

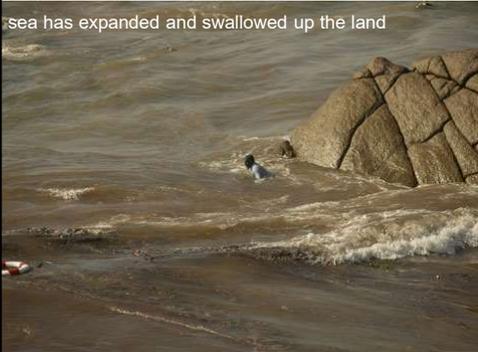
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## Development of the Sky Solar System to encourage both to accelerate natural energy development and to promote intensive agricultural farming

**Ben Nakamura**  
Architect, Planner, JIA, APEC, Architectural Institute of Japan  
Professor emeritus of Monotsukuri Institute of Technologist



sea has expanded and swallowed up the land



bricks only remains at the school yard



a village, 95% village people died



I would like to express sincere mourning to the Srilanka Tsunami Disaster. 2004, 26<sup>th</sup> Dec. Tsunami attacked the whole Srilanka Shoreline, 31,000 people died, 500,000 people lost home, 78,000 houses destroyed, 40,000 houses damaged.





### Report from Fukushima 2015



The city governments have built the 15m high retaining walls to defend against the next tsunami, which, will attack on hundreds years later. By its tremendous disaster, the tsunami and Nuclear Electricity generation plants burst accident, the people escaped from their houses, without any belongings.

Many reconstruction demand increased, It's a development babble. The construction cost has been higher, lack of workers, rejection new work, etc. Recover housing development started in public, very few in private houses. Because of their lost property by Tsunami and Nuclear Accident.



### Report from Fukushima 2014



**before**





**2011**



**2014**

**Fukushima Dai -ichi Nuclear Power Plant**

No.1:	460,000Kw1971
No.2:	784,000Kw1974
No.3:	784,000Kw1976
No.4:	784,000Kw1978
No.5:	784,000Kw1978
No.6:	1,100,000Kw1979
<b>total</b>	<b>4,696,000Kw</b>

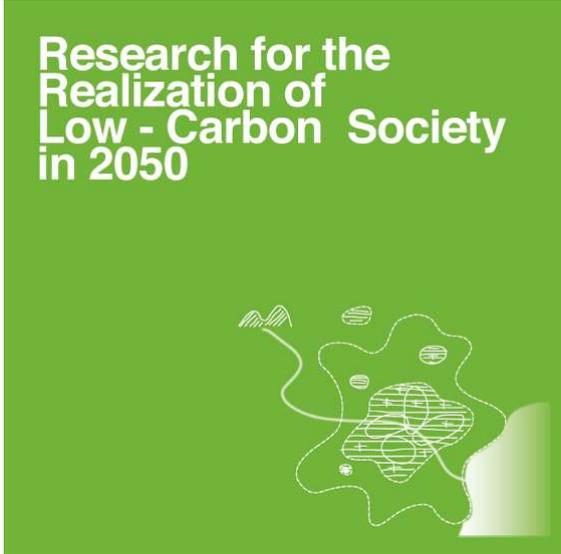
11, March 2011, Tsunami attacked and Plant Stopped by emergency electricity stopped. Melt down of the core happened and hydrogen burst destroyed No.1,2,3,4 plants.

In 2014, many tanks are set on the hills. Nuclear contamination water is most difficult 360,000tons stocked, 400tons/d increasing 30m Ice bar walls will be put around the plants (1500m) 30~40years needed to finish

## Background 1

### Research Committee for the Low Carbon Society

© Ben Nakamura



sponsored by Ministry of Environment

background1

- Ben Nakamura had organized the Committee of the Low Carbon Society in the Architectural Institute of Japan
- Research for Three years, 2009~2011 was collaborated with Tokyo University, Tokyo Institute of Technology, and Nihon university and others.
- We have appealed 13 guidelines to realize actual city to Low Carbon City in 2050
- However, We have not concerned to the regional energy development.

## Recovery Plan for Fukushima Disaster Area

© Ben Nakamura

After the disaster, I wanted to stretch out helping hands not only for getting the spiritual relief, but also for getting the economical affordability, by the land rent with the elevated sky solar system.

The electric consumption per capita in 2010 is 4.2mwh/y for average family.

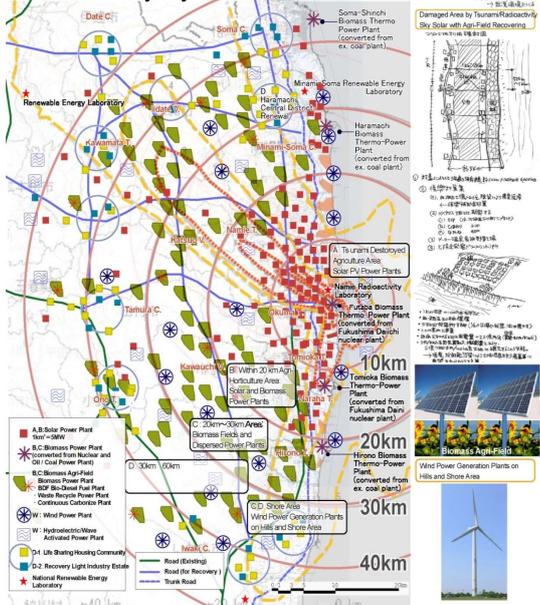
Tokyo demand	154,000,000mwh/y
So-so(N-E)	819,000mwh/y,
Iwaki (S-E)	1,432,000mwh/y.

