IEA Implementing Agreement on Photovoltaic Power Systems

Task 8 Status Report

October 2014

Task 8 Operating Agent, Japan

Task 8:
Study on Very Large Scale Photovoltaic Power generation System (VLS-PV)

Objective

The objective of Task 8 is to examine and evaluate the potential and feasibility of Very Large Scale Photovoltaic Power Generation (VLS-PV) systems, which have a capacity ranging from over multi megawatt to gigawatt, and develop practical project proposals toward implementing VLS-PV projects in the future.

Task8 has recognised that states/governments all over the world consider solar power plants as a viable option for their energy electrical power supply. However, to accelerate and implement real VLS-PV projects, feasibility of such projects should be informed to decision-makers in an appropriate manner, and Task8 can/should contribute to achieving this vision.

Under our workplan, through active disseminations and communications with stakeholders, VLS-PV vision and strategy will be developed. As well, requirements for VLS-PV system to integrate with energy network, in the near-term and mid- & long-term will be clarified. As eventual conclusions, suggestions/recommendations/drafts of how to overcome hurdles/ barriers, from viewpoints of technical and non-technical will be proposed for accomplishment of VLS-PV project.

Task activity plan

	1999-2002	2003-2005	2006-2008	2009-2011	2012-2014
Subtask 1 Conceptual Study of the VLS-PV System	→				
Subtask 2 Case Studies for Selected Regions for Installation of VLS-PV Systems	→	→	→	→	⇢
Subtask 3 Comprehensive Evaluation of Feasibility of VLS-PV Systems	→				
Subtask 4 Practical Project Proposals of VLS-PV Systems		→			
Subtask 5 General Instruction for Practical Project Proposals to Realise VLS-PV Systems in the Future		→	→	→	
Subtask 6 Future Technical Options for Realising VLS-PV Systems			→	→	→
Subtask7 VLS-PV vision, strategy and communication					→

Participating Countries

Canada
China
Germany
France
Israel
Italy
Japan (OA)
Korea
The Netherlands
Spain (tbc)
Mongolia (observer)

Key matters for ExCo discussion and/or action

(1)Publication of Task8 report

Along with the document production plan approved at the previous PVPS ExCo meeting in April 2014, a draft of the technical report entitled, 'Energy from the desert: PV Power Plants for Energy Transition', has been developed by the task participants.

The final draft will be sent to ExCo members, who are participating to Task 8, and Task 1 OA, with a report approval ballot, in December 2014.

ExCo should be asked to approve the Task8 report.

Brief Summary of Task Activity during the Last 6 Months

1. Drafting Task8 publication

The year 2014 will be the final year for Task8 activity under the workplan. Along with the document production plan approved at the previous PVPS ExCo meeting in April 2014, all contributors made a lot of efforts for drafting the manuscripts of Task8 publication, which will be published in 2015. The latest table of contents is shown as *Attachment 1*.

For drafting the publication, Task8 has made communication with Task12, and some Task12 members have kindly contributed to the publication.

2. Large and Medium-sized Photovoltaic Power Station Construction and Operation Efficiency Workshop in Xining, Qinghai, China

A workshop on 'Large and Medium-sized Photovoltaic Power Station Construction and Operation Efficiency' was held on 30 August - 1 September 2014 in Xining, Qinghai, China, by the China Photovoltaic Society.

A session for Task8 was organised in the morning of 1 September 2014. Asian Task8 members contributed to the session and made presentations.

As well, a small Task8 meeting and a technical visit to VLS-PVs were organised.

3. Contribution to international conference

For dissemination of Task8 activities, Task8 made a technical presentation at the 29th EU-PVSEC in Amsterdam, the Netherlands (September 2014), as well as a workshop in Qinghai, China.

Progress with Task Activities

1 Accomplishments of the previous six months

1.1 Subtask activities

During the previous six months, Task8 concentrated the work for drafting the manuscripts of Task8 publication.

