

AFORE-1

1st Asia-Pacific Forum on Renewable Energy

16th (Wed.) ~ 19th (Sat.) November, 2011
Grand Hotel, Busan, KOREA



Quake, Tsunami and PV on New Wave in Japan



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Tokyo Institute of Technology

AES International Research Center

TOKYOTECH

AES



In Cooperation with PV-net in some part

Global Energy Innovator Forum 2011

Phoenix Island Resort 14 NOV 2011

Real Meaning and Possibilities of Solar Photovoltaics



1. Quake, Tsunami & Nuke
2. PVs against Quake & Tsunami
3. Quick Review :
Japan's Approach on
Photovoltaics

Huge TSUNAMI! *alas* ...



East Japan Earth Quake 9/11:
Magnitude: 9.0

Fukushima Nuke's **DISASTER!** *alas* ...



TSUNAMI destroyed NUKE!

A/E/S
TURNKEY

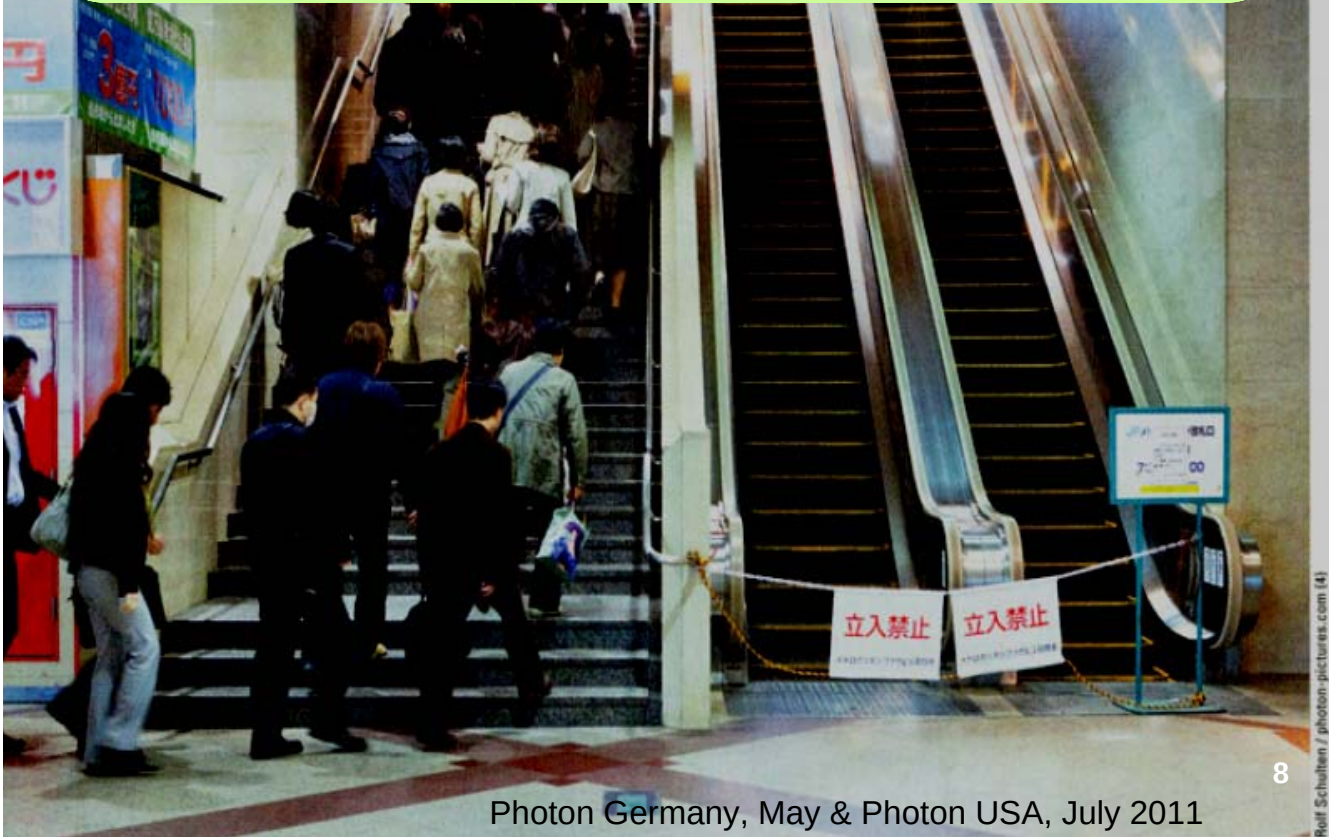
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Nuke Fukushima I (Unit4)



Nikkei_13 Nov 2011

Sleep Mode! Brownout!
but No Blackout beyond summer!