Nuclear Dai-ichi generates 4,696mw  
 Renewable Supply (Nakamura Plan)

Solar	6,150mw
Wind	5,000mw
Ocean wind	20,000mw
Biomass	50,000mw = 81,150mw

**I was confident the power of the renewable energy is enough, and no need of Nuclear Power.**

**Srilanka has tremendous capacity, by strong sun and ocean wind and wave.**



## Development for Sky Solar System

to make double effect for solar generation and free activity



**The development criteria** for the Sky Solar System:

- In Japan, the area capacity of the flat lands for normal solar panel on the ground is **very small**, and competitive with normal land use.
- Normal Solar System needs land fill, cut and dig roots, and leveling the land, therefore, **the cost for the land formation** is high.
- The cost for **the preparation against the natural menace** like earthquake, tsunami and typhoon is also very high, because normal type is not needed to check the structural standard.
- The solar panels put on the ground is needed to prohibit the people's entering into the site.
- Elevated Solar Panels is needed to be adapted to the low of the standard of the architecture in order to allow the people enter underneath the panels.

**Could you hand your land to the solar panel single use in the 20 years?**

**Sky Solar System allows the multiple land use, and make the shade for the land be cool, make the desert land be green, and change the land to the park, road, car parking, agricultural development for the people.**

## Development for Sky Solar System

to make double effect for solar generation and underneath activity

©Ben Nakamura

### 5 Types of Sky Solar System

- ① Cable Sky Solar
- ② High Pole Sky Solar
- ③ Carport Sky Solar
- ④ Solar Glass House (BIPV)
- ⑤ Solar Curtain Wall (BIPV)



## ① Cable Type Sky Solar

©Ben Nakamura and JFE Technos

**First Concept Sketch:**  
Initial idea is started to use undeveloped space above daily activities

**Model Wind Test:**  
Wind durable test is needed for Typhoon disaster.

**1/5 Real Material Model Test:**  
Real Material Model shows the details of Joints and construction method..

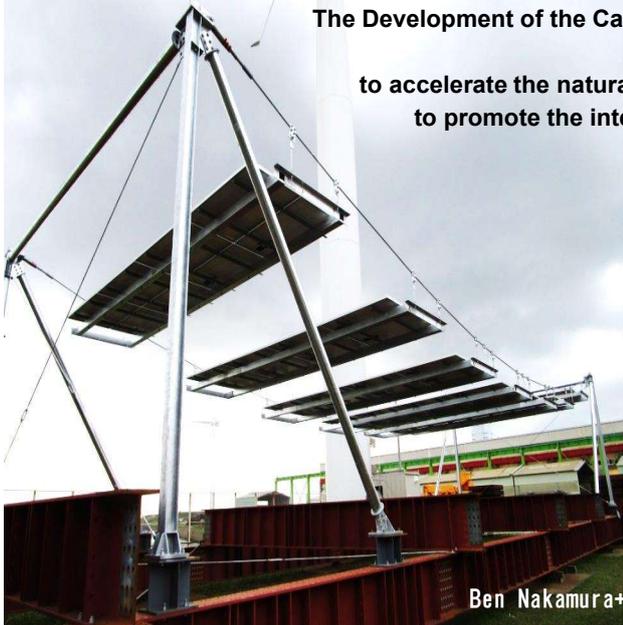
**Implementation Scheme :**

**CABLE type**  
ケーブルタイプ

**Sky Solar above the hilly slope:**

**Proposals for A Amusement Park Car Parking Space :**

### ① Cable Sky Solar Test Model in Futtsu



The Development of the Cable Type Sky Solar System is to encourage both to accelerate the natural energy development and to promote the intensive agricultural farming development.

**SKY SOLAR**  
Ben Nakamura+ Komai Haltec+ Provance

### ① Cable Sky Solar Air Wind Test

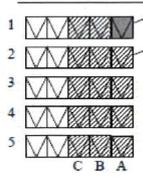
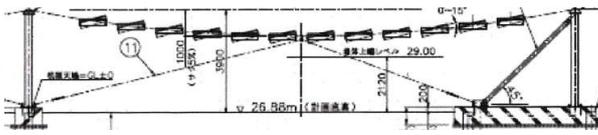
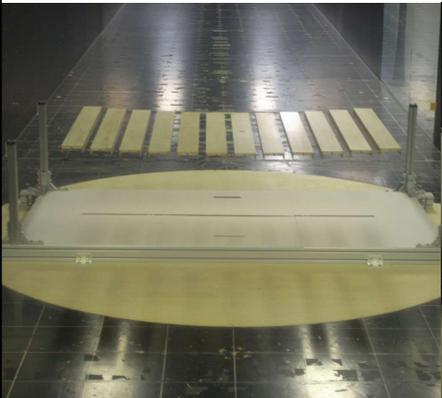


図3 複数アレイ模型の配置状況( $H=0.5m, \beta=10^\circ$ )