Results from each Subtask have been edited as manuscripts of the report as below.

(1) Subtask 2: Case Studies for Selected Regions for Installation of VLS-PV Systems

***Objective**: Employing the concepts of VLS-PV and the criteria and other results produced under other subtasks, Participants have been undertaking case studies on VLS-PV systems for the selected regions and evaluating the resulting effects, benefits and environmental impact. Feasibility and potential of VLS-PV on deserts will be evaluated from viewpoints of local, regional and global aspect.*

Following case studies have been carried out and will be drafted as the report.

- Environmental issues
  - Environmental issues in developing PV power plants
- Socio-economic issues
  - Socio-economic evaluation of localisation in photovoltaic value chains
  - Possible approaches for local assembly of CPV
- International Tendering of PV Power Plants
- China as a Role Model to the World for the Massive Introduction of PV Power Plants
- VLS-PV case study on Gobi desert: North-East Asian Super Grid
- How to approach VLS-PV in Africa

As for the environmental issues, Task8 has made communication with Task12, and some Task12 members have kindly contributed to the publication.

(2) Subtask 6: Future Technical Options for Realising VLS-PV Systems

***Objective**: Various technical options for implementing VLS-PV systems will be proposed and analysed. From the viewpoint of future electrical grid stability, a global renewable energy system utilizing globally dispersed VLS-PV systems as the primary electrical energy source will be also analyzed. To clarify requirements for VLS-PV system to integrate with energy network in the near-term and mid-&long-term, combination with other renewable energy technology or energy source will be discussed as well.*

Following items have been carried out and will be drafted as the report.

- Lessons Learnt from existing large scale PV plants
  - State-of-the-art of PV power plants in China
  - Lessons learnt and operational status of PV power plants
  - Importance of operation & maintenance
- CPV potential for VLS-PV
  - State-of-the-art of CPV technology
- Technical options for entire energy system
  - Geographic dispersion and curtailment of VLS-PV electricity
  - VLS-PV as part of Super-Grids, e.g. competitive edge

(3) Subtask7: VLS-PV vision, strategy and communication

***Objective**: Based on the previous results and changing market environment, Participants will perform active dissemination and communication with stakeholders to develop VLS-PV vision and strategy. As well, possible approach and enabler to achieve the vision and implement the strategy will be developed and identified. For accomplishment of Task8 activity, suggestions/recommendations/drafts of how to overcome hurdles/ barriers, from viewpoints of technical and non-technical will be proposed.*

Following items have been drafted as the executive summary of Task8 activity.

- Expectations and potential for PV power plants
  - Why VLS-PV?
- Technical feasibility of PV power plants
  - VLS-PV can become technically feasible!
- Economic feasibility of PV power plants
  - VLS-PV can provide low-cost electricity!
- Environmental benefits of PV power plants
  - VLS-PV can produce sustainable environment!
- Socio-Economic benefits of PV power plants
  - VLS-PV can contribute to sustainable social development!
- VLS-PV visions
  - How VLS-PV can contribute as a major power source?
- Conclusions and recommendations
  - Directions for real VLS-PV

1.2 Inter-task cooperation

Task8 has made communication with Task12 about environmental aspects of PV power plants, and some Task12 members have kindly contributed to the Task8 publication.

1.3 A workshop on 'Large and Medium-sized Photovoltaic Power Station Construction and Operation Efficiency'

A workshop on 'Large and Medium-sized Photovoltaic Power Station Construction and Operation Efficiency' was held on 30 August - 1 September 2014 in Xining, Qinghai, China. As well, a small Task8 meeting and a technical visit to VLS-PVs were organised.

(1) A workshop on 'Large and Medium-sized Photovoltaic Power Station Construction and Operation Efficiency'

A workshop on 'Large and Medium-sized Photovoltaic Power Station Construction and Operation Efficiency' was held on 30 August - 1 September 2014 in Xining, Qinghai, China, by the China Photovoltaic Society.