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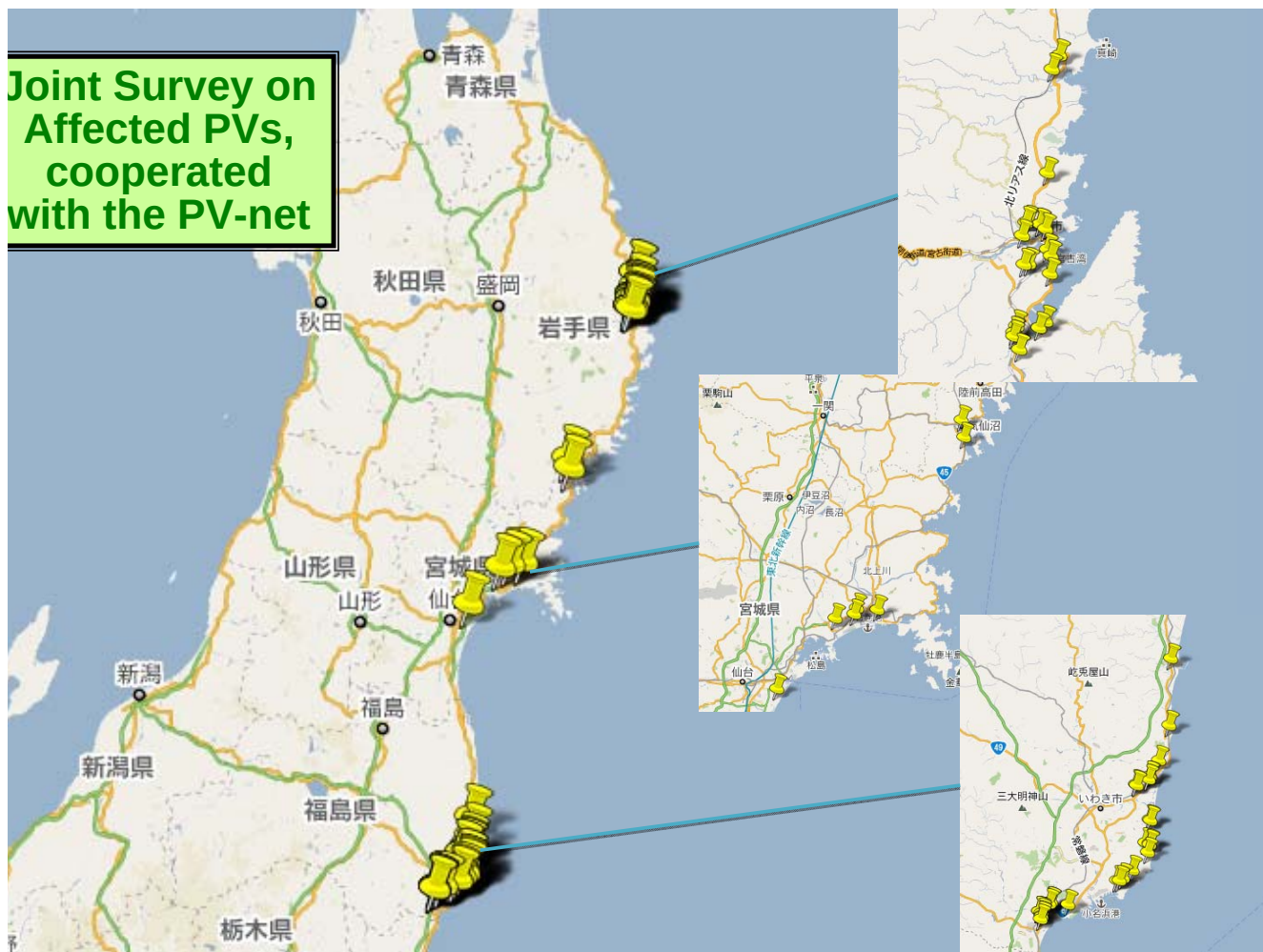
Global Energy Innovator Forum 2011 Phoenix Island Resort 14 NOV 2011

Real Meaning and Possibilities of Solar Photovoltaics



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Joint Survey on
Affected PVs,
cooperated
with the PV-net



The Most Severe Case on PV

Ogatsu Community Hall, Ishinomaki, Miyagi



(株)荏原電産殿提供

The Most Severe Case on PV

Ogatsu Community Hall, Ishinomaki, Miyagi



A.E.S.

(株)荏原電産殿提供

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TSUNAMI destroyed all but PV !?



Higasi-Matuyama, Miyagi, 19 Mar. 2011

A.E.S.

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TSUNAMI destroyed all but PV !?

岩手県宮古市田老地区
Taro, Miyako, Iwate Pref.

Here, too!



(セキスイハイム)

<http://kenplatz.nikkeibp.co.jp/article/const/news/20110331/546733/?SS=imgview&FD=1154182637>

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Rikuzen-Takada (PV-net)



岩手県陸前高田市

2階建屋と一緒に流されたPV
東工大阿部准教授提供

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TSUNAMI destroyed all but PV !?



Kadowaki, Ishinomaki, Miyagi Pref., 28 Mar 2011
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TSUNAMI destroyed all but PV !?



(セキスイハイム)

Kadowaki, Ishinomaki, Miyagi Pref., 28 Mar 2011
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Ishinomaki and Kesennuma, Miyagi Pref. (PV-net)



Shinkansen damaged seriously!



Shinkansen damaged seriously!



