Paradigm Shift of the Energy Industry after the Great East Japan Earthquake

- For creation of the best mix energy industry-

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Hiroshi Fujiwara,Ph.D

BroadBand Tower, Inc.

President and Chairman CEO, Broad Band Tower, Inc.

BIOGRAPHY

Position **President and Chairman CEO, Broad Band Tower, Inc.**

Education

Bachelor of Science in Physical Science, Kyoto University in 1977
Ph. D in Electronic Information Engineering, University of Tokyo

Experience

1977-77 IBM Japan, System engineer,
1977-85 Hitachi Gr.:Engineer, super mini computer communication development,
1985-96 ASCII Corporation for Digital Media Project(Microsoft & MPEG)

- 1985-87 Manager of Microsoft Communication Project
- 1987-1991 Vice President, Graphics Communication Technologies,Ltd.(GCT) sponsored by Japanese Government Developed R&D strategy of H261/MPEG
- 1988-1992 Appointed as a visiting research scientist of Bell Communications Research (Bellcore) of the U.S, as the collaborative research with GCT
- 1993-1996 Senior Vice President, Graphics Communication Laboratories

Entrepreneur

1996- Founded Internet Research Institute, Inc. (IRI) . President and CEO, (current)
⇒IPO: IRI(1999/12), Ubiteq (2005/6: IRI Subsidiary), BBTower (2005/8: IRI Subsidiary)
2005-Founded Nano-Optonics Energy: EV venture, Founder
2012-BBTower, President&Chairman, CEO(current)

Broad Band Tower, Inc.

(TSE JQS:3776)

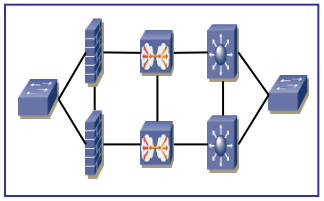
Established: 2000/2 Capital: JPY 2228 mil. President:Hiroshi Fujiwara Share self owned:30%

Internet Data Center and Commerce Business: Revenue about 250M$

Platform business

Co-location Service

YAHOO! JAPAN



IP Network Service

Solution Service

BBF (Subsidiary)

EC Outsourcing for Hi-grade Fashion Industry,

EC and Internet-aided Business Planning, Sales Promotion, System Configuration, and Operation for Fashion or Life-style related goods

Movie, Music,and Audio-Visual Content Distribution

Abstract

The energy problem is one of the most important items of the super maturity society development. Japan after the East Japan Great Earthquake disaster works on renewable energy and energy saving, the new technology, such as the smart grid aiming at a breakaway from nuclear energy dependence.

A technology, policy, industry become the Trinity and it develops, then I survey a strategy of the best mix energy industry creation in order to accelerate research and development of related energy system technologies.

Content

1. What is Fukushima?
2. Change of Energy Policy in each country
3. Brief Review of Industrial Revolutions.
4. Today is the era of the 4th. Industrial Revolution!
5. Big Data Impact on 4th.Industrial Revolution
   - For creation of the best mix energy industry-

1 . What is Fukushima?

Plate Tectonics Theory

Geophysics made mechanism of the big earthquakes clear in 1960s.