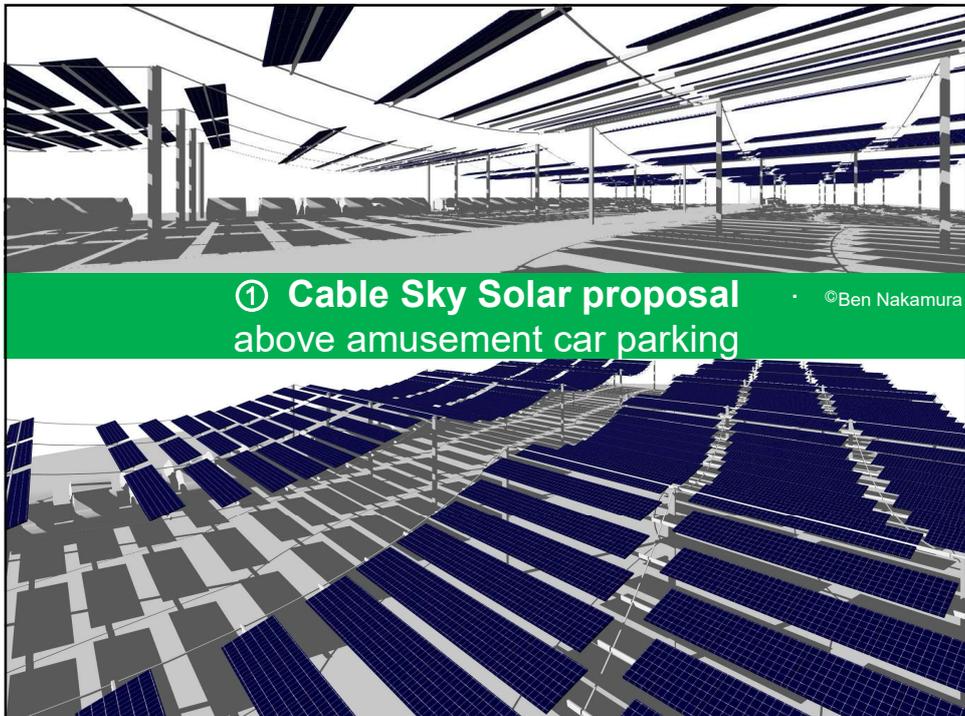
Suspension Bridge technologies are used. Wind test confirm the stability of the Skysolar



Very stable, only 30mm move in the center of the poles,




©Ben Nakamura + JFE Technos



**① Cable Sky Solar Proposal to Oota city  
above rain hazard lake 2MW**  
©Ben Nakamura and JFE Technos

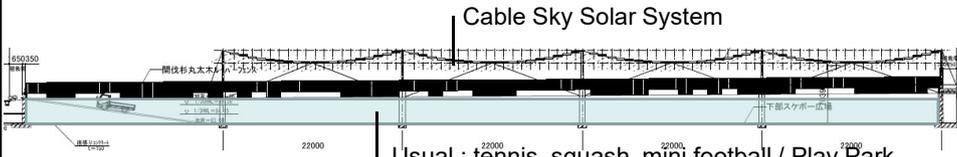
The image contains technical drawings and two photographs. The top part shows two technical drawings of the solar structure. The left drawing is a side elevation showing a cable supported by two towers, with solar panels attached. It includes dimensions such as a cable length of 1000, a height of 1500, and a ground level of 26.86m. The right drawing is a cross-section showing the tower structure with labels like '基礎下層-GL±0', '4-M27', and '4-M20'. Below the drawings are two photographs: the left one shows a wide, muddy river or lake under a cloudy sky, and the right one shows the proposed solar structure with its cables and panels installed in a field next to a concrete path.

**① Cable Sky Solar Proposal above a pasture field  
6MW**  
©Ben Nakamura and JFE Technos

The image is a 3D architectural rendering of the solar structure over a pasture field. The structure consists of a series of tall, thin towers connected by a network of cables, with solar panels suspended from the cables. The ground is a lush green field with a large round hay bale in the foreground. In the background, there are trees and a blue sky with light clouds. The shadows of the solar panels are cast onto the grass, indicating the sun is high in the sky.

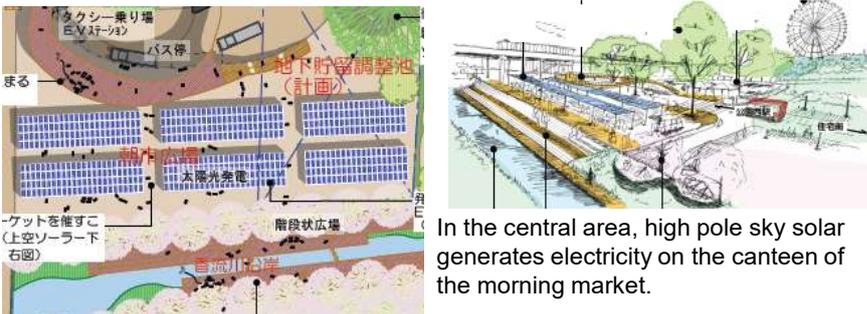
## Proposal: ①Cable and ②High Pole Sky Solar For Nagakute City Above Flood Control Pond / Play Park and a Market

©Ben Nakamura and JFE Technos



**Cable Sky Solar System**

Usual : tennis, squash, mini football / Play Park  
Emergency: Flood Control Pond



In the central area, high pole sky solar generates electricity on the canteen of the morning market.

