

An aerial photograph of a tropical atoll, showing a series of small, irregular islands with white sand beaches and lush green vegetation, surrounded by clear turquoise water. The horizon is visible in the distance under a blue sky with some clouds.

Open Energy Systems

Hiroaki Kitano

Professor, Okinawa Institute of Science and Technology
President & CEO, Sony Computer Science Laboratories, Inc.

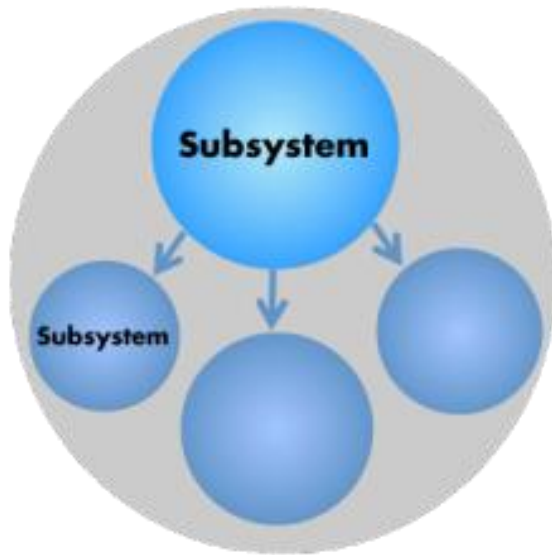
A member of Global Agenda Council on Future of Electricity
for the World Economic Forum

A member of Scientific Advisory Committee for ALSTOM

Open Energy Systems(OES)

