, and electromagnetic interference (EMI) are being examined.

ISO standards of environmental management systems will be examined in the future for applicability to PV modules, components and systems. PV standards may be required to comply with the requirements of "Performance evaluation" and/or " Life Cycle Assessment" sections.

C System approach aspects

Standards prepared within TC82 are primarily “product” in nature, with the exception of those written by WG3, (Systems) and the technical specifications of the JCWG.
Liaisons with other TC/SCs is as mentioned previously in Section A.

Various Working Groups of TC 82 are Customers of Standards;
or where TC 82 contributes to writing of standards

TC 4 Small hydro
TC 8 Systems aspects for electrical energy supply
TC 21 Battery Storage
TC 22 Power electronic systems and equipment
SC 23B Plugs, socket-outlets and switches
SC 23E Circuit-breakers and similar equipment for household use
SC 32B Low-voltage fuses
TC 47 Semiconductor devices
TC 57 WG17 PV-Communications
TC 64 Electrical installations and protection against electric shock
TC 77 / SC77A EMC Low frequency phenomena
TC 81 Lightning Protection

TCs that are suppliers of standards to TC 82

TC 21 Battery Storage
SC 32B Low-voltage fuses
TC 88 Wind turbines
TC 105 Fuel Cells

Customer / Supplier

IEEE
ASTM
UL
CENELEC

D Objectives and strategies (3 to 5 years)
Continued maintenance on existing standards will be undertaken by the working groups of the TC. New standards will also be written, especially within the PV concentrator WG to include documents defining trackers and safety. Energy and power rating documents will be refined within both WG2 and WG7. Building-integrated PV standards will also be explored within WG3.
Continued monitoring of advancements in PV technology will be undertaken and standards rewritten to include these technologies once they have been proven to have met the user expectations of long outdoor deployment and safe operation.

E Action plan
All TC 82 working groups plan two meetings per year except for the joint TC21/TC82WG on batteries for PV systems which usually meets only once a year. Project teams within the working groups have been created to facilitate timely completion of the documents. Due to the financial restraints and limitations on time for international meetings, it is expected that more homework will be required of the participating experts and that electronic mail communication will play a much larger role in this work of standard preparation. Initial contact is being made currently between some of the experts with this technique and it is forecast to increase significantly in the near future.

Many of the initial IEC PV documents were restricted to crystalline silicon devices for simplicity. These documents will need to be amended to accommodate new thin film devices. Current work anticipates this need and provisions are included to consider improvements or changes in the device technology.

WG 1 will continue to add new terms, symbols, and graphics to IEC TS 61836 as future TC 82 standards are approved for publication. In addition, a more world-wide set of definitions of the terms and symbols used in PV technology will be incorporated in this guide.

The highest priority in WG 2 will be the preparation of standards addressing the safety of PV modules, particularly for high voltage grid connected applications of grid-connected systems. WG 2 will also develop an energy rating standard to define performance for standard days of high and low ambient temperature and irradiance rather than relying on a single power rating. WG 2 will also revise and correct the translation equations that are used to compare the I-V curves measured under field operating conditions with factory measurements made under Standard Test Conditions (STC).

WG 3's top priority is a standard for defining the performance and test requirements for small, standalone PV systems is nearing final publication, as well as the second edition of its standard for connecting to the electric grid WG 3 will also address the safety issues for all types of PV systems. Standards for individual systems, guidelines and requirements which are applicable to specific performance monitoring, efficiency measurements and acceptance testing at the system level are moving into a position to receive higher attention. It will also explore writing Building Integrated PV standards.

Working Group 6 will prepare standards for the balance-of-system components. Its highest priority is the standard defining safety of grid-connected inverters. As this standard is completed, similar standards dealing with charge controllers will take precedence. The standards from WG 6 will define the requirements and test procedures for determining the component performance, safety and environmental reliability. Safety guidelines and requirements will also be developed to specify the electrical and mechanical construction characteristics. An AC module qualificiton and type approval standard is also being contemplated.

Working Group 7 will prepare standards for concentrator PV systems to define the requirements and test procedures for determining the module and system performance, safety and environmental reliability. Safety guidelines and requirements will also be

developed to specify the electrical and mechanical construction characteristics for concentrators.

The JCWG TC82/TC21/TC88/TC105/TC64 will continue to prepare a series of recommendations for small renewable energy and hybrid systems for rural electrification systems employing PV, wind, fuel cells and/or batteries. The co-operating TCs in the JCG will be responsible for the specific technical requirements of each technology with the JCG providing a co-ordinating function. The JCWG will also consider topics that apply to all technologies such as project management, project integration, safety and data systems. The group will endeavour to involve other TCs such as TC 4 and TC 64. Work in this group has hit a bump, as the convenor has had to resign. At this writing no convenor has volunteered to take Alain Schmitt's place, although several leads are being explored.

To respond to the increasing market and international exchange of PV products, the PV standards being prepared must have a certain flexibility to be able to follow the evolution of the technology. Consideration must also be given to the natural environmental impact issues of manufacturing and disposal of PV products.

Other international organisations such as the International Energy Agency (IEA) have initiated PV programmes to promote the technology and closer liaison (Category A) is deemed necessary to maximise the value of the work done under all the programmes. Surveys done by others of PV system failures for instance could be valuable sources of information to improve qualification and standard requirements.

Future work items will include:

- System commissioning, maintenance and disposal;
- Updates of existing publications;
- New thin film photovoltaic module technologies such as CdTe, CIS, CuInSe2 , etc. characterisation and measurement;
- New technology storage systems;
- Applications with special site conditions i.e. tropical zone, northern latitudes and marine areas;
- Life cycle and disposal analysis for impact on natural environment.

F Useful links to IEC web site

IEC/TC 82 dashboard (enter 82) gives access to Membership, TC/SC Officers, Scope, Liaisons, WG/MT/PT structure, Publications issued along with their stability dates and Work Programme.

Name or signature of the secretary

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