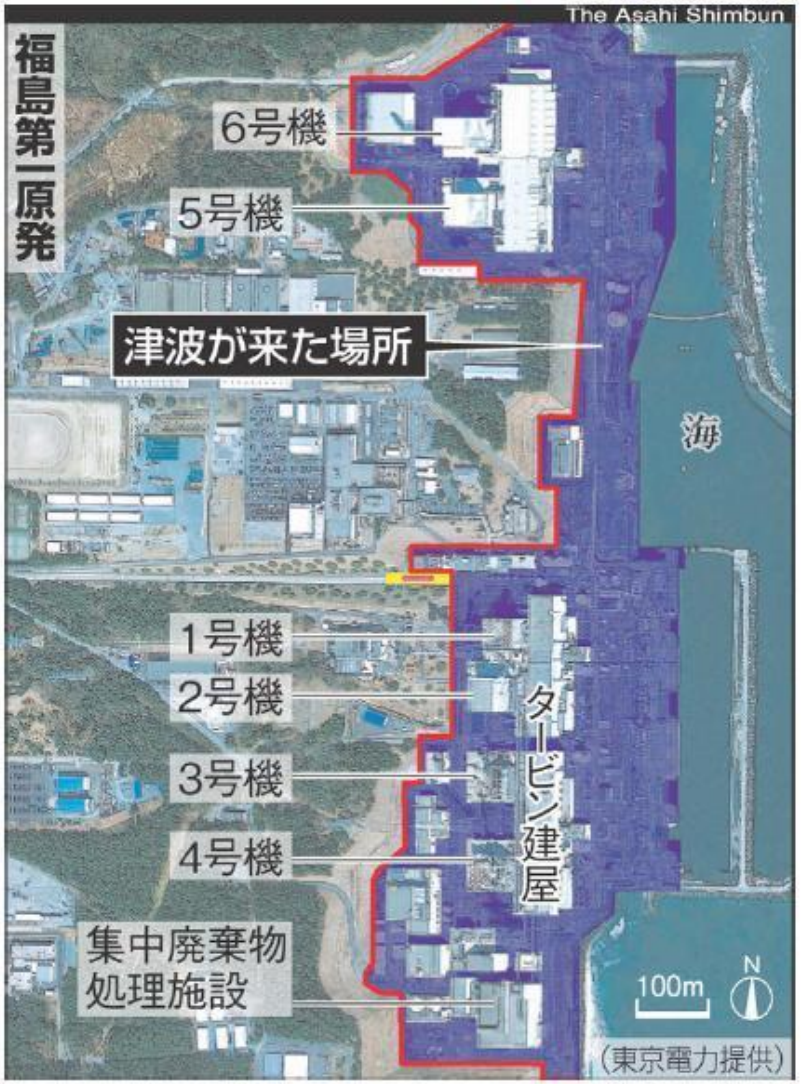
“Geophysics” has ringed the alarm to “Nuclear Power Engineering” !

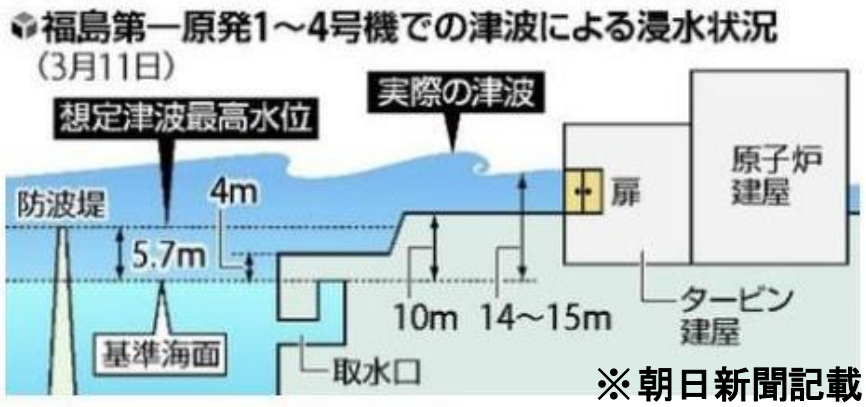
The Great East Japan Earthquake (2011) Mw9.1(M9.0)

2011,March 11, 14:46
200km off Sanriku Coast, 24km depth
M9.0 Biggest Earthquake in Japan
Area of Damage : 47,597km2
Refugee Number : 550 thousand people
Suspension of water supply Houses: 1.79M houses
The amount of damage: 250 billion yen
Dead/Missing People: 23482

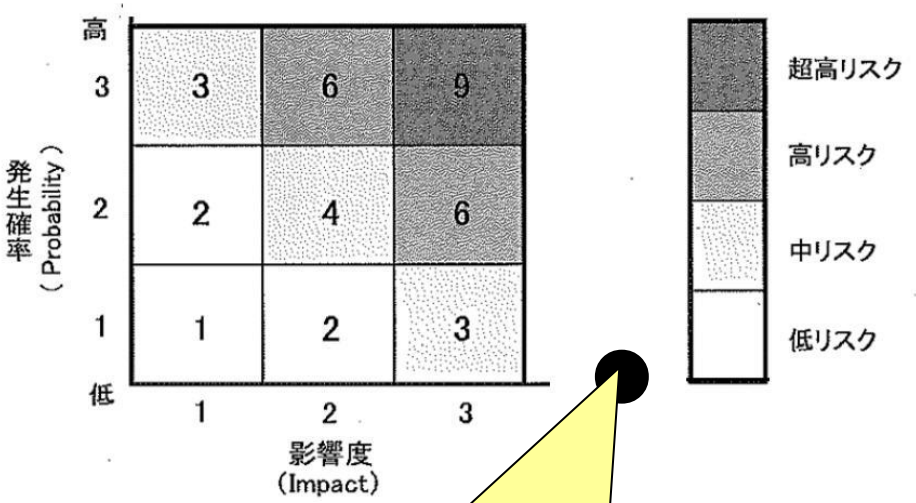
Accident at 1 st. Fukushima Nuclear Power Plant