<A solution for global energy and sustainability problems>

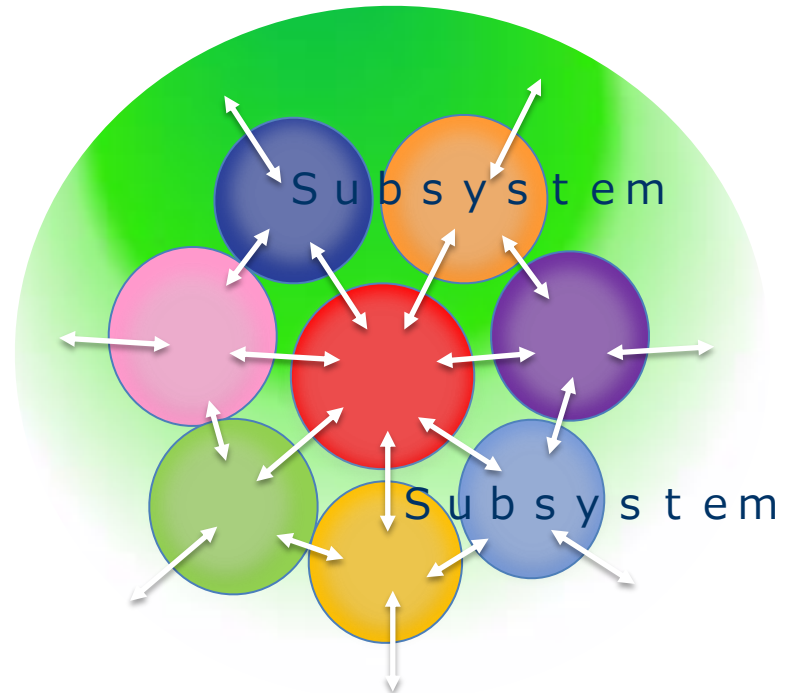
Closed System



Conventional system

*Top-down power transmission
based on large scale power generation*

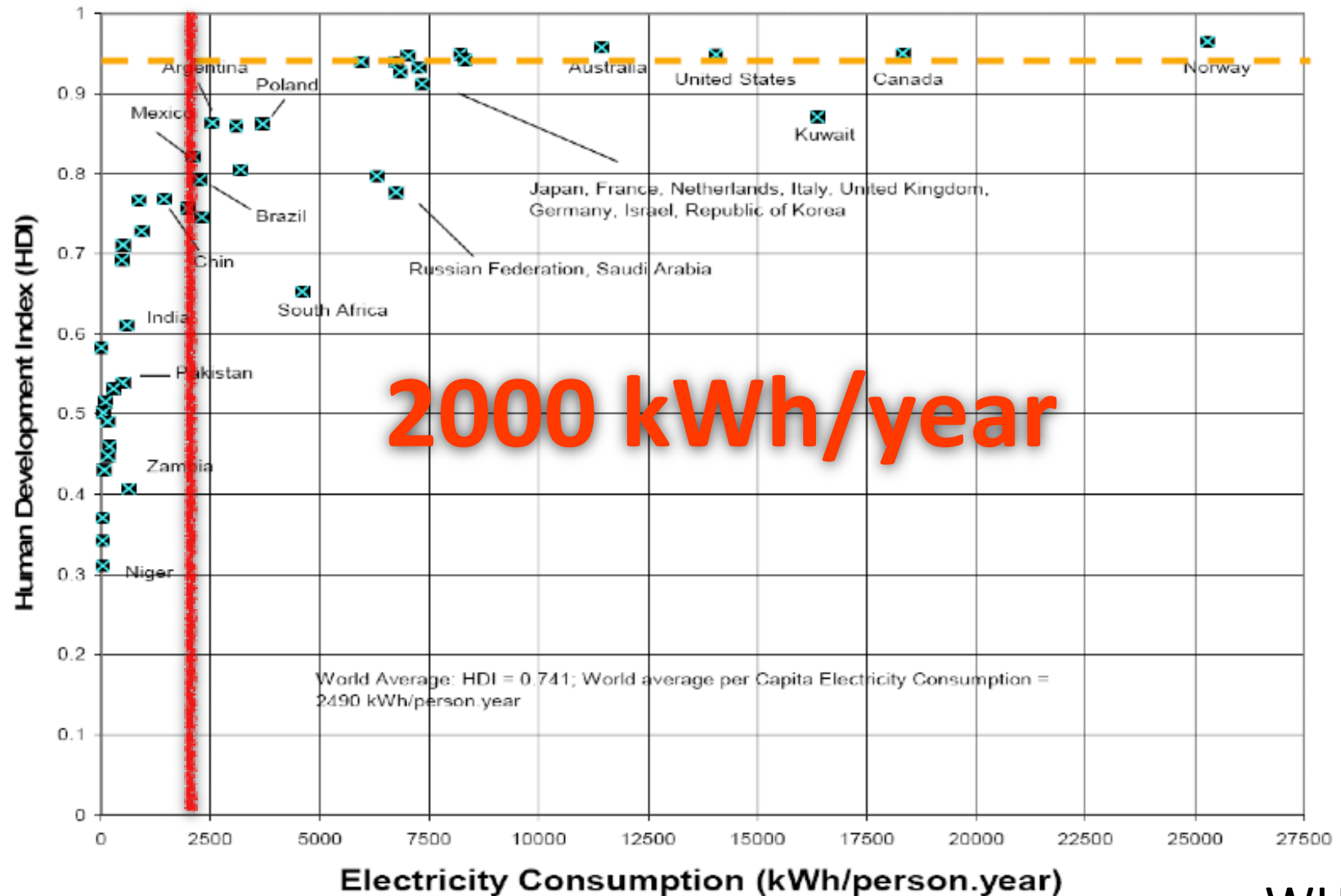
Open System



OES

*Bottom-up and interconnection based
on unstable distributed power sources*

Quality of Life and Electricity Consumption



SMART GRID

Digital and communications devices installed throughout a power system can track usage and minimize and manage disruptions.


- Communication
- Power lines




We go extreme

MEP

Consumer Generated Energy

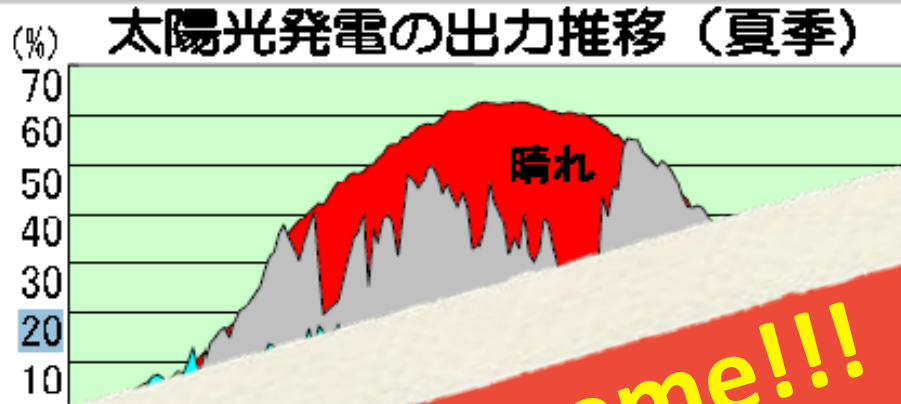
- Paradigm change in energy system
 - status quo: power company to provide electricity
- 
- Future: everyone generates and distribute electricity

Transformation already took place in media industry

- TV station and movie companies create contents and distribute
- 
- YouTube etc: anyone creates and distributes contents

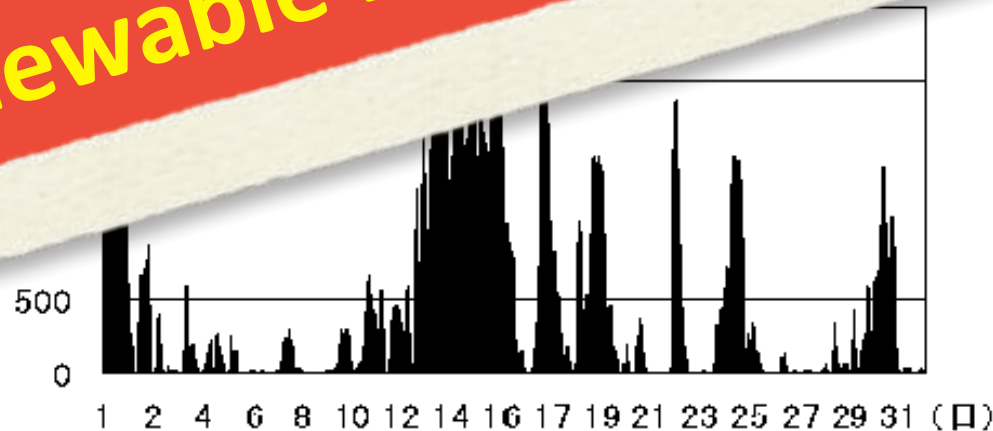
Fluctuation of power generation

Solar PV



Think Extreme!!!
Renewable Energy for Base Load

W



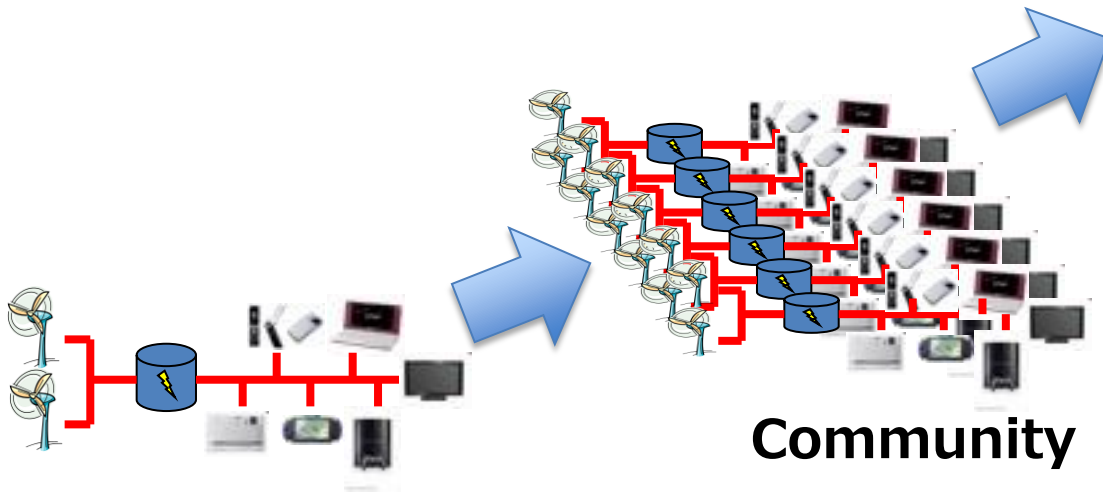
【出典】総合資源エネルギー調査会新エネルギー部会資料

Milestones of Open Energy System

IAEA forecast of electricity demands in 2030:
31,524 TWh (20,037 TWh as of 2010)

US\$ 10 Trillion cumulative investment
+
US \$6Trillion / year ($\$0.2 = 1\text{kW}$) electricity sales