ケンプラッツ, 2011.3.18

⊕ クリックで拡大

ラーメン高架橋柱の上部が破壊した東北新幹線の第1中曽根高架橋の端部橋柱。曲げせん断破壊とみられる (写真: 高橋良和・京都大学防災研究所准教授)

Shinkansen damaged seriously *but PV!*



ケンプラッツ, 2011.3.18

第3岡島高架橋は耐震補強されていないが、躯体に損傷がなかった(写真: 高橋良和・京都大学防災研究所准教授) 原典: ケンプラッツ, 2011.3.18

Iwaki City, Fukushima Pref. (PV-net)

地震による棟の瓦破損 破損しなかったPVモジュール



PV売電電力メーター
(東北電力のメーター
は取り外し済み)



Iwaki City, Fukushima Pref. (PV-net)



分電盤



パワコン
接続箱

Outside OK!

Burned J-Box inside



炭化の激しい
接続箱の内部

Tsunami @ Watari Fishery Cooperative, Miyagi



Watari Spa “Tori-no-umi”

2011.3.16

All houses were washed out in this area, but PV!



Watari Spa "Tori-no-umi"

2011.3.16

- PV system output cable already removed!
- It looks safe? **No, no, very dangerous!**
- PV array wiring mostly still connected in series and **Left active!**
- **Electric shock and Fire possibility left!!**



Tsunami @ Watari, Miyagi

2011.3.16



Fishery Cooperative @ Watari, Miyagi 2011.7.13

A PV system: Useful
Emergency Power Supply



N: 38° 2'21.369 999 999 995 3
E140° 54'57.760 000 000 009 2

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Location of Evacuation Shelters



More than 2,000 sites

Image © 2011 TerraMetrics
Data © 2011 MIRC/JHA
© 2011 Cnes/Spot Image
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
37° 22'24.59" N 139° 08'36.17" E 標高 11 m

高度 2574.98 km

Useful “Emergency PV”

大船渡市の基石コミュニティセンターへ太陽光発電



<http://www.kahoku.co.jp/news/2011/04/20110405t35044.htm>

可搬式「リチウムイオン蓄電システム+太陽光発電」



<http://www.47news.jp/CN/201105/CN2011050301000487.html>

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TAKAFU



<http://headlines.yahoo.co.jp/hl?a=20110405-00000008-maip-soci.view-000>



無償提供する移動型太陽光発電機を前に「自社技術が役立てば」と話す宮内会長（左）＝春日井市で

エムエムシー他
中日2011.4.7

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Useful “Emergency PV”

<http://www.asahi.com/shimbun/nie/kiji/kiji/20110425.html>



発電パネルを設置する東北大学の土屋教授（左）ら。シートは丸めて運べる＝3月28日、宮城県石巻市北上町、中山写す

1kWフレキシブル太陽電池：
南極観測の経験を活かして

A.E.S.
TAKAFU



避難所に設置された太陽光発電を使った浄水器＝1日、宮城県南三陸町歌津の歌津中学校、橋本弦撮影

アフリカ仕様の太陽光発電浄水装置
造水能力：500L/時
（エスイーバイオマステクノ社）

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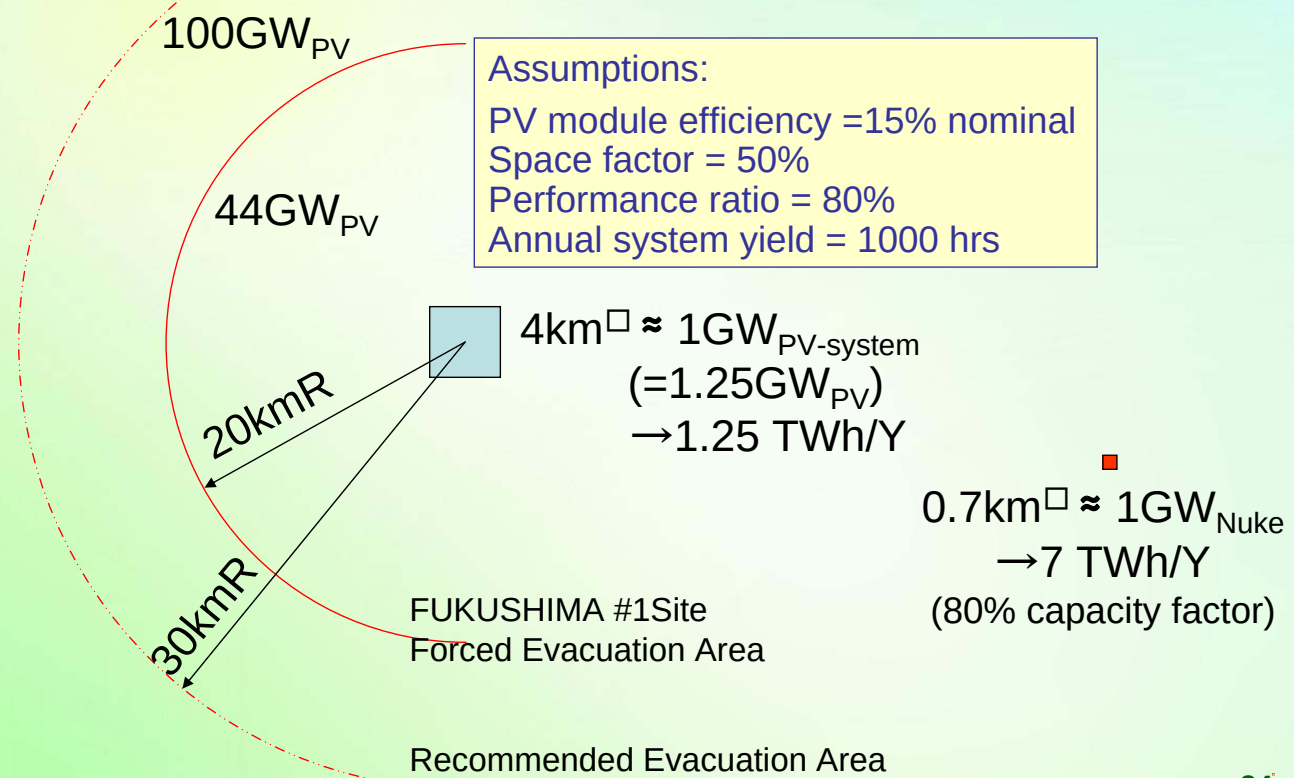
An Example of Reconstruction Plan