Tsunami Damage for 1st.Fukushima Nuclear Power Plant





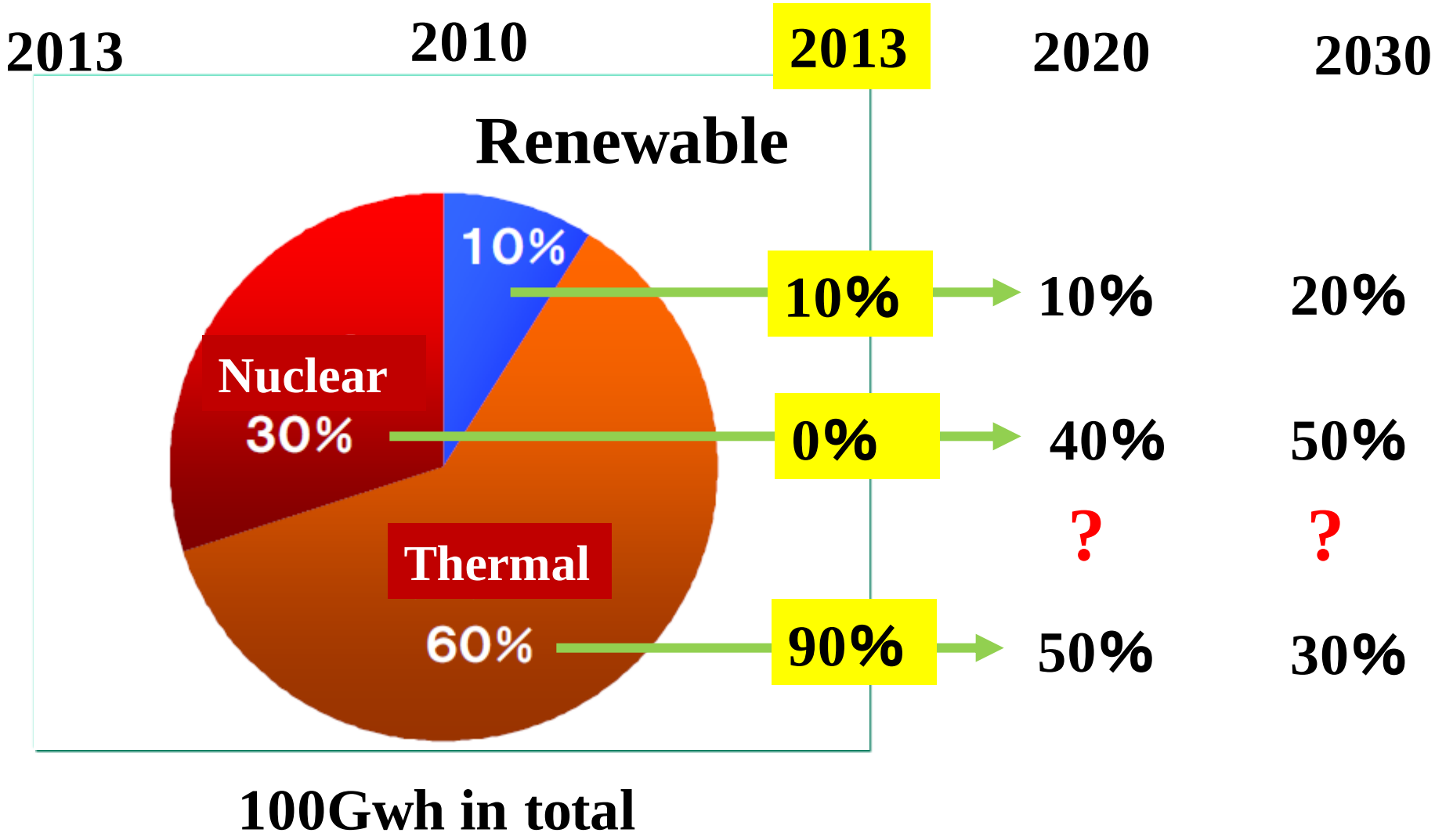
Risk Probability vs Impact Matrix



1st.Fukushima Accident: Huge Impact

Current Energy Policy in Japan

We are facing the biggest turning point after "Fukushima"!



We are facing the biggest turning point after “Fukushima”!