**Energy Cloud at
market scale**



Stand Alone

Community

Global Agenda Council on New Energy Architecture

Leap Frog Strategy,
Battery-Centered Distributed Grid &
Deep Demand Management



Summit on the Global Agenda 2012

Dubai, United Arab Emirates 12-14 November

WORLD
ECONOMIC
FORUM

COMMITTED TO
IMPROVING THE STATE
OF THE WORLD



Sony CSL Ghana Project

FIFA World Cup 2010 Public Viewing

- May 2010 and June-July 2010 @ Ghana
- Flexible Solar Panels and Li-Ion Batteries
- In cooperation with JICA HIV/AIDS Campaign



JICA Project

Mobile Phone Charging Business using Solar Panel and Batteries

BOP Business F/S Project, Ghana (2011.4~2014.3)

Funded by JICA (Japan International Cooperation Agency)



A. Mobile phone charging service using power generator

B. Mobile phone charging service using Geo System at Kpachelo, Ghana

C. F/S in non-electrified locations

D. Mobile phone charging and video viewing services using Geo System at Puriya, Ghana

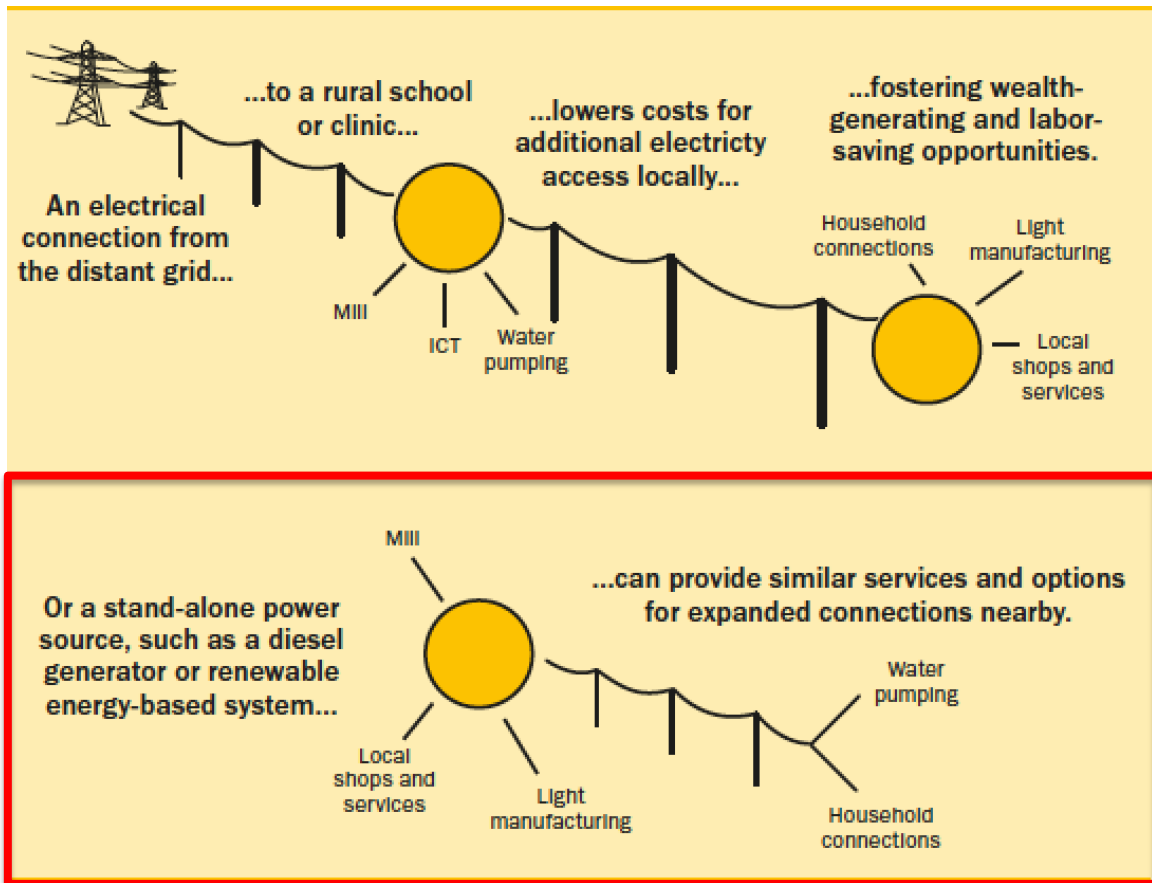
On Grid or Off Grid

Energy Services for the Millennium Development Goals



Achieving the Millennium Development Goals

MillenniumProject
Initiative to Accelerate Progress on MDGs



Sony CSL – OIST Project on Open Energy System



An Actual Installation @ OIST

PV Panel@House 204

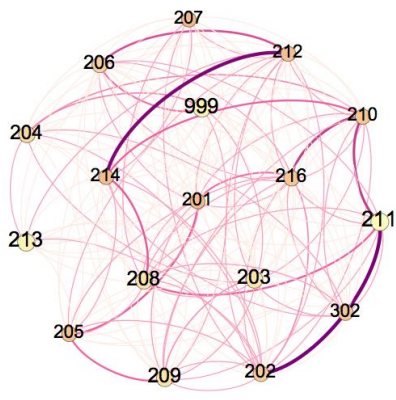
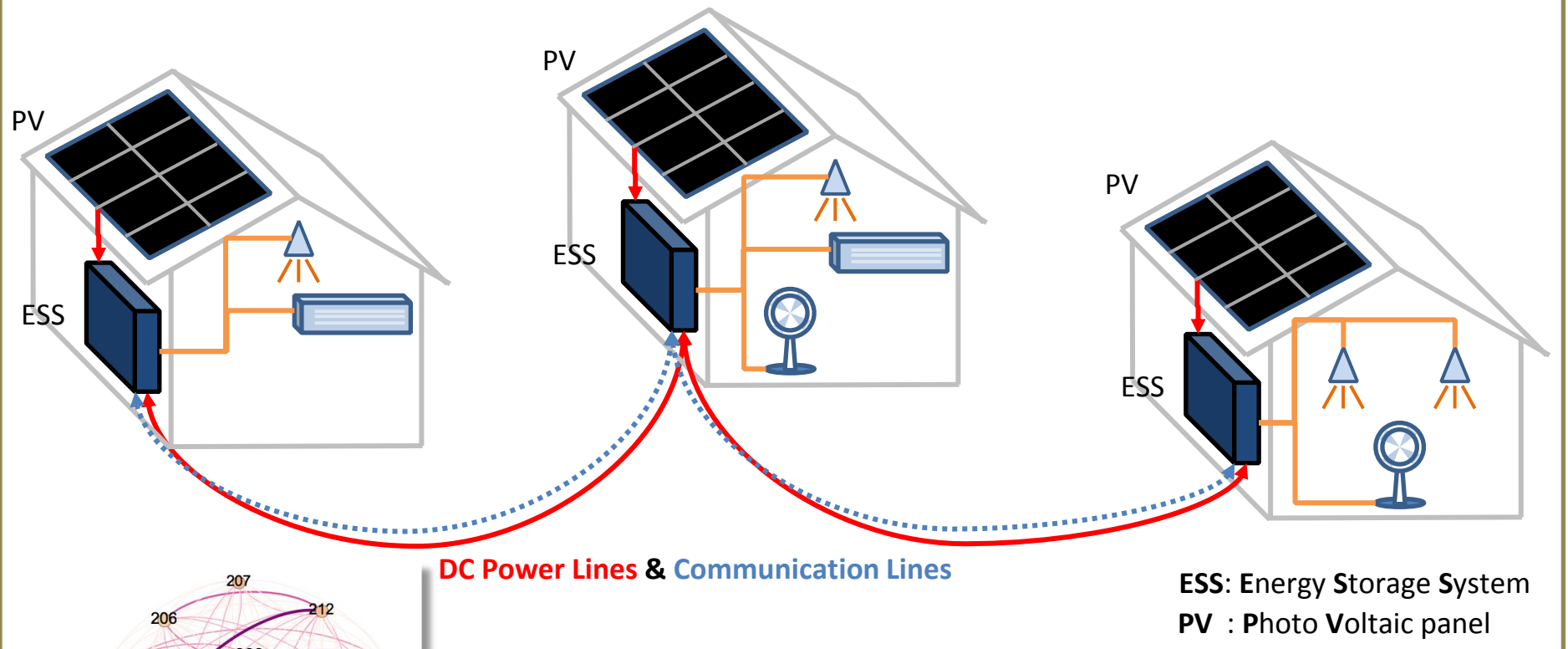