More than 300 experts from Chinese PV industry, government, etc. joined the workshop.

A session for Task8 was organised in the morning of 1 September 2014. Task8 Asian members contributed to the session and made following presentations.

- K. Komoto (Task8 OA, Japan): IEA PVPS Task8: towards deployment of VLS-PV power plants
- J. Song (Task8 member, Korea): A concept of North East Asia Super-Grid
- N. Emebish (Task8 member, Mongolia): PV Status in Mongolia, and Actions for VLS-PV and Super-Grid

(2) Ad-hoc Task8 meeting

An ad-hoc Task8 meeting was held in the afternoon of 1 September, and Task8 members from Japan, China, Korea and Mongolia discussed about progresses of drafting Task8 publication.

(3) Technical visit to VLS-PVs in Golmud, Qinghai, China

A technical visit to VLS-PVs in Golmud, Qinghai, China was organised on 2-3 September 2014.

We visited following VLS-PVs and communicated with Chinese experts about lessons learnt from experiences of construction and operation of real VLS-PV.

Longyuan Golmud New Energy Development, PV power station : 90MW	
Shenguang high concentrating PV (HCPV) power station : 60MW	
Yellow River hydroelectricity, PV power station : 300MW (planned to expanding to 500MW)	

1.3 Contributions to international conference

As well as a workshop in Qinghai, China described above, Task8 made a technical presentation at the 29th EU-PVSEC in Amsterdam, the Netherlands (September 2014) to disseminate Task8 activities

- 29th EU-PVSEC, 22-26 September 2014, in Amsterdam, the Netherland
  - K. Komoto (Task8 OA): IEA PVPS Task8: Study on Very Large Scale PV Systems

2 Future plans

2.1 Task8 meeting and PVPS event

Following meeting and event are planned.

- Task8 32nd meeting
  - 23 November 2014, in Kyoto, Japan
- PVPS workshop in Beijing, China
  - 29-30 November 2014, in Beijing, China

2.2 Completing Task8 publication and its dissemination

Task8 publication, entitled 'Energy from the Desert: Very Large Scale PV Power Plants for Energy Transition', is currently under drafting.

The final working draft will be discussed and confirmed by Task8 participants at the Task8 meeting on 23 November 2014, in Kyoto, Japan.

Task8 will ask ExCo members to approve it in December 2014.

The publication will be published in early 2015, after the approval by the ExCo, and should be available from the IEA PVPS website for dissemination.

2.3 Contribution to international conference

Task8 is planning to participate and contribute to the following event.

- 6th WCPEC, 23-27 November 2014, in Kyoto, Japan
  - Christian Breyer, Keiichi Komoto, Tomoki Ehara, Jinsoo Song, Namjul Enebish, et al.: North-East Asian Super Grid: Renewable Energy Mix and Economics

3 Summary of documents published and planned

- 'A preliminary Analysis of Very Large Scale Photovoltaic Power Generation (VLS-PV) Systems' (internal report under the umbrella of IEA/PVPS Task6) – published (1999)

- 'Energy from the Desert: Feasibility of Very Large Scale Photovoltaic Power Generation (VLS-PV) Systems', publication from James and James – published (2003)
- 'Energy from the Desert: Feasibility of Very Large Scale Photovoltaic Power Generation (VLS-PV) Systems - Summary booklet'– published (2003)
- 'Energy from the Desert: Feasibility of Very Large Scale Photovoltaic Power Generation (VLS-PV) Systems - Summary booklet: Japanese version'– published (2004)

- 'Energy from the Desert: Practical Proposals for Very Large Scale Photovoltaic Systems - Summary booklet', – published (2006)
- 'Energy from the Desert: Practical Proposals for Very Large Scale Photovoltaic Systems', publication from Earthscan – published (2007)

- ‘Energy from the Desert: Very Large Scale Photovoltaic Systems for Socio-Economic, Financial, Technical and Environmental Aspects’, publication from Earthscan – published (2009)
- ‘Energy from the Desert: Very Large Scale Photovoltaic Systems for Socio-Economic, Financial, Technical and Environmental Aspects – Summary booklet’, publication from Earthscan – published (2009)