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Case Studies



Real Meaning and Possibilities of Solar Photovoltaics

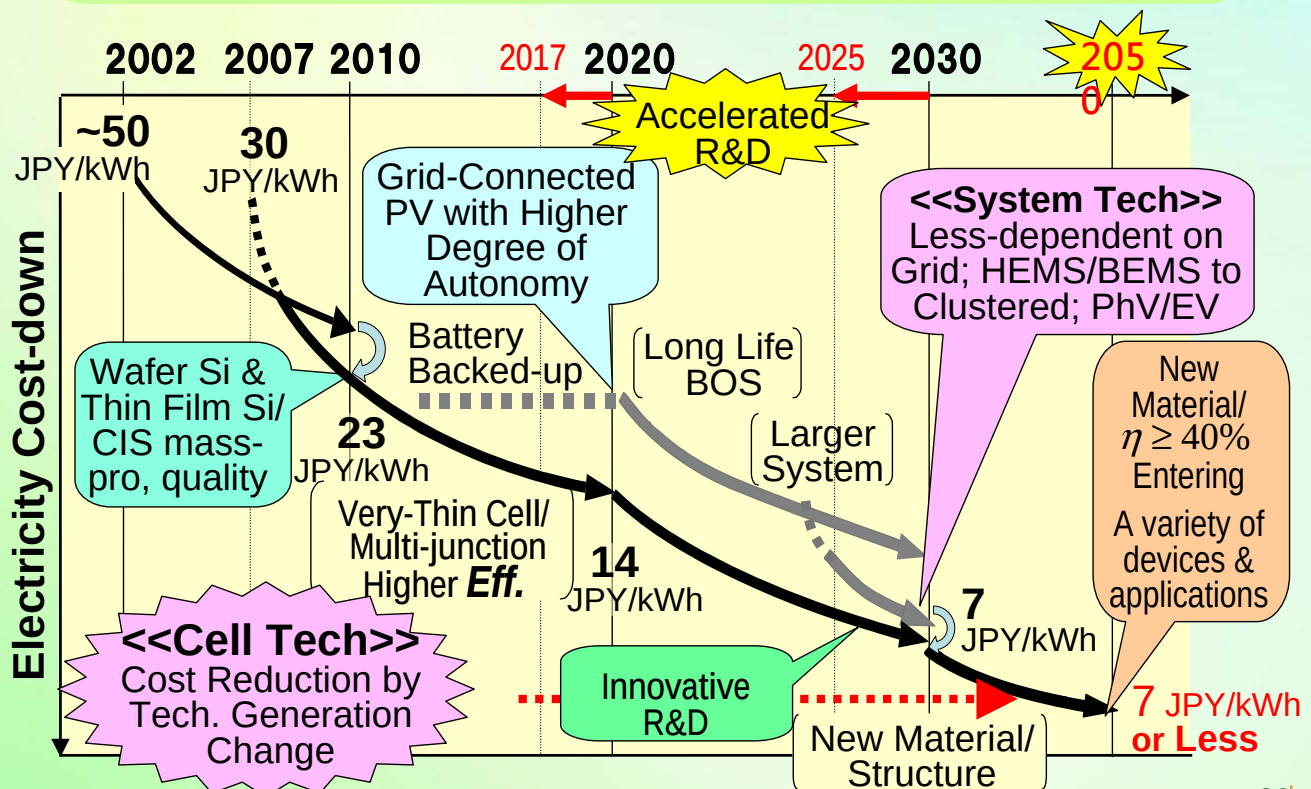


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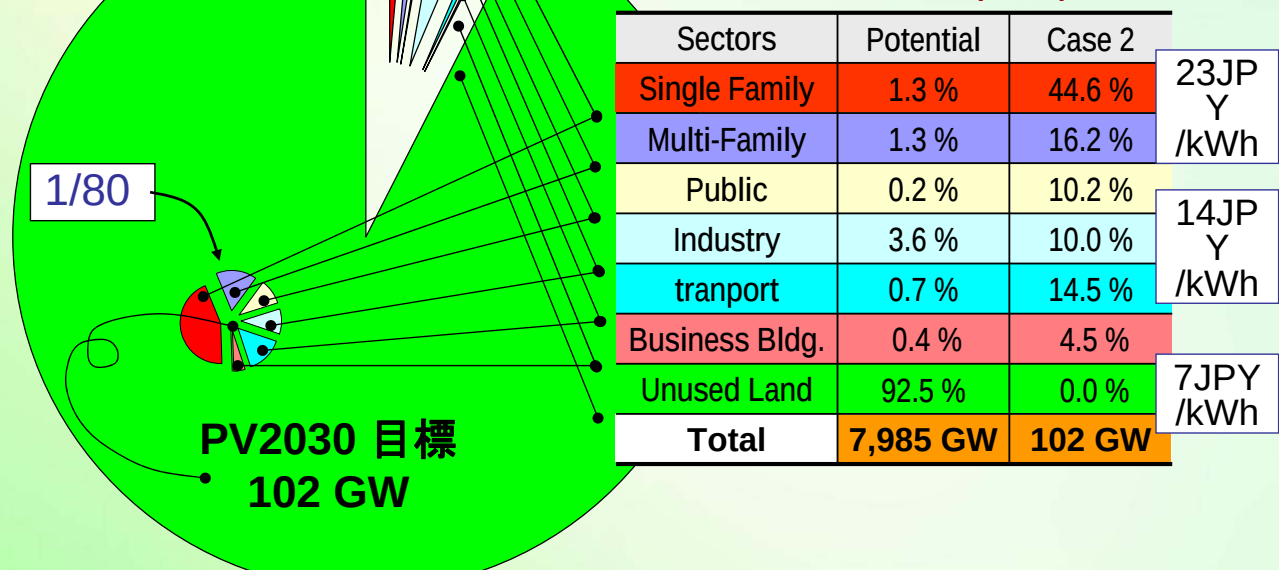
“ PV2030 + ” Extended Roadmap



PV Potential
7,985 GW

JP Domestic
x 8 times

Installable PVs (GW)