ESS@House 204



Installation at OIST

On-site Feasibility Test of Energy Exchange (OIST faculty houses)



**Dynamic DC Power Transfer
(17 houses simulation)**



Photo by Hiroaki Kitano at Lankanfushi Atoll, Maldives

OIST as a global hub of Open Energy Systems research and industrial development



Global Open Energy Forum 2015

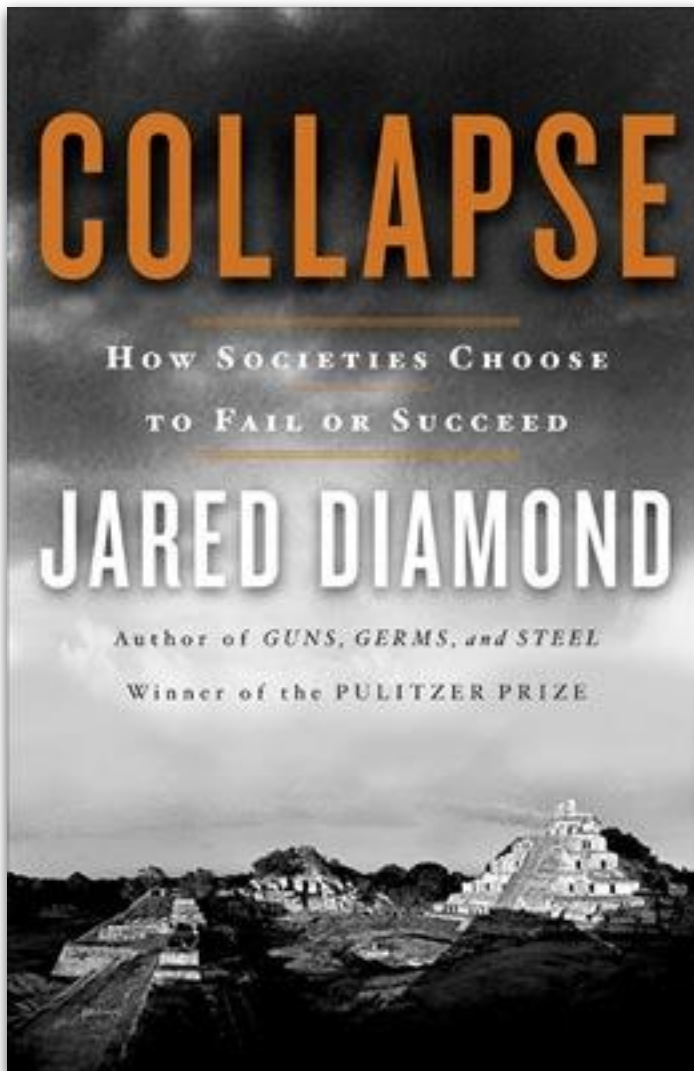
Early 2015

(Exact date to be announced)

**In conjunction with
The Second International Symposium on
Open Energy Systems**

@ Okinawa Institute of Science and Technology

Supplementary Slides



“...population and environmental problems created by non-sustainable resource use will ultimately get solved in one way or another: if not by pleasant means of our own choice, then by unpleasant and unchosen means...” Jared Diamond





ipcc

INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2013

The Physical Science Basis

Summary for Policymakers



DESERTEC Vision

DESERTEC-EUMENA



Concentrating
Solar Power



Hydro



Photovoltaics



Biomass



Modernizing Energy Services for the Poor: A World Bank Investment Review – Fiscal 2000–08

December 2010

Douglas F. Barnes
Bipul Singh
Xiaoyu Shi

Energy Services for the Millennium Development Goals



Achieving the Millennium Development Goals

MillenniumProject
Investments for development and capacity for the Millennium Goals



