TASK VIII COMMUNIQUE

ENERGY FROM THE DESERT

ANNOUNCEMENT TO THE WORLD

From the perspective of the global energy situation, global warming and other environmental issues, as well as from the case studies and scenarios, it is apparent that VLS-PV systems can:

- contribute substantially to global energy needs
- become economically and technologically feasible
- contribute considerably to the environment
- contribute considerably to socio-economic development.

RECOMMENDATIONS TO THE WORLD

To secure that contribution, a long-term scenario (10–15 years) perspective and consistent policy are necessary on technological, organizational and financial issues. Action is required now to unveil the giant potential of VLS-PV systems in deserts. In such action, the involvement of many actors is needed. In particular, it is recommended that, on a policy level:

- national governments and multinational institutions adopt VLS-PV systems in desert areas as a viable energy generation option in global, regional and local energy scenarios;
- the IEA-PVPS community continues International R&D Cooperation - Task VIII to expand the study, refine the R&D and pilot phases, involve participation by desert experts and financial experts, and collect further feedback information from existing PV plants;
- multilateral and national governments of industrialized countries provide financing to generate feasibility studies in many desert areas around the world and to implement the pilot and demonstration phases;
- desert-bound countries (re-)evaluate their deserts not as potential problem areas but as vast and profitable (future) resources for sustainable energy production, recognizing the positive influence on local economic growth, regional anti-desertification and global warming.

TASK VIII COMMUNIQUE - Annex

ENERGY FROM THE DESERT

OBJECTIVE

The scope of this study is to examine and evaluate the potential of very large-scale photovoltaic power generation (VLS-PV) systems (which have a capacity ranging from several megawatts to gigawatts), by identifying the key factors that enable VLS-PV system feasibility and clarifying the benefits of this system's application to neighbouring regions, as well as the potential contribution of system application to protection of the global environment. Renewable energy utilization in the long term also will be clarified. Mid- and long-term scenario options for making VLS-PV systems feasible in some given areas will be proposed.

In this report, the feasibility and potential for VLS-PV systems in desert areas are examined. The key factors for the feasibility of such systems are identified and the (macro-)economic benefits and the potential contribution to the global environment are clarified. First the background of the concept is presented. Then six desert areas are compared, and three of these are selected for a case study. Finally, three scenario studies are performed to ensure sustainability.

BACKGROUND AND CONCEPT OF VLS-PV

A very large-scale PV system is defined as a PV system ranging from 10 MW up to several gigawatts (0,1–20 km^2 total area) consisting of one plant or an aggregation of multiple units operating in harmony and distributed in the same district. These systems should be studied with an understanding of global energy scenarios, environmental issues, socio-economic impact, PV technology developments, desert irradiation and available areas:

- All global energy scenarios project PV to become a multi-gigawatt generation energy option in the first half of this century.
- Environmental issues which VLS-PV systems may help to alleviate are global warming, regional desertification and local land degradation.
- PV technology is maturing with increasing conversion efficiencies and decreasing prices per watt. Prices of 1,5 USD/W are projected for 2010, which would enable profitable investment and operation of a 100 MW plant.
- Solar irradiation databases now contain detailed information on irradiation in most of the world's deserts.
- The world's deserts are so large that covering 50 % of them with PV would generate 18 times the world primary energy supply of 1995.

VLS-PV CASE STUDIES

Electricity generation costs of between 0,09 and 0,11 USD/kWh are shown, depending mainly on annual irradiation level (module price 2 USD/W, interest rate 3 %, salvage value rate 10 %, depreciation period 30 years).

These costs can come down by a factor of a half to a quarter by 2010. Plant layouts and introduction scenarios exist in preliminary versions. I/O analysis shows that 25 000–30 000

man-years of local jobs for PV module production are created per 1 km2 of VLS-PV installed.

Other findings of the three case studies (two flat-plate PV systems and one two-axis tracking concentrator PV) are as follows:

- The case study in the Gobi Desert describes a VLS-PV system built of strings of 21 modules combined into arrays of 250 kW consisting of 100 strings. Two of these arrays are connected to an inverter of 500 kW. Two hundred of these sets of two arrays are distributed over an area of approximately 2 km2. Total requirements for construction of the plant based on local module assembly are 848 485 modules, 1 700 tons of concrete for foundations and 742 tonnes of steel for the array supports. The life-cycle CO2 emission is around 13 g-C/kWh, due mainly to manufacturing of the modules and the array supports.
- In the Sahara case study, several distributed generation concepts were compared to minimize transmission costs. A potentially attractive option is 300 dispersed plants of 5 MW PV systems, the total capacity of which is 1,5 GW, located along the coast of Northern Africa, connected to the grid by a single 1–10 km medium voltage line. A complete I/O analysis was also carried out, resulting in 2 570 induced jobs by the operation of a 5 MW/year PV module production facility.
- In the Negev Desert in the Middle East, a 400-sun concentrator dish of 400 m2 was evaluated. Simulations indicated that 16,5 % overall system efficiency is achievable, and an economically attractive operation with generation costs of less than 0,082 USD/kWh is possible.

SCENARIO STUDIES

Three sustainable scenario studies were developed showing that sustainable local economic growth, sustainable technological–environmental development and non-technological demonstration and sustainable financial (stakeholder) support are possible when a long-term perspective is developed and maintained:

- In the concept of sustainable local economic growth, the first local PV module production facility has an annual output of 5 MW. This local production supplies for the construction of the local VLS-PV system. In subsequent years, four more 5 MW module production facilities are brought into operation, so that annually 25 MW is supplied to the local VLS-PV system. After 10–15 years, a module production facility of 50 MW is put into operation. Every 10 years this facility is replaced by a more modernized one. Thus after approximately 40 years a 1,5 GW VLS-PV plant is in operation, and the local production facility supplies for replacement. In this way, local employment, and thus the economy, will grow sustainably.
- To reach the point of a 1 GW system, four intermediate stages are necessary: R&D stage, pilot stage, demonstration stage, and deployment (commercial) stage. From stage to stage, the system scale will rise from 2,5 MW to 1 GW, and module and system cost will go down by a factor of 4. Production will be shifted more and more to the local economy. Technological issues to be studied and solved include reliability, power control and standards. Non-technical items include training, environmental anti-desertification strategies, industrialization and investment attraction. These four stages have a total duration of 15 years.
- To realize the final commercial stage, a view to financing distribution is developed for all of the three previous stages, consisting of direct subsidies, soft loans, equity, duty reduction, green certificates and tax advantages. It is clear that direct subsidies will play an important role in the first three stages (R&D, pilot and demonstration). Ultimately, in the commercial stage, enough long-term operating experience and track record are available to attract both the soft loans and equity for such a billion-dollar investment.