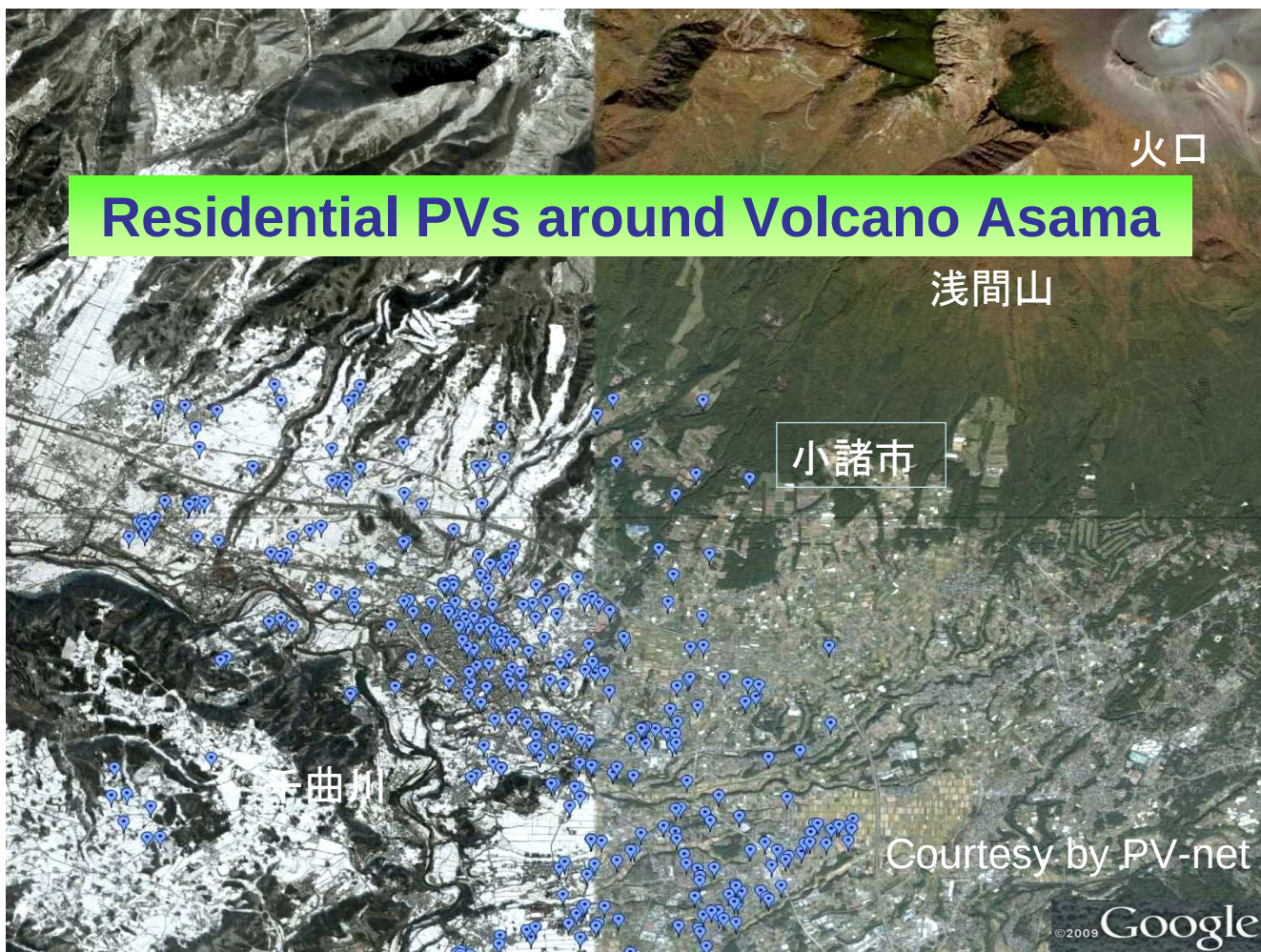


PV2030 Base Case $\doteq$ Domestic10%

Facts on Residential Rooftop PVs

- 3-4kW/house → 70-80% self-standing
- Approaching Grid Parity (home)!
- 100%-electricized Home available in future by higher efficiency
- One million houses already over Japan: Stable Big Market !!
- Real Sustainability and Own Energy