ESMAP
Energy Sector Management
Assistance Programme



**3 hours of electricity may change
their life**

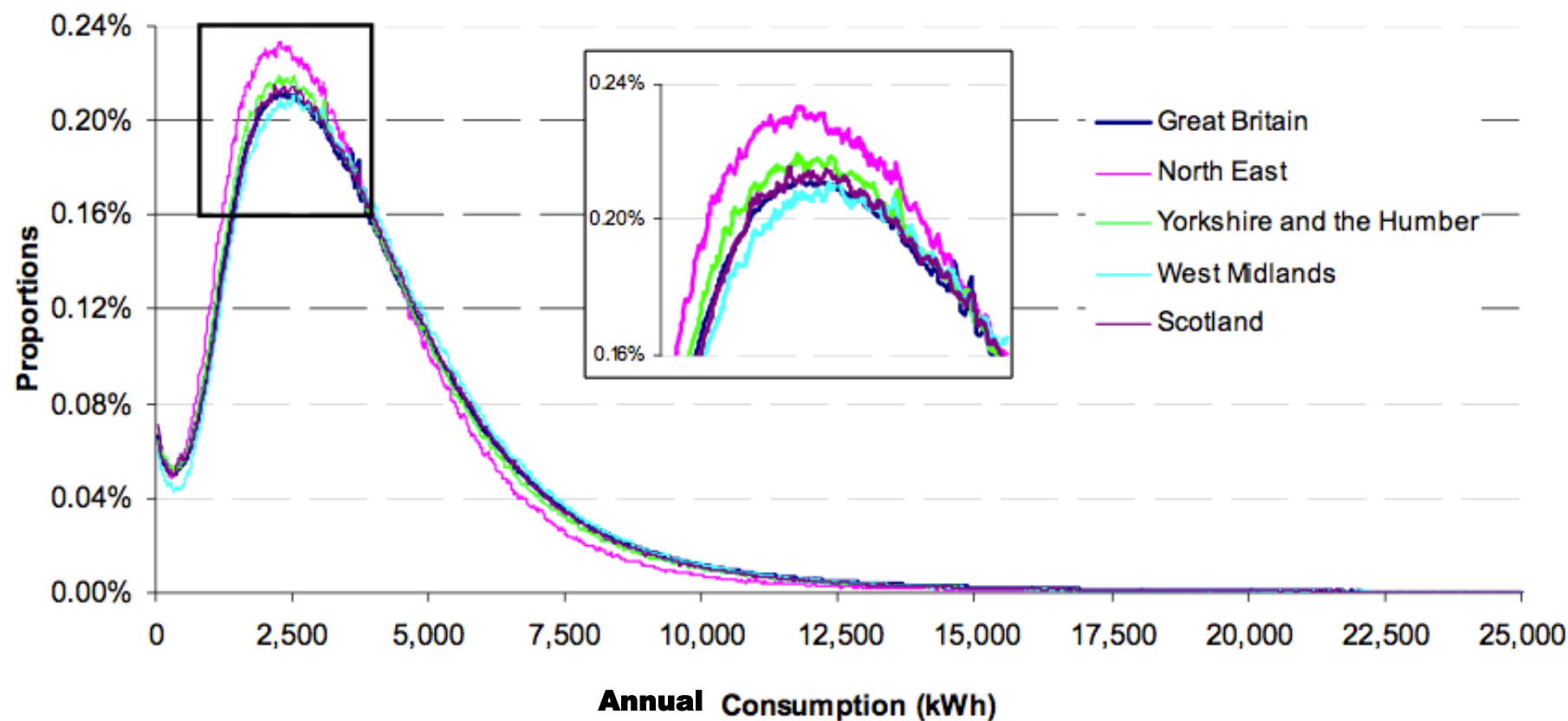
95% of Indian population live in darkness after sunset

Very cheap and simple ways to obtain clean water

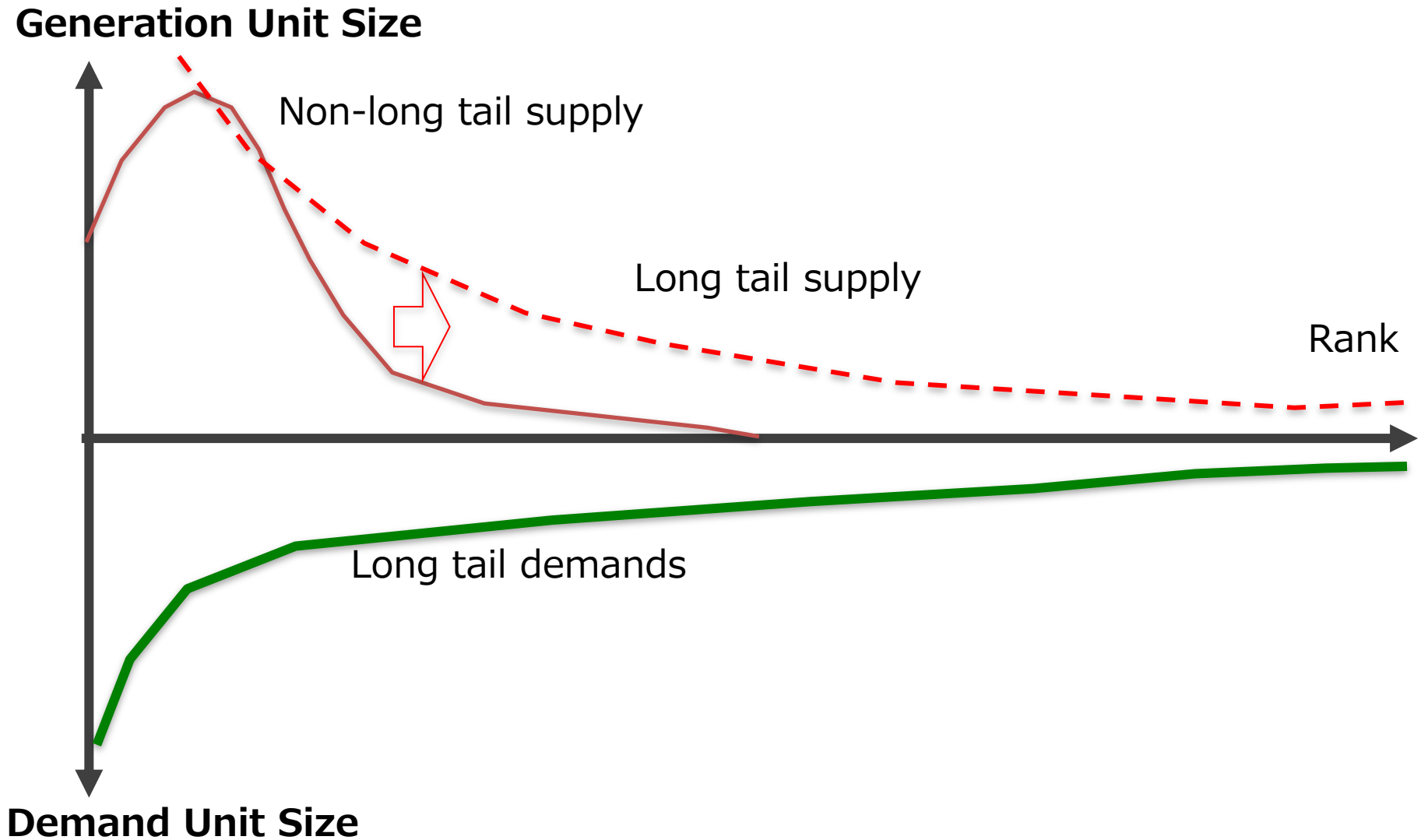


In India, 3000 people die due to lack of clean water everyday.
= 15 Boeing 777 crash / day

