

The Netherlands Embassy  
28th October, 2014

## Renewable Energy and Wind Energy Development in Japan

**Izumi USHIYAMA**  
President, Ashikaga Institute of Technology  
Tochigi, Japan  
Honorary Board Member for  
Japan Wind Energy Association

## CONTENTS

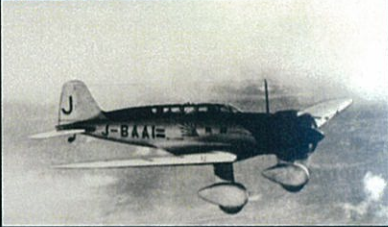
1. Self-Introduction
2. "Sunshine Project"; Origin of Renewable Energy Development in Japan
3. Present Status of Renewable Energy
4. NEDO's Activities
  - 4.1 Offshore Wind Project
  - 4.2 Marine energy
5. Challenging Tasks of Renewable Energy

## Prof. Dr. Izumi Ushiyama

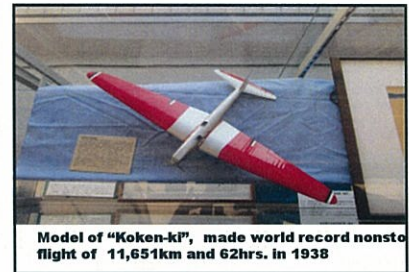
President, Ashikaga Institute of Technology  
Major sub.; Energy Conversion, esp. on RE

- A former Chairman of JWEA; Japan Wind E. A.
- A former Chairman of JSES; Japan Solar E. S.
- A Member of ISES, WWEA, GWEC, WREC, and
- A Member of TIMS ; The International "Molinological" Society

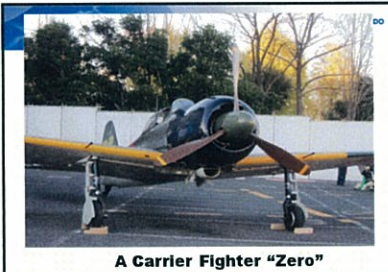
Japan's First World Record from Tokyo to London  
in 1937



World Record holder "Koken-ki" at Haneda hangar  
April 24, 1937



Model of "Koken-ki", made world record nonstop flight of 11,651km and 62hrs. in 1938



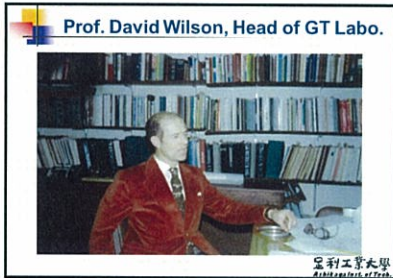
A Carrier Fighter "Zero"

"A Flying Lady" Lockheed-Constellation



Massachusetts Institute of Technology



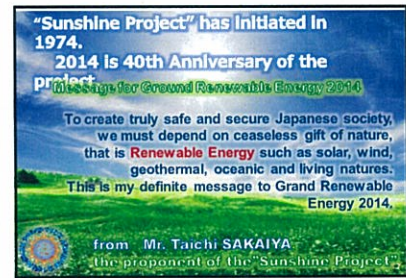
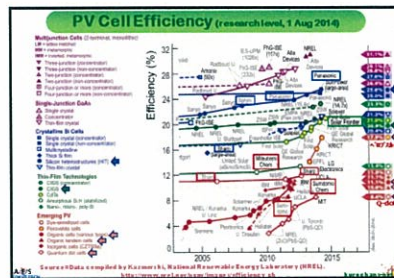
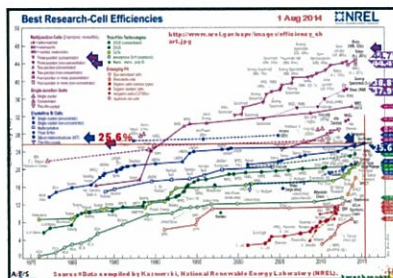
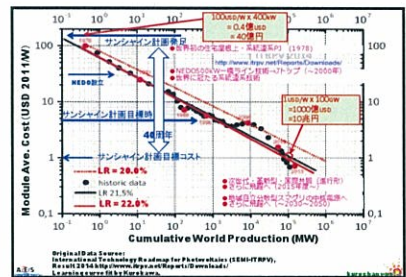