The Great East Japan Earthquake

Japan has been recognized as the world class earthquake country!

The world recognized “Fukushima”!

The energy policy is going through a historic change!

Energy Business Paradigm is changing!

2. Change of Energy Policy in each country.

Germany decided just after “Fukushima”!

【May31 AFP】

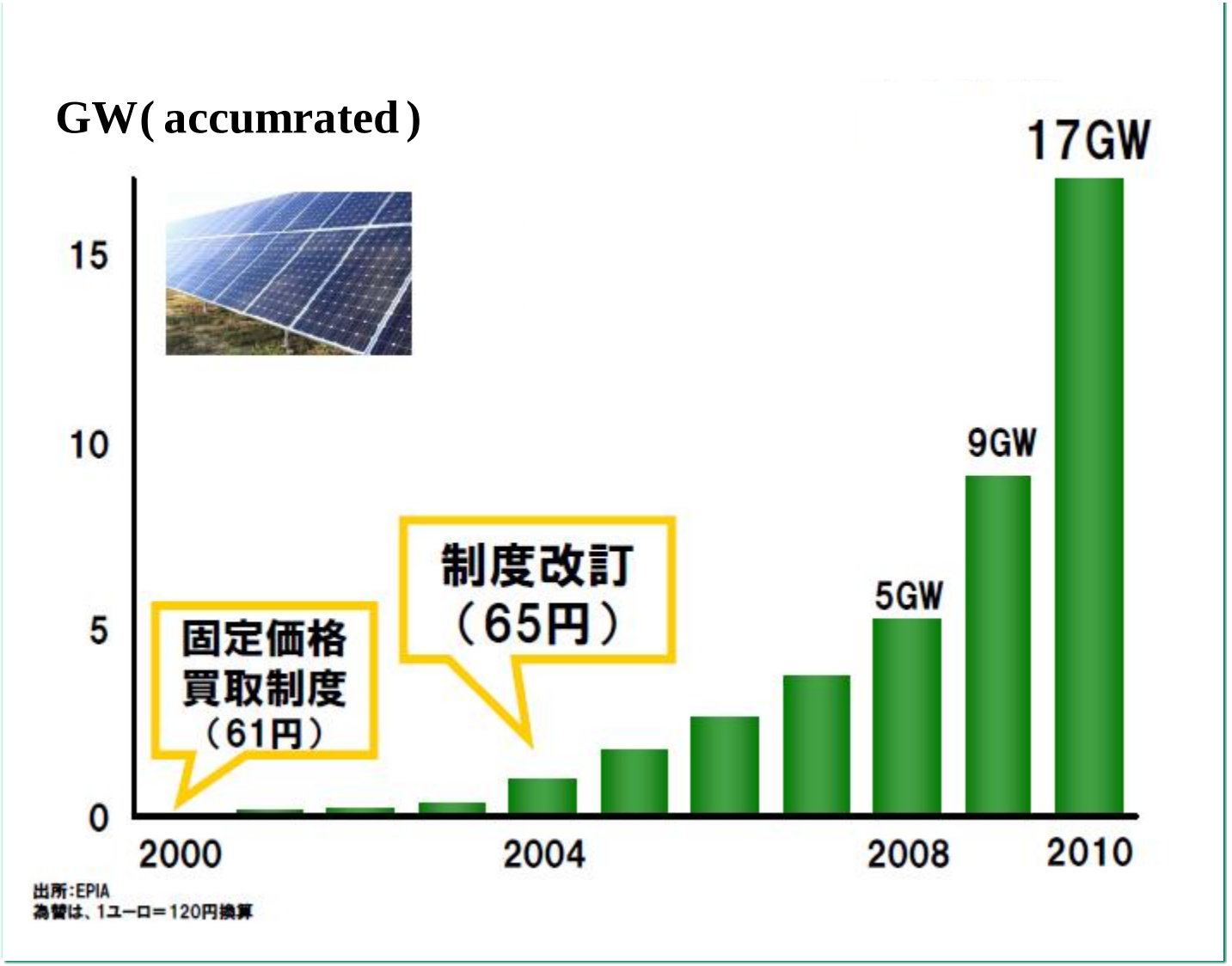
Prime Minister Angela Merkel declared that all of 17 nuclear power plants in Germany would be stopped by 2022.

Prime Minister Angela Merkel said “1st.Fukushima Nuclear Power Plant Accident instructed necessity of different kind of risk management from the existing methods. We believe that we could a pioneer of the renewable energy age.”