Chart 2: Distributions of profile 1 electricity consumption



Hypothesis:
**Electricity system architecture will converge into
long-tail supply & demand**



Future Grid Forum: Change and Choice

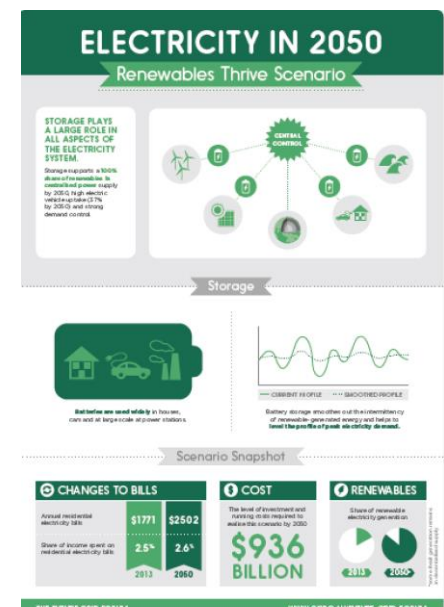
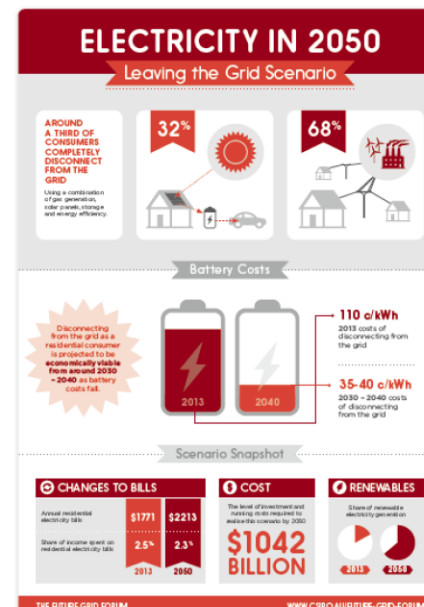
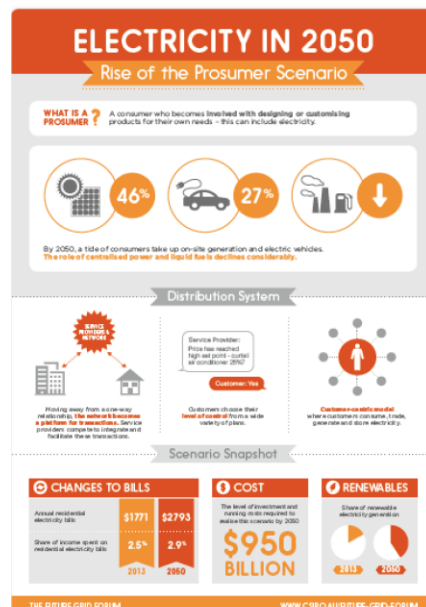
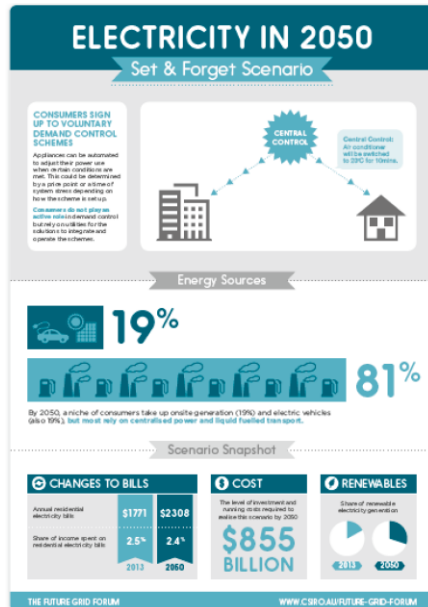
CSIRO, Australia

Set & Forget

Rise of the Prosumer

Leaving the Grid

Renewable Thrive



1/3 of consumers leave the grid



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検索



文字サイズ変更

小

中

大

グリーンエネルギーへの 取り組み

グリーンエネルギーへの取り組み

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- [新エネルギー施設](#)
- [葛巻町省エネルギービジョン](#)
- [バイオマスタウン構想](#)(PDF:639KB)
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- [施設見学申込み](#)
- [紙芝居](#)
- [新エネ百選](#)



くずまきで
学ぼう！



くずまきで
遊ぼう！



グリーンエネルギーへの
取り組み



[防災情報](#)

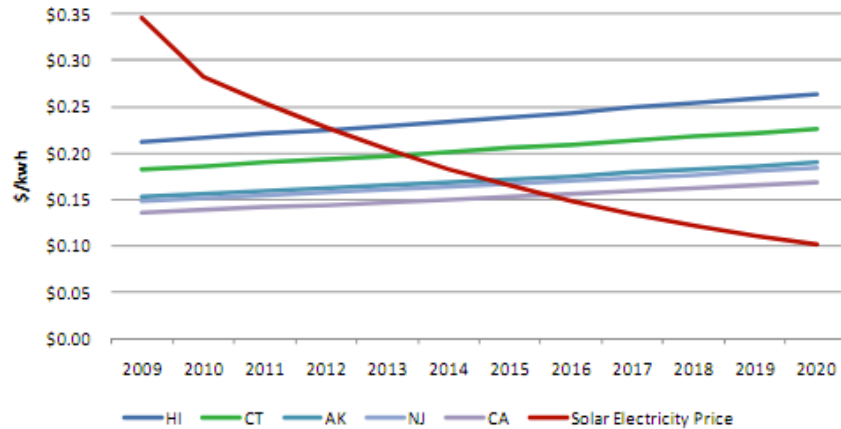
[今月のイベント](#)

[町民ニュース](#)