Residential PVs around Volcano Asama

火口

浅間山

小諸市

千曲市

Courtesy by PV-net

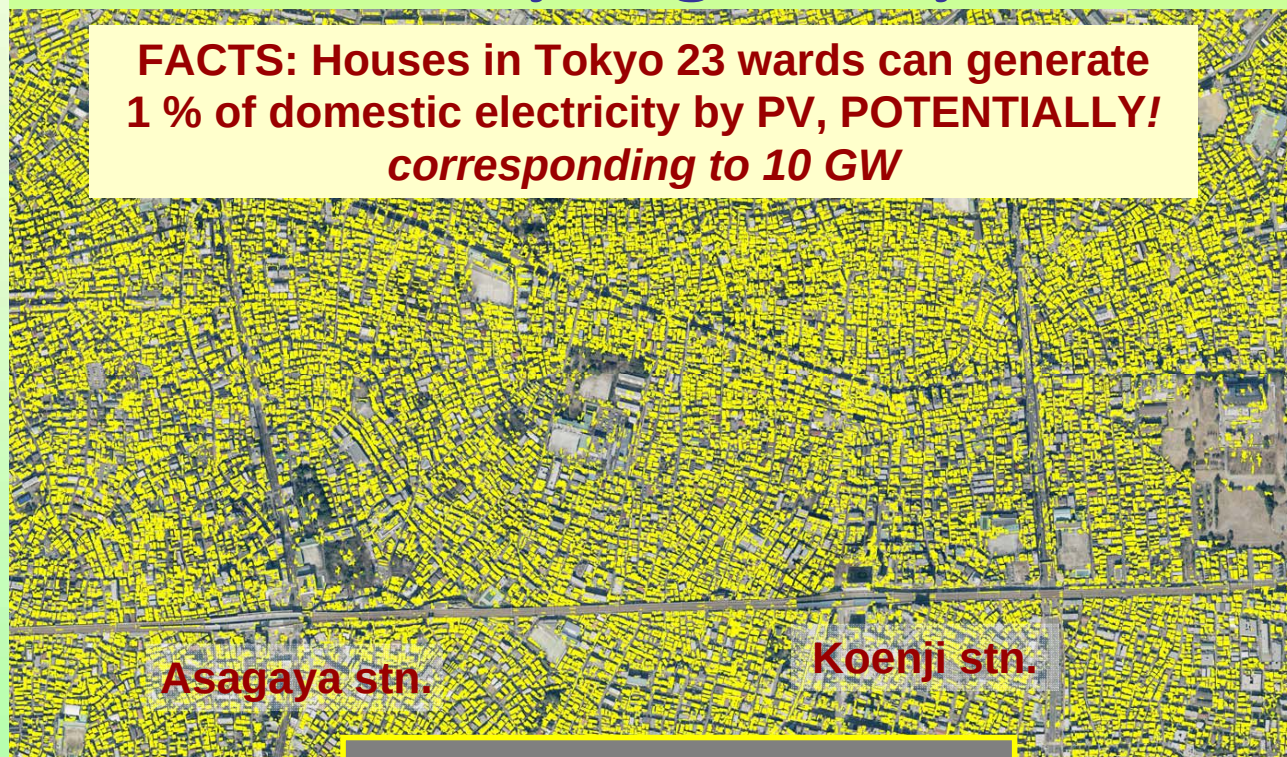
©2009 Google

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Metropolitan Tokyo 23 Wards PV Potential by Single Family Houses

**FACTS: Houses in Tokyo 23 wards can generate
1 % of domestic electricity by PV, POTENTIALLY!
corresponding to 10 GW**



Asagaya stn.

Koenji stn.

Yellow dots identified as roofs

How much energy from Soul, too?



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NEDO's PV R&D Projects

Year	2008	2009	2010	2011	2012	2013	2014
Short-term	PV System Practical Tech. Promotion		High Performance PV Generation System for the Future (Target : 2020) 5.9 BJPY, FY2011 6.5 BJPY, FY2012 request				
Mid-term	R&D for Next Generation PV System						
Long-term	R&D on Innovative Solar Cells (Target : 2050) 2.6 BJPY, FY2011; 2.7 BJPY, FY2012 request +3.5 BJPY for Organic PV Cell, FY2012 request						

“Let Japan Regain World Top Position!” ‘PV for the Future’ R&D Project

【Objective】 Realize **28GW** domestic penetration by 2020 and Strengthen Competitive Power in the world market.

【Target】 Module Cost → **75 ¥/W**; M. Efficiency → **20 %** to attain electricity price 14¥/kWh (Factory use base)

R&D for the Future by all-Japan team.

c-Si Cells

→ including SOG silicon; Low cost process; higher efficiency

Organic Cells

→ Efficiency; Lifetime; Low cost; Systemization.