### CONTENTS

1. Self-Introduction
2. "Sunshine Project"; Origin of Renewable Energy Development in Japan
3. Present Status of Renewable Energy
4. NEDO's Activities
  - 4.1 Offshore Wind Project
  - 4.2 Marine energy
5. Challenging Tasks of Renewable Energy



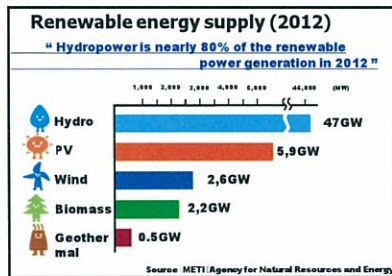
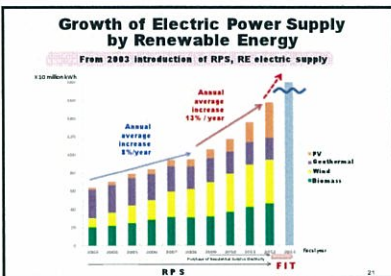
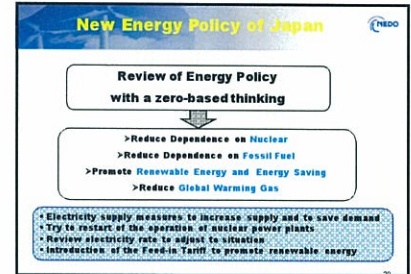
- ### Contents of "Sunshine Project"
- Solar Energy Technology**
    - 太陽熱発電システム
    - 太陽光発電システム、1000分の1
    - 太陽熱電子発電、宇宙発電、etc
    - 太陽蓄熱炉・太陽システム
    - 太陽エネルギー貯蔵
  - Geothermal Energy**
    - 研究・技術開発
    - 熱水利用発電技術
    - 次世代発電技術
  - Hydrogen Energy**
    - 水素製造技術
    - 水素輸送・貯蔵
    - 水素利用技術：燃料、化学利用、燃料電池、etc
    - 水素保安技術
    - 水素エネルギーシステム
  - Comprehensive Research**
    - ソーラシステム
    - エネルギーシステム
    - 燃料電池システム
    - 研究開発手法、産学協力、etc.





## CONTENTS

1. Self-Introduction
2. "Sunshine Project"; Origin of Renewable Energy Development in Japan
3. Present Status of Renewable Energy
4. NEDO's Activities
  - 4.1 Offshore Wind Project
  - 4.2 Marine energy
5. Challenging Tasks of Renewable Energy



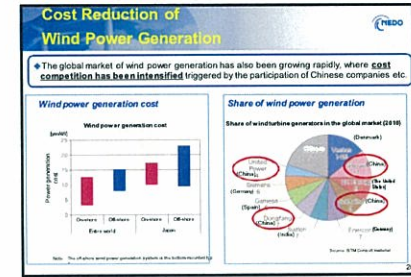
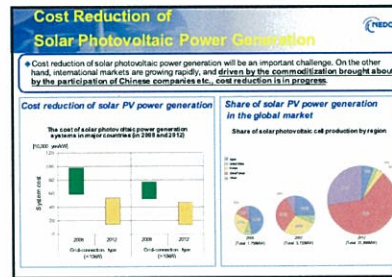
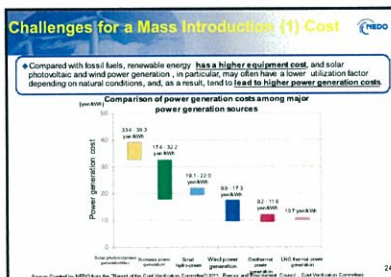
**Feed-in-tariff (FIT) for RE in Japan**