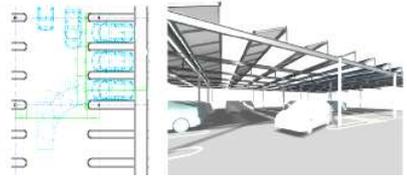
## ② High Pole Type Sky Solar

©Ben Nakamura and Komai Haltec

HIGH POLE type  
ハイポールタイプ



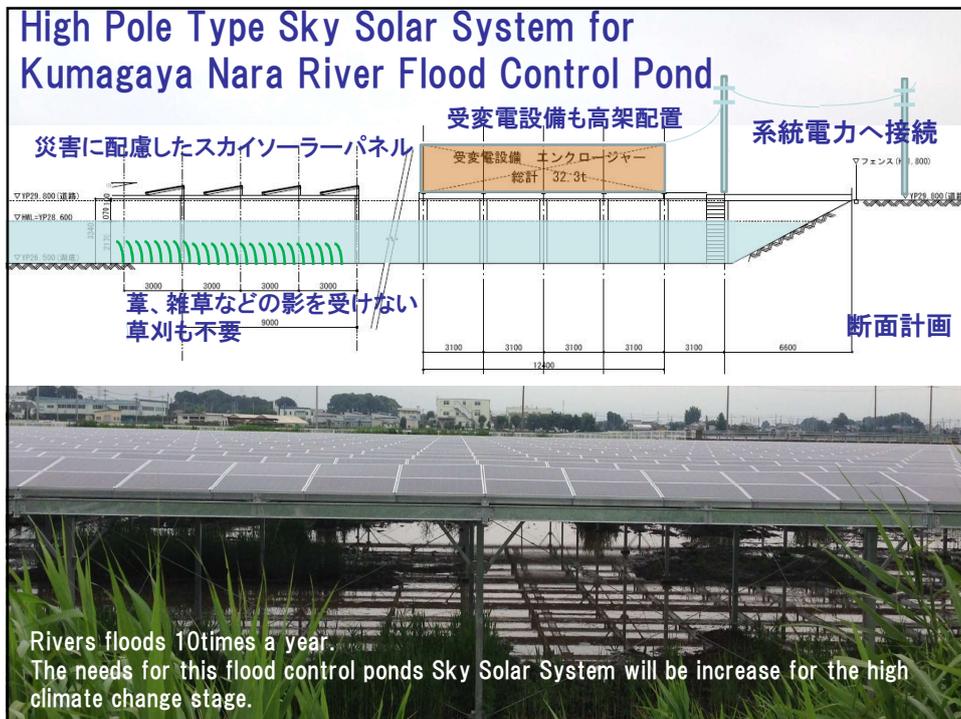
High Pole Type Sky Solar above River Flood Control Pond, Kumagaya City

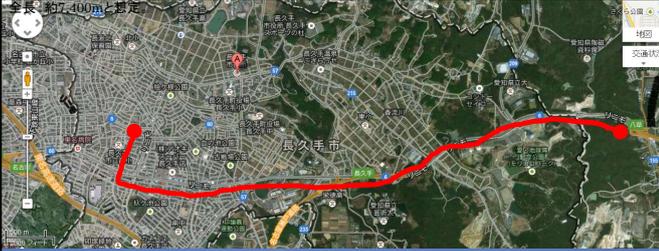


High Pole Type Sky Solar above Car parking, for factory, shopping market, amusement facility, etc.



High Pole Type Sky Solar above River Flood Control Pond, under construction





proposal:  
② High Pole Solar  
above  
Linimo Railway

Nagakute City  
6MW

©Ben Nakamura and Komai Haltec



proposal: ② High Pole Sky Solar  
above Car parking and Agri Field

©Ben Nakamura and Komai Haltec



©中村勉総合計画事務所



©中村勉総合計画事務所

### proposal: ② High Pole Sky Solar above shore walk way



Width 6.5m  
Length 2km  
900kw  
≒ 990,000kwh/y  
For the demands of this island

パネル面積	1m × 6.5m = 6.5㎡
パネル総面積	6.5㎡ × 950枚 = 6175㎡
面積あたり定格容量	140kw/㎡
定格容量	865kw
年間総発電量	866,762kwh (約200世帯の年間電力使用量 × 1)
総工事費概算	3億3千万円

\*1 電気事業連合会資料より





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### ③ Carport Type Sky Solar

©Ben Nakamura and Komai Haltec

#### CAR PORT type カーポートタイプ



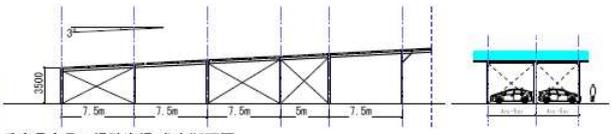
**兵庫県食品工場駐車場 駐車台数100台 250kW**  
食品工場の従業員用駐車場にカーポートタイプを設置しました。



**第一工区完成 第二工区建方 現場写真**  
工事中の駐車可能台数を減らさないために工区分けを行いながらの施工も可能です。



**第二工区建方 現場写真**



**兵庫県食品工場駐車場 参考断面図**





Aizu Wakamatsu  
Carport Type  
1.3MW

The panels are  
elevated above 2.5m  
of the snow depth,  
The carport is cleared  
by snowplows  
In every morning

**SKY SOLAR**

中村勉総合計画事務所+駒井ハルテック

**③ Carport Type SKY SOLAR**  
Electric factory developed renewable energy



Carport Type  
Sky Solar system  
is to make roof  
on the carpark.  
Normal type  
requires  
5m to 7,5m span  
for the 2 to 3  
vehicles.