TF Si Cells

→ Process development.

Evaluation; International standard; module materials & structure; etc.

Common Basis

(Evaluation; Recycle; etc.)

CIS & Compound Cells

→ TF CIS cost down; CPV.

Common Basis

(module/array materials; structure; components; etc.)

Innovative PV Cells: 3 Consortiums (U-Tokyo, AIST, Tokyo Tech)
NEDO-EC Joint Call CPV Project (45% target: Yamaguchi-Luque)
JP-US CPV Project

A series of Bi-Lateral International Demos on **Smart Grid**

R&D on Innovative Solar Cells

Project Structure

NEDO

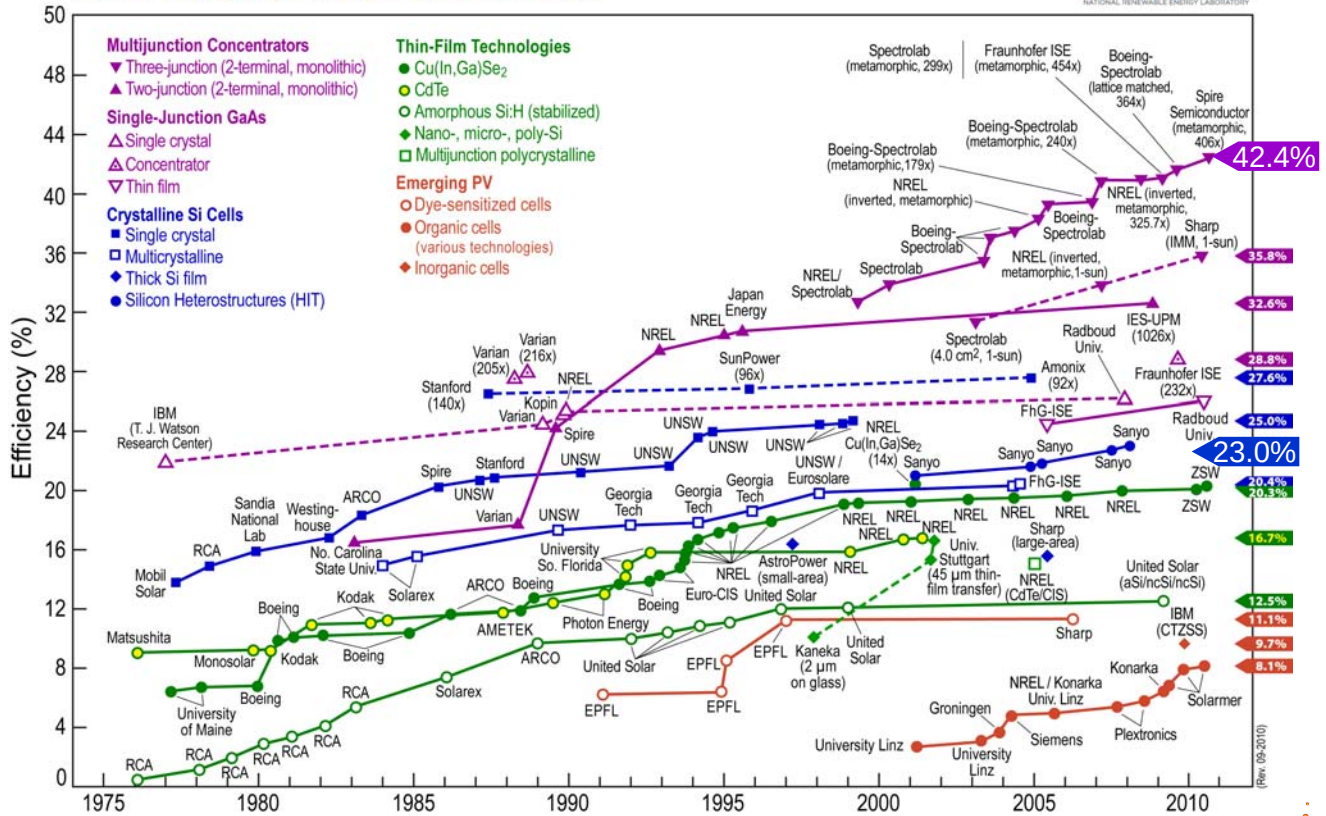
Post-silicon solar cells for ultra-high efficiencies
Team leader: Prof. Y. Nakano (Univ. of Tokyo)

Novel thin multi-junction solar cells with a highly-ordered structure
Team leader: Dr. M. Kondo (AIST)

Thin-film full spectrum solar cells with low concentration ratios
Team leader: Prof. M. Konagai (Tokyo Inst. of Tech.)

PV Cell Efficiency (research level)

Best Research-Cell Efficiencies



Source=Data compiled by Lawrence Kazmerski, National Renewable Energy Laboratory (NREL).



New FIT Law enforced soon!

26 AUG 2011 enacted.

- PV
- Wind
- Mini-Hydro
- Geothermal
- Biomass



2MWPV (TF-Si)

@Haneda Airport International Cargo area
(TEPCO/Mitsui Corp.)