7 reactors became too old for work, and 1 stopped by the technical problem out of 17 reactors. 6 will be stopped by 2021, and 1 by 2022.

Currently the nuclear power plants generate 22% of the total energy in Germany.

Growth of the electric power generated by the solar energy in Germany



Reactions of the other countries to German decision.

●France commented that they respect German decision , but that France will never abandon Nuclear Energy

⇒Prime Minister Francois Fillon proudly declared that Nuclear Energy would be the best solution for the future.

⇒Also she added that electricity price in France is 40% cheaper than the other European countries.

●Sweden criticized Germany because the countries balance get out of step for climate change.

●Poland and Austria sympathized with Germany.

⇒Poland: They will reconsider the 1st.Nuclear Power Plant Plan in 2020.

●Nikolaus Berlakovich, Minister of Agriculture, environment, and water in Austria, said "World class advanced industrial country's decision will provide the big impact to the world, and suggested possibility of abandon of Nuclear Power Plants. "

Reactions of the other countries to German decision.

●Both the USA and the United Kingdom declared to construct the new nuclear power plants in order to suppress Greenhouse Gas.

●Italy abandoned all of the nuclear power plants in 1987 just after Chernobyl accident.

●Switzerland declared to abandon all of the nuclear power plants by 2034.

Sweden

- Sweden decided “de-nuclear” according to a national referendum in 1980.
- The upper limit decided 10 plants.
- The electric power company have to abandon the old plant, if they will construct the new plant.

⇒The government will never support them financially.

⇒ The electric power companies have hesitated to construct.

- It is very different from Japanese cases

⇒METI has fully supported in Japan.

⇒ Electric power generation and power electric transmission have been separated in Sweden.

⇒ Power electric transmission line has been released.

⇒Many small power generating companies participated in the market.

- The government fully supports renewable energy, and set up the goal 50% in total by 2020.

China

● separation between “Government” and “Enterprise”
⇒“Generation” and “Transmission”

●The government provided electricity since 1949.

●They changed the economic policy from a planned economy into the market economy.

⇒The government sector of the electric power was separated into the government owned company「国家電力公司」in 1997.

⇒They revised the structure as it is now in 2002.

● Electric power generation and power electric transmission have been separated

⇒2 Transmission Companies
「国家電網公司」と「南方電網有限責任公司」

⇒5 Generation Holding Companies
「中国華能集団公司」「中国大唐集団公司」「中国華電集団公司」
「中国国電集団公司」「中国電力投資集団公司」

China

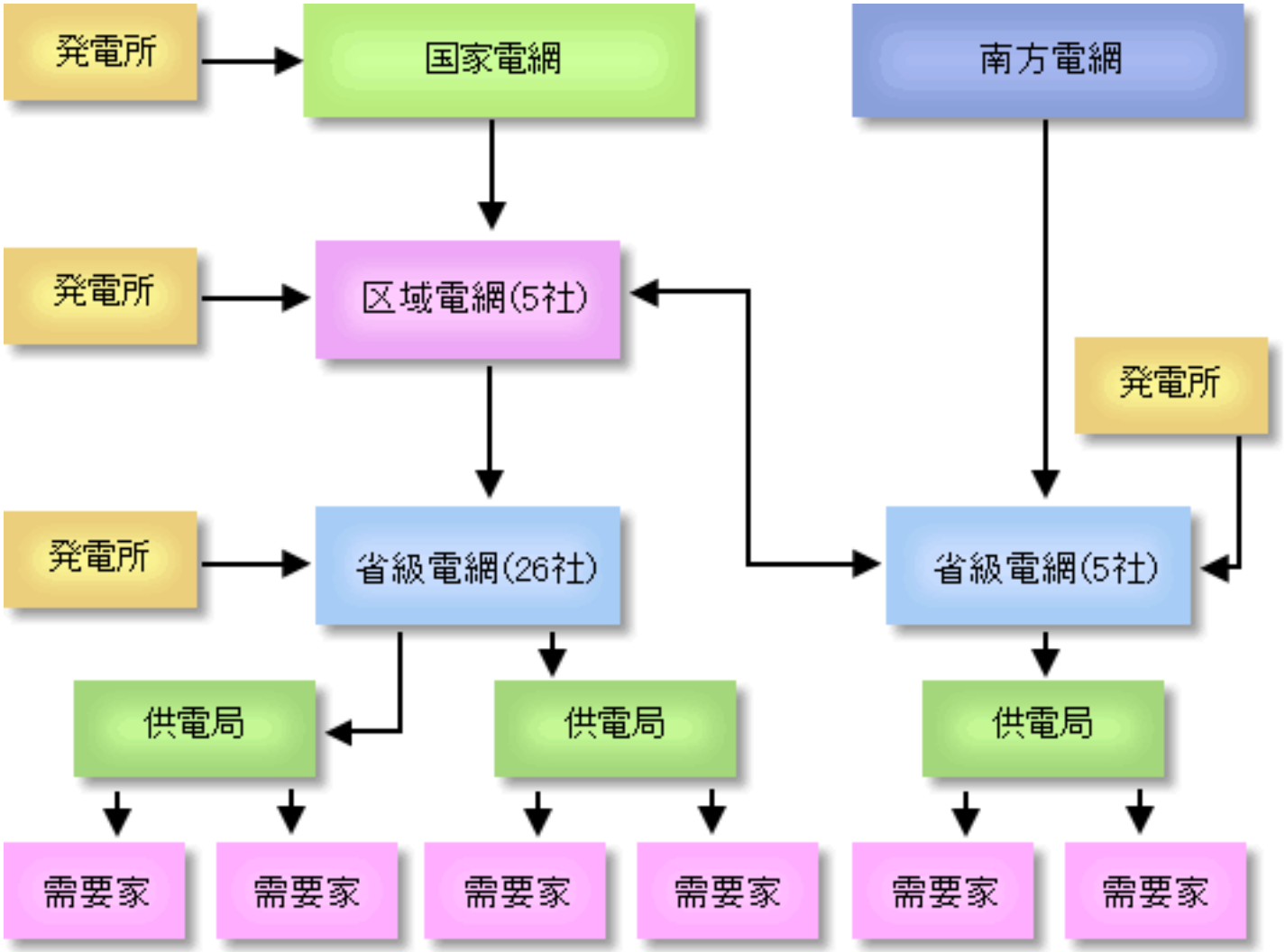
- **Policy Change :**
  Economic Growth⇒the protection of the environment