**SKY SOLAR**

Ben Nakamura and Kokko Facility Co. jp

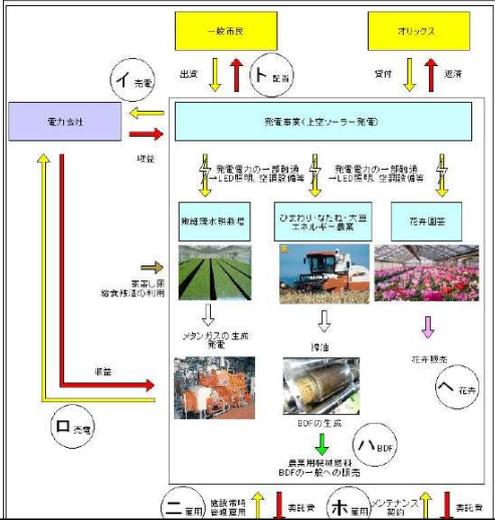
**③ Carport Type SKY SOLAR for Bus Station**  
 Tokyo metropolitan Government to accelerate to develop renewable energy

Bus carport needs long span and the 4m height,  
 which needs truss structure system



**② High Pole Solar System with Agricultural Industry**  
 “6” sector development,

©Ben Nakamura and Komai Haltec



The new strategy of the ministry of the agriculture is “6” sector development. For this strategy, Sky Solar System is most useful solar sharing system

“6” sector development aims Integrated development with multi sectors around agricultural development

1<sup>st</sup> Ind.: agriculture  
 2<sup>nd</sup> Ind.: downstream industry +energy generation  
 3 tertiary Ind: direct IT purchase +sightseeing

**1+2+3=6**

## ② High Pole Sky Solar System with Agricultural Industry Flower Garden



- Flowers and Agri-Clops needs less than 50% of the solar energy

Light Intake Capacity for species

Rice padi: 40~50 Klux

Tomato : 70

Lettuce : 25

Grapes, Peaches: 40

Flowers : 5~10~15

ref: Sun in fine : 100~400 Klux

in cloudy : 10 Klux

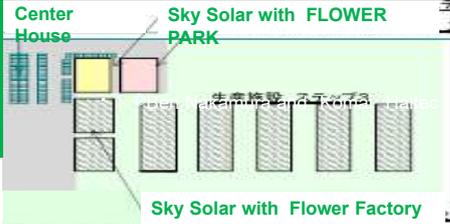
- ©Ben Nakamura and Komai Haltec

6<sup>th</sup> Industry Development in ShikokuChuo City  
Solar energy sharing with agriculture  
For the Pine Bonsai nursery 1MW