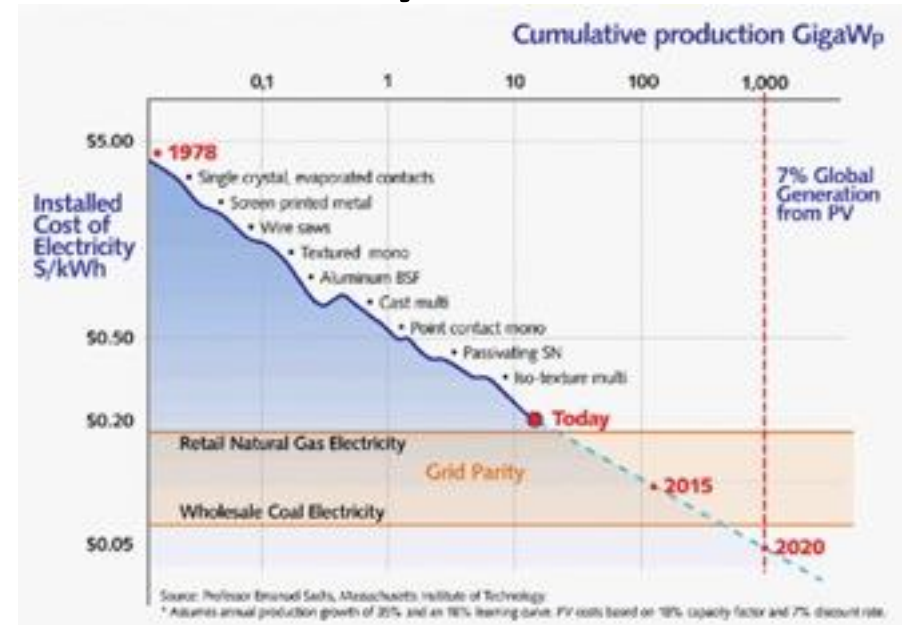
[例規集](#)

Reaching Grid Parity

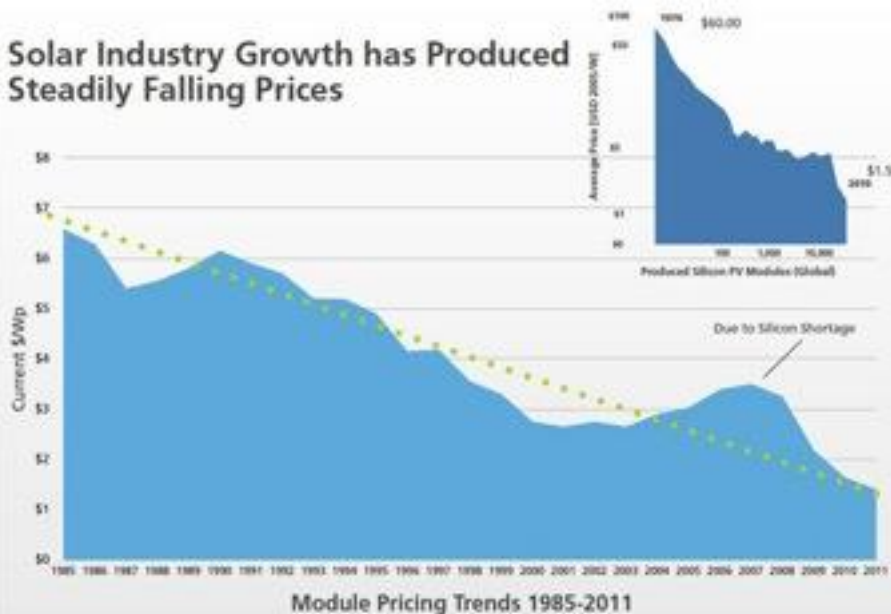
US GRID PARITY PROJECTION FOR KEY STATES



Source: EIA, Piper Jaffray Research.

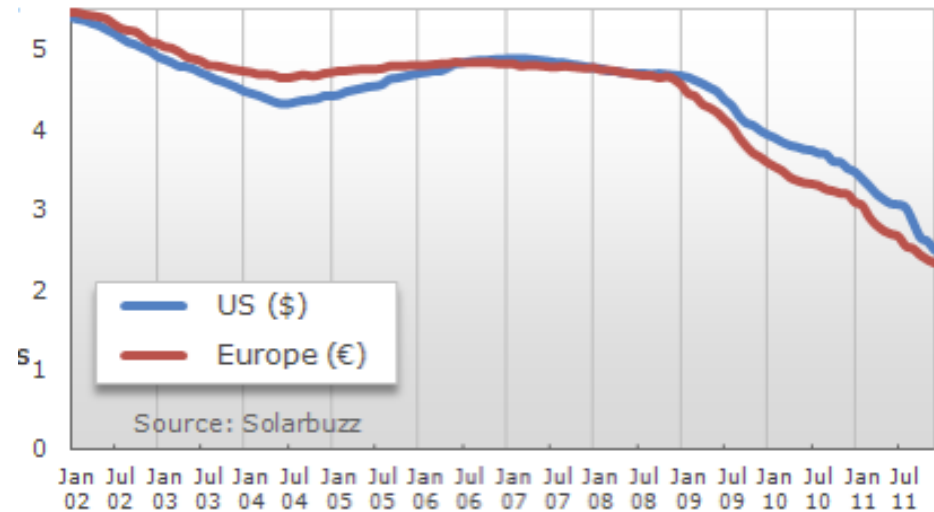


Solar Industry Growth has Produced Steadily Falling Prices

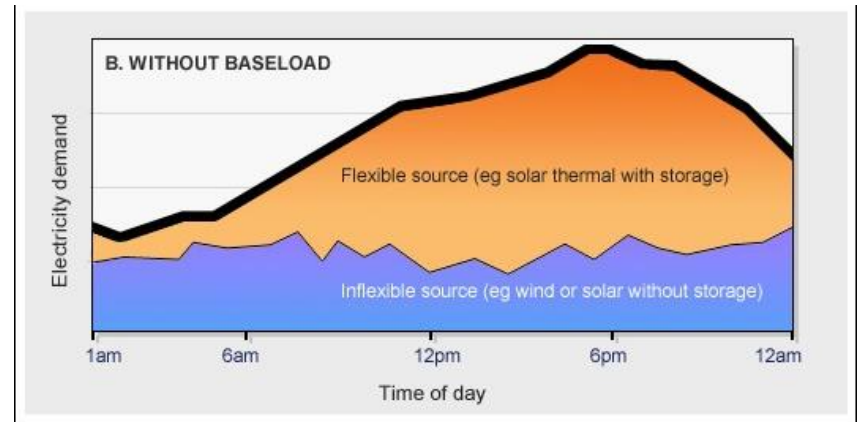
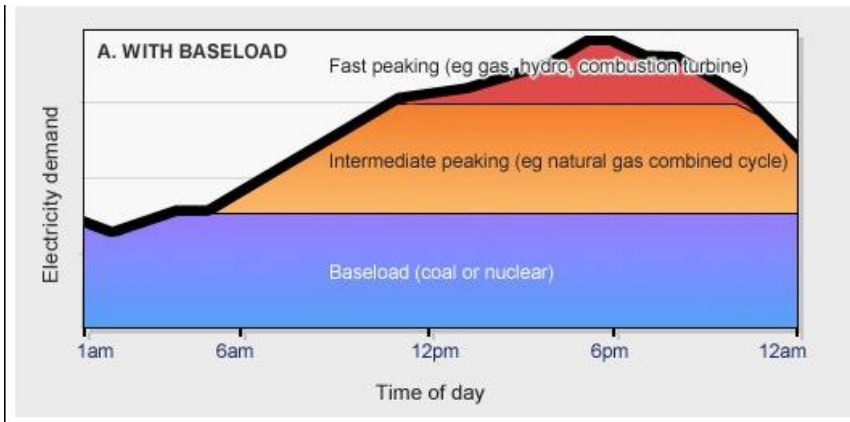