- **Total Electric Power Capacity in 2009:**
  65.1GW(Thermal) out of 87.4GW(Total)
  75%=Thermal
  ⇒No.1 CO2 discharge country (7Gt)

- **Increase of Nuclear and Renewable Energy Policy**
  ⇒ Nuclear Plants : Under Construction 24 plants /27.4GW
  40GW by 2020

  ⇒ Renewable Energy: 10% in 2010, 15%by2020

China



De-regulation of Electric Power Business in Europe

- 1980s Monopoly ⇒De-regulation Trend :
  Finance, Telecommunication, and Airline
- 1990s Monopoly⇒ De-regulation in Electricity

- Britain:
  1990 Thatcher :
  Government Sector
  ⇒National Grid(Transmission)
  National Power +Power Gen(Thermal Power Generation)
  Nuclear Electric(Nuclear Power Generation)
  ⇒Generation: Complete Competition in 1990
  ⇒Pool Market of Electricity
  ⇒Retail Sector : gradually since 1990
  complete competition in 1999
- Norway: 1991

- EU: 1996

De-regulation of Electric Power Business in the USA

- **Wholesale of power generation : competition since 1992**
- **California and Pennsylvania : Pool Market in 1998**
- **The states considered: 50% of the states introduced competition**
- **around 1990**
  - **⇒more than 3000 electric power companies**
  - **⇒consistent type(generation to distribution)**
  - **⇒ generation only type**
  - **⇒distribution only type**
- **Convergence Now**

Un-bundling based 3types of Transmission Network

●3types

①Property Separation:
Generation and Retail sectors ⇒Capitally separated
【Britain, North Europe, Italy, Spain】

②Company Separation:
Generation and Retail sectors
⇒Companies separated under the holding company
【France, Germany, the USA(13 North-east states and Washington DC】