- ‘Energy from the Desert: Very large scale PV power -state of the art and into the future-’, publication from ‘Earthscan from Routledge’ – published (2012)
- ‘Energy from the Desert: Very large scale PV power -state of the art and into the future- Summary booklet’, publication from ‘Earthscan from Routledge’ – published (2012)

- ‘Energy from the Desert: PV Power Plants for Energy Transitions, planned in 2015

Summary of Task participation and effectiveness

	2009		2010		2011		2012		2013		2014		
	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	Ad-hoc	32nd (planned)
Canada	N	A	N	A	N	N	N	N	N	N	N	N	N
China	O	N	N	N	N	N	N	N	A	A	N	A	A
France	A	A	A	A	A	A	A	N	N	A	A	N	(A)
Germany	A	A	N	A	A	N	A	A	N	A	A	N	A
Israel	N	N	A	A	A	A	A	A	A	A	N	N	N
Italy	N	A	N	A	N	A	N	N	N	N	N	N	N
Japan	A	A	A	A	A	A	A	A	A	A	A	A	A
Korea	A	N	A	N	N	N	N	A	A	N	A	A	A
Netherland	A	A	N	A	A	A	A	A	N	N	N	N	N
Finland											O	N	O
Mongolia	N	N	O	N	N	N	N	N	N	N	N	O	O
Spain							O	N	N	O	N	N	(N)
USA	N	N	N	N	N	N				O			
First Solar							O	O	O	N	O	N	O
INES								O		O			

Note) '**A**': attend, '**N**': absence, '**O**': attend as observer

Meeting and Workshop/Symposium

Meetings

1st : 29-30 June 1999, Paris, France
2nd : 1-3 December 1999, Utrecht, the Netherlands
3rd : 30 April 2000, Glasgow, the United Kingdom
4th : 15-16 and 18 September 2000, Sacramento, the United States
5th : 9-10 June 2001, Cheju Island, Korea
6th : 2-4 September 2001, Ulaanbaatar, Mongolia
7th : 28 February -1 March 2002, Utrecht, the Netherlands
8th : 12-14 September 2002, Warsaw, Poland
9th : 30 June - 1 July 2003, Lens, France
10th: 2-5 February 2004, Perth, Australia
11th: 5-6 June 2004, Paris, France
12th: 9-11 January 2005, Scottsdale, the United States
13th: 2-4 June 2005, Leipzig, Germany
14th: 8-10 September 2005, Vancouver, Canada
15th: 5-6 May 2006, Hawaii Island, the United States
16th: 6-8 October 2006, Tokyo, Japan
17th: 21-22 April 2007, Athens, Greece
18th: 31 August - 2 September 2007, Milan, Italy
ad-hoc: 3 December 2007, Fukuoka, Japan
19th: 17-19 April 2008, Utrecht, the Netherlands
20th: 29-30 August 2008, Valencia, Spain
ad-hoc: 13 October 2008, Busan, Korea
21st: 24-25 April 2009, Nanterre, France
22nd: 18-19 September 2009, Erfurt, Germany
23rd: 24-26 June 2010, Hokuto, Japan
24th: 4-5 November 2010, Paris, France
25th: 5-6 May 2011, Eindhoven, the Netherlands
26th: 12-13 September 2011, Rome, Italy
27th: 19-20 April 2012 in Madrid, Spain
28th: 20-21 September 2012 in Arnstadt, Germany
29th: 24-26 June 2013 in Arizona, USA
30th: 7-8 October 2013 in Chambery, France
31st: 23-25 April 2014, Casablanca, Morocco
ad-hoc: 1 September, Xining, Qinghai, China
32nd: 23 November 2014, Kyoto, Japan (planned)