SKY SOLAR



**② Sky Solar "6" sector Development**  
**Flower Park Proposal for Iidate village in Fukushima**



Center House  
Sky Solar with FLOWER PARK  
Sky Solar with Flower Factory

Image of the Flower garden ©Kamo Kachoen

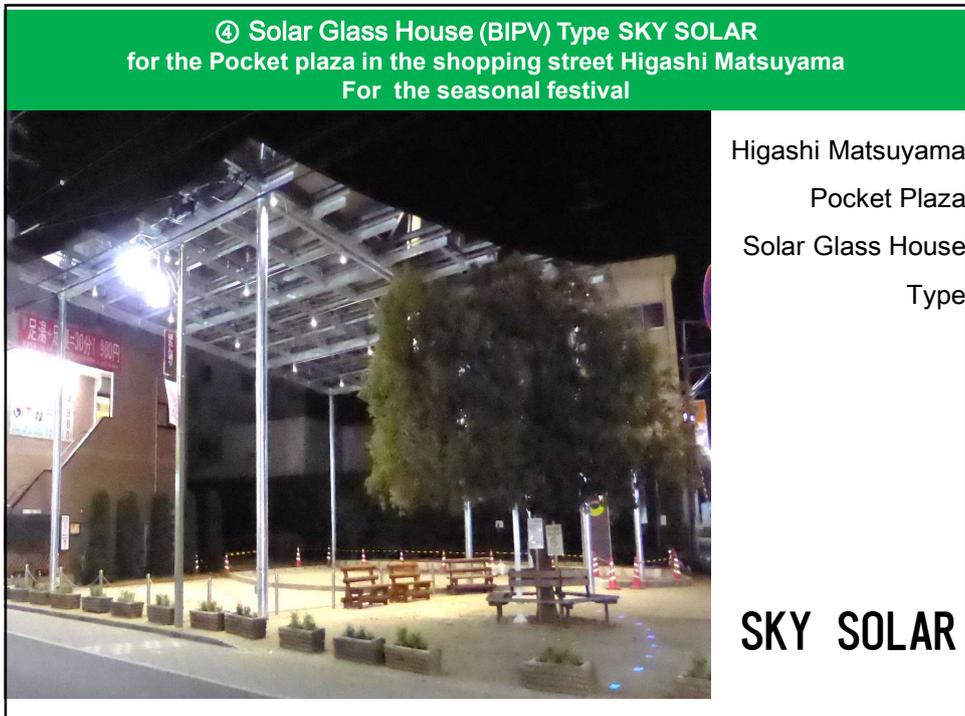
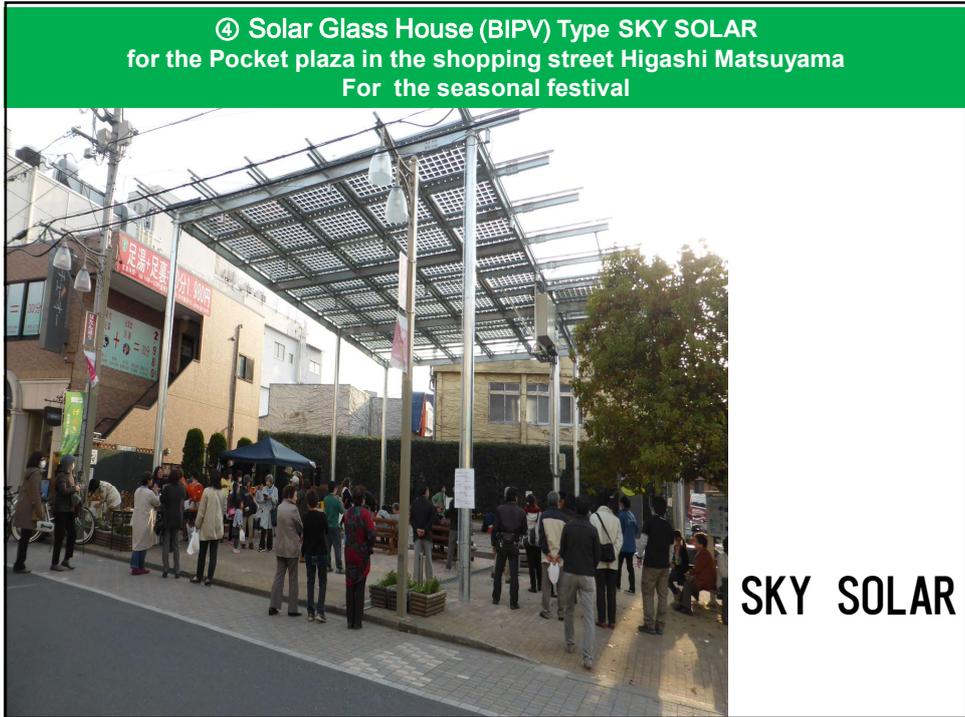