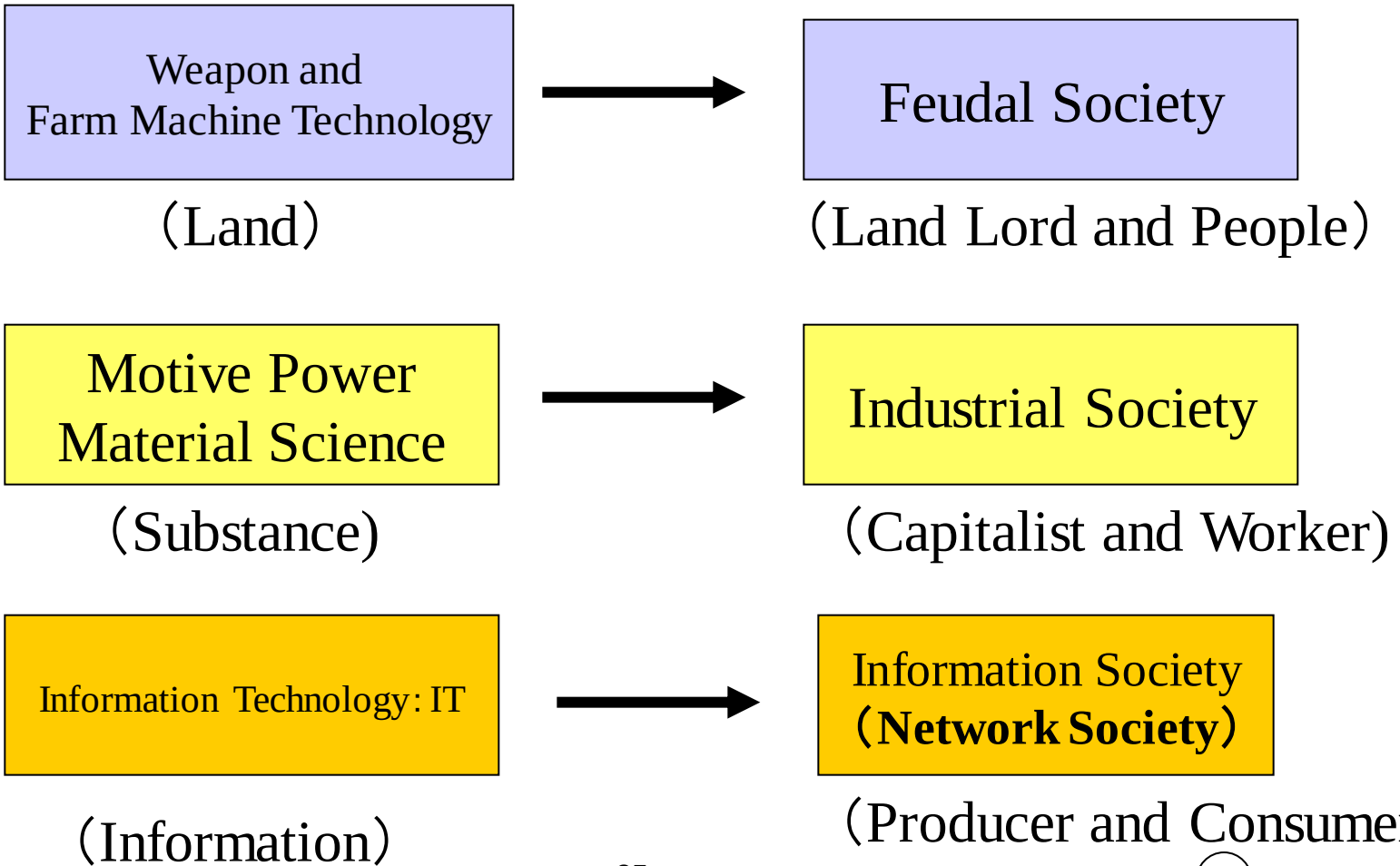
③Account/Function Separation(Behavior Regulation)
Consistent Generation and Retail sectors
【Japan, the USA(South-east states】

3 .Brief Review of Industrial Revolutions.

Role of Technology in the History of Social Development

Technology → **Creation of New Society** → **Society**

【Industrial Revolution】



What is the Principle of the Industrial Revolution ?

1st. Industrial Revolution

- 1780～1830: Britain: Spinning Machine(Waterpower)
- 1830～1880: Britain: Railroad (Steam Locomotive)

Principle: *Mechanics* ⇒Cotton Textile/Railroad industry

2nd. Industrial Revolution

- 19th Century: Germany Heavy Industry(Electric Machine, Steel)
- 1913～1970: America Manufacturing Revolution emerging from T-Type Ford(1913)
  ⇒Mass Production, Car Industry, Petroleum Oil

Principle:*Material Science*⇒Heavy Chemical Industry

3rd. Industrial Revolution

- 20th Century～: America Digital Information Revolution

Principle:*Mathematical Science* ⇒ Information Industry

The suburbs of Manchester

【Special Features】

- Rochdale ⇒many xx-dales
- Dale = Hollow
- There are streams.