Source	PV		Wind		Geothermal		Biomass		
	<10kW	>10kW	<20kW	>20kW	<10MW	>10MW	<10kW	>10kW	
Price (yen/kWh)	37.80	38.00	23.10	57.75	27.30	42.00	25.20	30.45	35.70
Including tax	38	38	22	65	28	40	24	29	34
Term (year)	20	10	20	20	15	15	20	20	20

Source	Methane fermentation		Wood		Waste (excluding wood)		Recycled wood	
	average (yen/kWh)	By research (yen/kWh)	unused wood	wood	waste (excluding wood)	waste (excluding wood)	recycled wood	recycled wood
Price (yen/kWh)	42.95	33.60	25.20	25.20	17.85	17.85	13.65	13.65
Including tax	59	52	24	24	17	17	13	13
Term (year)			20	20	20	20	20	20

Source: METI/Agency for Natural Resources and Energy









### Fukushima Floating Offshore Wind Project (METI Project)

**Project Consortium 11 members:**  
 NEDO (Project Manager)  
 University of Tsukuba  
 Mitsubishi  
 Hitachi  
 Nissan  
 Hitachi  
 Hitachi  
 Hitachi  
 Hitachi  
 Hitachi  
 Hitachi

**Hitachi 3MW JMU Spar**   **Hitachi 3MW Mitsui sparless**   **MHI 7MW JMU Spar**   **MHI 7MW MHI sparless**

### Development of 7MW-class Wind Turbine

Development of the wind turbine with innovative mechanisms (drive system, blade, etc.) to realize the highly reliable 7MW wind turbine

**Rated output:** 7MW class  
**Rated diameter:** Over 80m  
**Wind class:** IEC Class I  
**Drive system:** Hydraulic transmission system  
**Generator:** High-speed synchronous generator  
**Inverter:** IGBT

### Getting larger and larger

Blade scale comparison

3MW class: 45.2m  
 7MW class: 61.6m

Onshore wind   Offshore wind

### Offshore Wind Turbines

SIEMENS: 6MW   MHI & NEDO: 7MW

### CONTENTS

1. Self-Introduction
2. "Sunshine Project"; Origin of Renewable Energy Development in Japan
3. Present Status of Renewable Energy
4. NEDO's Activities
  - 4.1 Offshore Wind Project
  - 4.2 Marine energy
5. Challenging Tasks of Renewable Energy

### Potential of Marine Energy in Japan

**Wave:**  
 1) 195GW  
 2) 5GW  
 3) 19TWh/yr

**Ocean current:**  
 1) 205GW  
 2) 1GW  
 3) 10TWh/yr

**Tidal current:**  
 1) 22GW  
 2) 2GW  
 3) 6TWh/yr

**Ocean thermal:**  
 1) 904GW  
 2) 6GW  
 3) 47TWh/yr

### R&D of Marine Energy Technology (FY2011-2015)

**A. Demonstration Research of Ocean Energy Technology (Medium term)**  
 Target: Establishment of power generation systems that can achieve a power generation cost of 40 yen/kWh

**B. Elemental Research and Development of Ocean Energy Technology (Long term)**  
 Target: Establishment of element technologies and components that can achieve a power generation cost of 20 yen/kWh

Research theme	FY2011	FY2012	FY2013	FY2014	FY2015
<b>A. Demonstration research</b>		FS(Tank Testing)		Demonstration at sea	
		Public offering	Public offering	Public offering	
<b>B. Elemental Research and Development</b>		Element technology development			

### A. Demonstration Research Projects

- Wave power generation (mechanic)
- Wind and Tidal current power generation (floating)
- Wave power generation (air-turbine)
- Tidal current power generation (seabed mounted type)

### B. Elemental Research and Development Projects

- Ocean current power generation (underwater floating: Active control)
- Heat exchanger for Ocean thermal energy conversion