2010.07.15 Photo by kurochan

+ 1,240 kW Another PVs in
Haneda

@ Terminal 1 & 2, Parking Bldg

太陽光発電、新章。

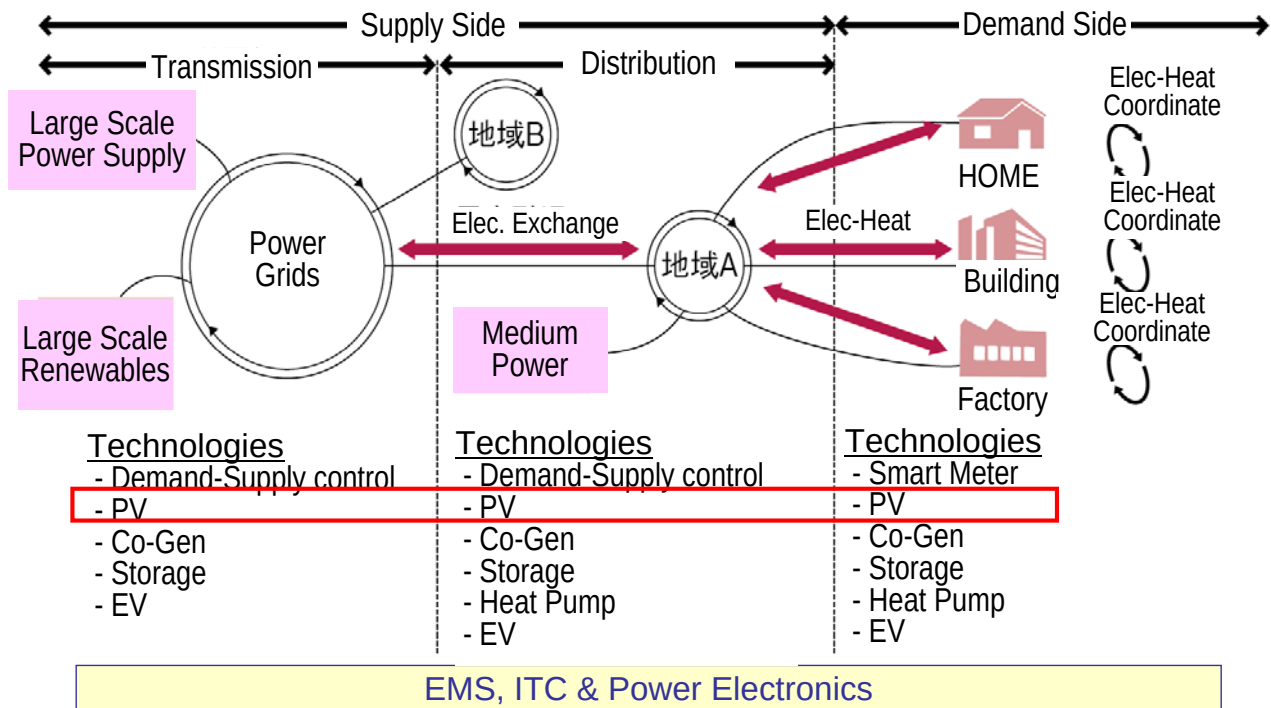
太陽光発電の歴史において、世界一頼もしい光になる。NTTファシリティーズの意志が結集した自社施設「ソーラーテクノパーク」が年内、いよいよ始動。
山梨県北杜市の全面協力を得て、最新の多種多様な太陽電池を設置。隣接する「北杜サイト太陽光発電所」と連携し、最先端のノウハウを蓄積する世界的実証サイトへ。
ソーラー技術の未来を担うシステムインテグレーターとして、最高峰の太陽光発電システムの提供に挑みます。

+ New FIT Law expected to make Mega-Solar realistic!!

©最終完成イメージ

TEPCO's Kawasaki-Oogishima 13MW PV

Japan's Next Generation Energy Network



http://www.jftc.or.jp/shoshaeye/contribute/contrib2010_07e.pdf

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Miyako-jima Smart Grid Test Bed !

NEDO/OEPCO: JP-US Joint Project



PV System from now (Japan)

1. From kW to kWh

- **Life time electricity generation** most important!
- **Operational Yield Improvement:** module reliability; PC reliability; **construction reliability**; system reliability; system monitoring; 'mieruka' (visualization) service for user; energy related quality-assurance/guarantee/certification/standardization (JIS/IEC).
- **Life Time kWh:** system life time extension; module life time; PC life time to match module life; reuse/recycle/waste.

2. PV Contribution to ZEB/ZEH Concept

- Zero Energy House / **ZEH**: Main actor is PV!
- Zero Energy Building / **ZEB**: So is it here, too!
- Zero Energy Town / **ZET**: possible extension!
Important PV's role in street planning to community planning such as Masdar city, smart community, etc.

PV System from now (Japan)

3. Mega Solar, Super-Mega Solar to Giga Solar

- **Unused Land** exists enormously abundant in Japan; Large PV needs expected to Smart Community in Japan.
- **PV Array Field Construction** with Low-cost / Short-completion-period; light weight / reliable / rigid PV module structure; low carbon technology, etc.
- **PV System: key technology essential for Smart Network Integration**
smart house; smart building-ZEB; smart community; national backbone network; ...
- **Local Industry Enhancement by PV Supply Chain;**
Possible contribution for Quake-hit Area.
- **Penetration into PV World Market;**
System Integrator Activation, etc.

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