Solarbuzz Retail Module Price Index

Dec 2001: \$5.40 €5.47 — Nov 2011: \$2.49 €2.33
Price per Watt Peak



Theoretically Study using 2008 US energy demand data by Dr. David Mills (Ausra Inc., currently Areva Solar)



THE CURRENT WAR

THE TALE OF AN EARLY TECH RIVALRY

DC

DIRECT CURRENT

The flow of electricity is in one direction only. The system operates at the same voltage level throughout and is not as efficient for high-voltage, long distance transmission.

Direct current runs through:



Battery-Powered Devices Fuel and Solar Cells Light Emitting Diodes

"[TESLA'S] IDEAS ARE SPLENDID, BUT THEY ARE UTTERLY IMPRACTICAL."

- THOMAS EDISON

AC

ALTERNATING CURRENT

Electric charge periodically reverses direction and is transmitted to customers by a transformer that could handle much higher voltages.

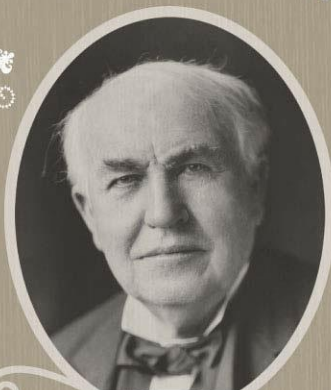
Alternating current runs through:



Car Motors Radio Signals Appliances

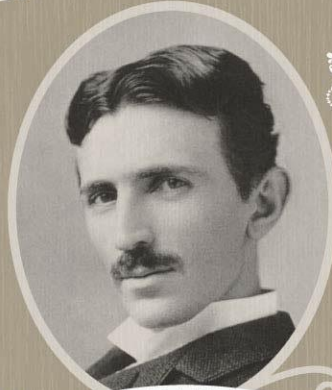
"IF EDISON HAD A NEEDLE TO FIND IN A HAYSTACK, HE WOULD PROCEED AT ONCE... UNTIL HE FOUND THE OBJECT OF HIS SEARCH. I WAS A SORRY WITNESS OF SUCH DOINGS, KNOWING THAT A LITTLE THEORY AND CALCULATION WOULD HAVE SAVED HIM 90 PERCENT OF HIS LABOR."

- NIKOLA TESLA



THOMAS EDISON

VS.



NIKOLA TESLA

You would have never found two geniuses so spiteful of each other beyond turn-of-the-century inventors Nikola Tesla and Thomas Edison. They worked together—and hated each other. Let's compare their life, achievements, and embittered battles.

1847 BORN 1858

Milan, Ohio BIRTHPLACE Smiljan, Croatia

Wizard of Menlo Park NICKNAME Wizard of the West

Home-schooled and self-taught EDUCATION Studied math, physics, and mechanics at The Polytechnic Institute at Gratz

Mass communication and business FORTE Electromagnetism and electromechanical engineering

Trial and error METHOD Getting inspired and seeing the invention in his mind in detail before fully constructing it

DC (Direct Current) WAR OF CURRENTS: ELECTRICAL TRANSMISSION IDEA AC (Alternating Current)

Incandescent light bulb; phonograph; cement making technology; motion picture camera; DC motors and electric power

NOTABLE INVENTIONS

Tesla coil - resonant transformer circuit; radio transmitter; fluorescent light; AC motors and electric power generation system

1,093 NUMBER OF US PATENTS 112

0 NUMBER OF NOBEL PRIZES WON 0

1 NUMBER OF ELEPHANTS ELECTROCUTED 0

1931—Passed away peacefully in his New Jersey home, surrounded by friends and family DEATH 1943—Died lonely and in debt in Room 3327 at the New Yorker Hotel

LATE BLOOMER

Thomas Edison, the youngest in his family, didn't learn to talk until he was almost 4 years old.

"Genius is one percent inspiration, and ninety nine percent perspiration."

-Thomas Edison

FALLING OUT

Edison promised Tesla a generous reward if he could smooth out his direct current system. The young engineer took on the assignment and ended up saving Edison more than \$100,000 (millions of dollars by today's standards). When Tesla asked for his rightful compensation, Edison declined to pay him. Tesla resigned shortly after, and the elder inventor spent the rest of his life campaigning to discredit his counterpart.

EDISON FRIES AN ELEPHANT

In order to prove the dangers of Tesla's alternating current, Thomas Edison staged a highly publicized electrocution of the three-ton elephant known as "Topsy." She died instantly after being shocked with a 6,600-volt AC charge.

WAR OF CURRENTS OFFICIALLY SETTLED

In 2007, Con Edison ended 125 years of direct current electricity service that began when Thomas Edison opened his power station in 1882. It changed to only provide alternating current.

NOBEL PRIZE CONTROVERSY

In 1915, both Edison and Tesla were to receive Nobel Prizes for their strides in physics, but ultimately, neither won. It is rumored to have been caused by their animosity towards each other and refusal to share the coveted award.



SOURCES: CHENEY, MARGARET. "TESLA: MAN OUT OF TIME" | UTH, ROBERT. "TESLA: MASTER OF LIGHTNING." | THOMASEDISON.COM | PBS.ORG | WEB.MIT.EDU | WIRED.COM

A COLLABORATION BETWEEN GOOD AND COLUMN FIVE