Workshops/Symposiums/Seminars

International Workshop:	2 May, 2000, Glasgow, the United Kingdom (in conjunction with 16th EU-PVSEC)
International Symposium:	11 June, 2001, Cheju Island, Korea (as a side event of 12th PVSEC)
International Symposium:	18 May 2003, Osaka, Japan (as a side event of WCPEC-3)
Special Session as a part of 2nd MOPVC:	5 September 2003, Ulaanbaatar, Mongolia
International Seminar:	2 February 2004, Perth, Australia
International Symposium	9 October 2006, Makuhari, Japan (as a side event of

	Renewable Energy 2006)
International Symposium	20 April 2007, Athens, Greece (as a session of 2nd PVMED)
International Symposium	6 September 2007, Milan, Italy (as a side event of 22nd EU-PVSEC)
International Symposium	14 October 2008, Busan, Korea (as a side event of Renewable Energy 2008)
PVPS Workshop: Task1 & 8	22 September 2009, Hamburg, Germany (as a side event of 24th EU-PVSEC)
Task8 Workshop	16 February 2010, Israel (as a session of 16th Sede Boqer Symposium on Solar Electricity Production)
International Symposium	27 June 2010, Yokohama, Japan (as a side event of the Renewable Energy 2010 International)
International Symposium	27 September 2012, Frankfurt, Germany (as a side event of 27th EU-PVSEC)
INES-Task8 Workshop	9 October 2013, at the INES, Chambery, France
International Workshop	1 September 2014, Xining, Qinghai, China

Attachment #1

Table of contents of Task8 5th phase report (as of October 2014)

Title	Energy from the Desert: Very Large Scale PV Power Plants for Energy Transition			
Expected volume	100-150 pages in total - Executive Summary: 30 - 40 - Chapters: 80 – 120			
Options for publication	PDF document as free-publication (Cheaper options for commercial publication will be considered, if available)			
	Contents			Expected Contributors
	Foreword, Preface, Task8 participants, List of contributors, Acknowledgement			
Executive Summary	1	Expectations and potential for PV power plants		Komoto, Mr. Ehara (Japan)
	2	Technical feasibility of PV power plants		
	3	Economic feasibility of PV power plants		
	4	Environmental benefits of PV power plants		
	5	Socio-Economic benefits of PV power plants		
	6	VLS-PV visions		
	7	Conclusions and recommendations		
Chapters	1	Technical requirements for PV power plants		
		1.1	State-of-the-art of PV power plants in China	Mr. Wang, Mr. Xu, Ms. Lv (China)
		1.2	Lessons learnt and operational status of PV power plants	Mr. Sinha (First Solar)
		1.3	Importance of operation & maintenance	Mr. Cunow (Germany)
			Issues on Spain and Italy (tbc)	*Mr. Salas (Spain), Mr. De Lia (Italy)*
	2	Environmental and Socio-Economic Considerations		
		2.1	Environmental issues in developing PV power plants	Mr. Sinha
		2.2	Socio-economic evaluation of localisation in photovoltaic value chains	Mr. Wade (First Solar)
	3	International Tendering of PV Power Plants		Mr. Cunow
	4	Potential of Concentrator Photovoltaic (CPV)		
		4.1	State-of-the-art of CPV technology	Prof. Faiman (Israel), Mr. Kenji Araki (Japan)
		4.2	Possible approaches for local assembly of CPV	Mr. Kenji Araki
	5	Future technical options for entire energy system - Geographic dispersion and curtailment of VLS-PV electricity		Mr. Perez (US)
	6	Proposals on long-term vision		
		6.1	China as a Role Model to the World for the Massive Introduction of PV Power Plants	Prof. Faiman, Mr. Wang, etc.
		6.2	North-East Asian Super Grid	Prof. Breyer (Finland), Mr. Song (Korea), Mr. Enebish (Mongolia), Mr. Xu, T. Ehara, Komoto
			How to approach for VLS-PV in Africa (tbc)	*Mr. Megherbi*