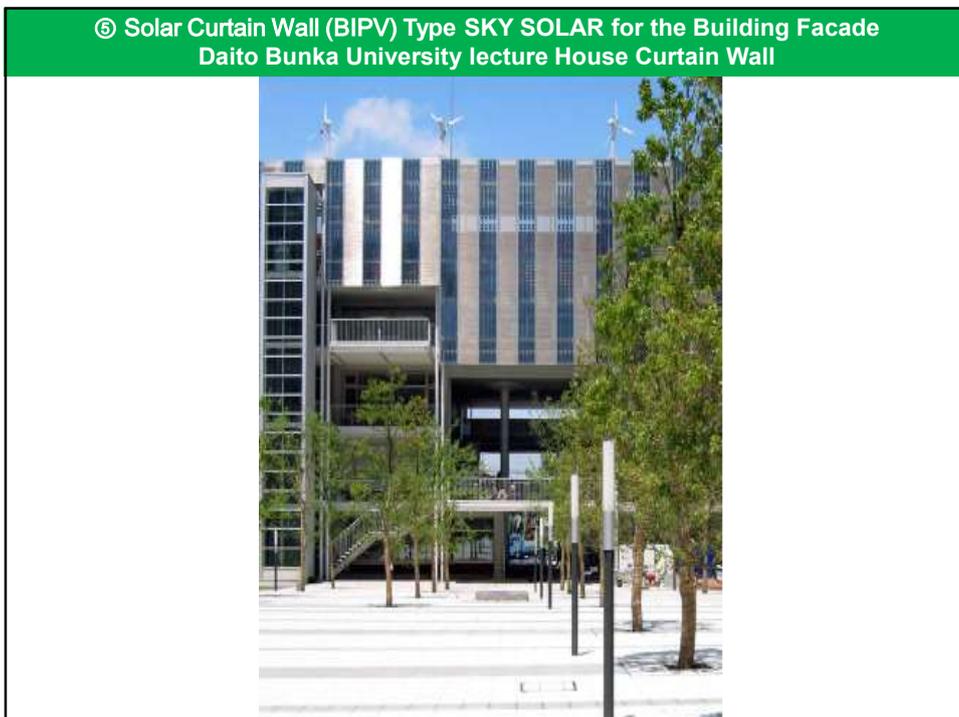
Sky Solar with Flower Factory

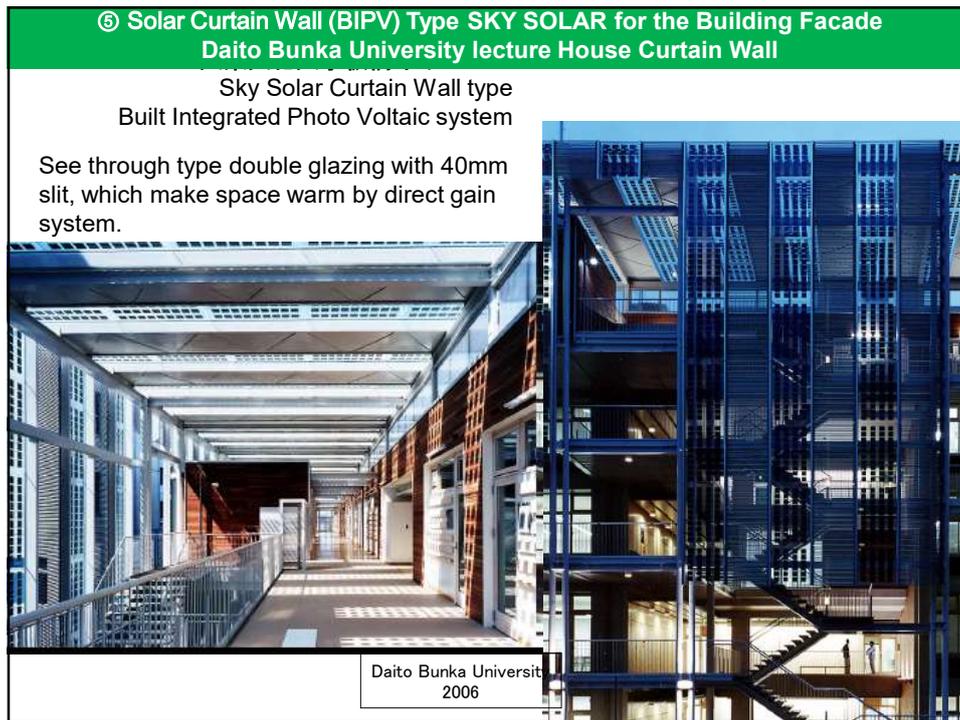
**③ Glass House Solar 2006, Nara**  
design : Tamiya Glass and Ben Nakamura



©タミヤ製作所+中村勉総合計画事務所







### 3. Scope of the world wide contribution

#### A) Wares of Great Britain,

I was invited by the peace group of the Wares, and gave some idea to develop the renewable energy in the Anglesey Island as "Natural Energy Island", and appealed to the people not to redevelop the renewal of the nuclear generation plant.

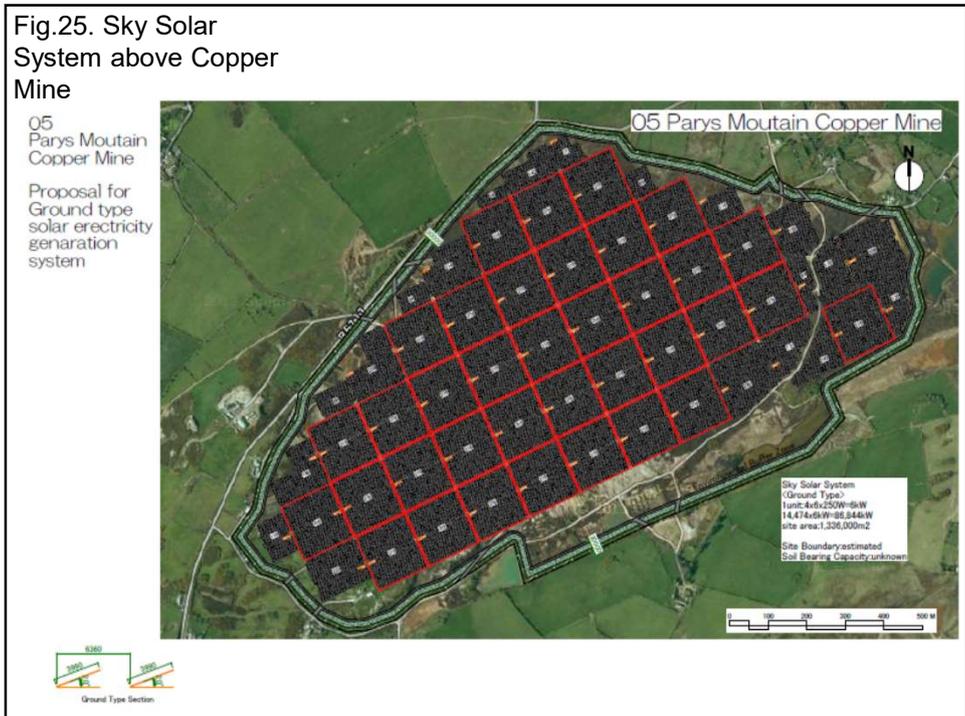
#### B) the desert of Cairo, Egypt,

I proposed the idea to develop the Sky Solar System on the desert skirt along Nile river.

The space structure along the Nile, built environment are built along the river, and over the city area, the huge area of the sand desert area cover the land.

If the Sky Solar System is developed in this fringe area, the shaded area will be spread to the desert, and green vegetable will be produced under the solar panels.

This idea will encourage both to accelerate the natural energy development in the sky and to promote the greening the land to the agricultural farming for the people.



**Sky Solar System Proposal for the sand desert in Cairo, Egypt**

Fig.27. Cairo City and Nile River

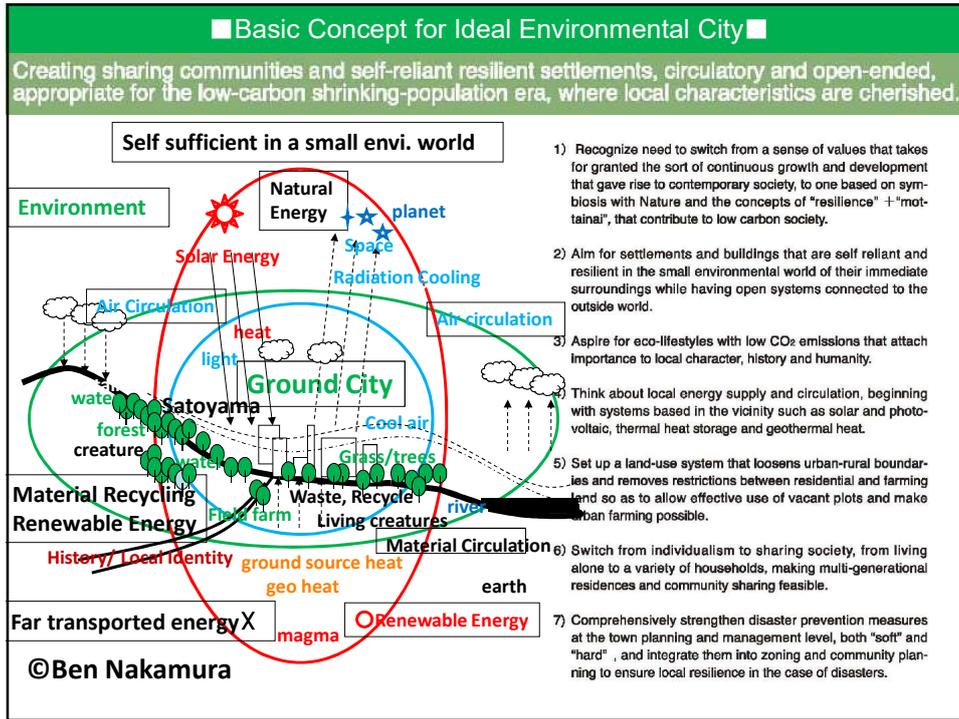
These idea is to create the shaded area under the solar panels  
And to create multiple activity land use, which will be more useful  
in the tropical area, Asia monsoon, and desert area.

**Sky Solar System Proposal the shaded way  
for the GOOD WALK Project for Bangkok**

I am promoting to Thai Bangkok friends  
to develop this Sky Solar System  
It is useful  
in the tropical areas in the Asian countries.

เพื่อการฟื้นฟูเมือง  
กลุ่มย่านที่อยู่อาศัย  
ย่านนาวา-บางคอแหลม  
ทางเดิน-ทางจักรยานริมน้ำ  
ย่านนาวา





## Council for Promoting a Low-Carbon Society

The realization of a low-carbon society is crucial. Therefore, "Proposal: Vision 2050 for a Low-Carbon society of the built environment of JAPAN - Heading towards Carbon-Neutralization" was announced in December 2009. To put the contents of the proposal into action, 18 organizations related to architecture and urban design set up a council for promoting a low-carbon society for the purposes of exchanging the latest information, sharing issues and, by sharing roles, providing information and proposals for the national and local governments as well as for the citizens for the realization of a low-carbon society.

**Council for Promoting a Low-Carbon Society**

- Exchanging and sharing information related to the growth of a low-carbon society
- Sharing issues related to establishing a low-carbon society
- Coordinating the roles of each organization
- Examining the methods related to policy proposals and other statements
- Sharing tools that promote a low-carbon society
- Examining energy issues

9 December 2014  
The First Symposium of the Council for Promoting a Low-Carbon Society  
Introduction of participating organizations

#### Issues for the Council for Promoting a Low-Carbon Society

1. Promoting low-carbonization in society development
2. Identifying problems and promoting measures based on the vision of future society in 2050
3. Dealing with population reduction, ageing, disaster prevention and changing values
4. Evaluating measures for climate change adopted by various ministries, agencies, bureaus and municipalities
5. Studying the management of area energy and renewable energy
6. Proposing a low-carbon lifestyle
7. Conservation and utilization of natural resources such as forests, water and ecosystems
8. Summarizing the challenges in resource-recycling-based urban communities
9. Evaluation of earthquake disaster reconstruction projects from a low-carbon promotion perspective
10. Environmental education
11. Examination of methods related to policy and structural reform proposals for ministries, agencies and local government offices
12. International cooperation
13. Others

#### General description of the Council for Promoting a Low-Carbon Society

**[Participating Organizations]**  
Public Interest Incorporated Associations: The Society of Heating, Air-Conditioning and Sanitary Engineering of Japan, The Japan Institute of Architects, Japan Federation of Architects & Building Engineers Association, The City Planning Institute of Japan, and Japan Association for Real Estate Sciences.

**General Incorporated Foundations:**  
Institute for Building Environment and Energy Conservation.

**General Incorporated Associations:**  
Japanese Association of Building Mechanical and Electrical Engineers, Association of Building Engineering and Equipment, Japan Federation of Housing Organizations, The Institute of Electrical Installation Engineers of Japan, Japan District Heating & Cooling Association, Japanese Sustainable Building Consortium, Japan Federation of Construction Contractors, Architectural Institute of Japan, Japan Structural Consultants Association, Japan Association of Architectural Firms, Japan Solar Energy Society, and The Japan Wood Research Society.

**[Date of Establishment]**  
22 July 2014

**[Head Office]**  
Architectural Institute of Japan  
5-20-20 Shiba, Minato-ku, Tokyo  
108-8414

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**The Sky Solar System  
will save the world**

Ben Nakamura