Before Industrial revolution

*Gentleman= Landowner

*Farmer = Farm management leader

*Farm worker = Peasant

After Industrial revolution

*Gentleman ⇒ Factory owner

*Farmer ⇒ Factory-manager

*Peasant ⇒ Factory worker

* Stream ⇒ Water power

The suburbs of Manchester

- **Rochdale**
- **Cotton-mill ruins**
- **Farm field area**

Condition of Industrial revolution

【Shift of the division of labor system】

The cotton-mill ruins is now auto-repair shop!

An accident happened !

I lost my passport in such a exciting place after dark!

2nd Industrial Revolution

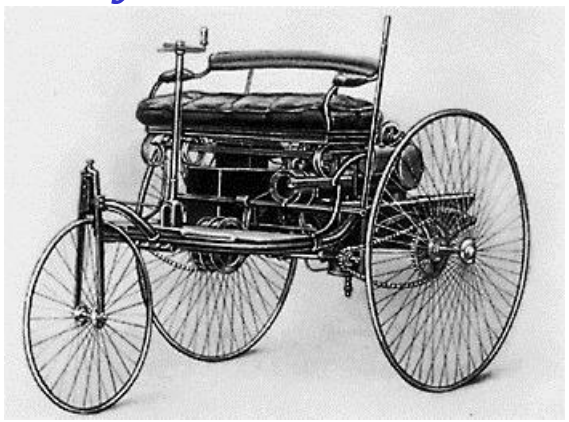
～Heavy Chemical Industry Revolution in Germany～

●*Era of German Empire : Representative of the Great Powers of Imperialism State, Expansion of the army*

⇒**Maintenance of warship in the coast of Baltic Sea compatible to England's navy.**

⇒**Ruhr Industry Area : Centralizing Krupp Inc. (steel plant and arms factory)** *Development of Military Industry*

●*1886 Gottlieb Daimler; 4 Wheeled Vehicle*
Karl Benz; 3 Wheeled Motorwagen



Benz; 3 Wheeled Motorwagen

●*Industrial Revolution in Germany*
＝Heavy Chemical Industry Revolution
＝Alfred Krupp

⇒**The crest of Krupp represents the seamless railway wheel. Developed to a military industry after the Germany unification.**

3rd Industrial Revolution ～Digital Information Revolution～

●What was the drive force of Digital Information Revolution？

Mathematical Science ！

⇒The harvest of Digital Information Revolution was not the direct “material production” or “transportation of some certain substance” but the “information” itself.

⇒MIT Media Laboratory Nicholas Negroponte described it by using the expression “atom to bits”

⇒the “process of information” and “convey of information” bear values

●Mathematical science is independent. It doesn’t rely on any phenomenon or other field of study.

-Narrow meaning-mathematics and applied mathematics

-Broad meaning-any study using mathematics in general

ex. economics

Inventor and Non-Inventor of the Computer

【Inventor】 **Individual thought of computers ！**

Bill Gates

Steven Jobes

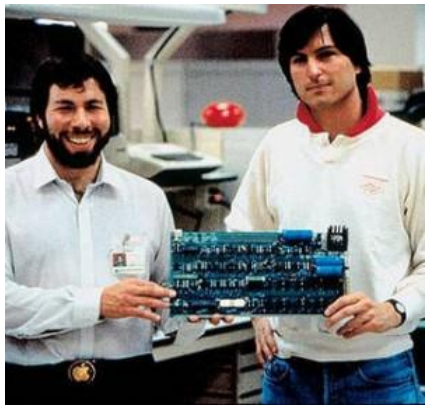
Stephen Wozniak

Alan Kay

Gary Kildall

Mitchell Kapor

Gordon Moore



1st Hit Personal Computer

Apple-Ⅱ

“Entrepreneurs” and “Engineers” leads the future!

【Non-Inventor】

Main Frame・Computer・Vender

IBM HITACHI Inspire the Next FUJITSU

Leading Companies didn’t think of computers ！

Inventor and Non-Inventor of the Internet

Individual thought of Networks！

【Inventor】

Paul Baran

Vinton Cerf/Bob Kahn

Jun Murai

Timothy John Berners-Lee

Marc Andreessen

Jerry Yang

Sergey Brin/Larry Page

“Entrepreneurs” and
“Engineers” leads the future!

Larry Page 40years

Google

【Non-Inventor】

Communication

Carriers

at&t BT NTTグループ

Leading Companies didn’t think of Networks！

Leading figures of Digital Information Revolution

Bill Gates

Steve Jobs

Stephen Gary Wozniak

4. Today is the era of the 4th. Industrial Revolution!

IT is moving fast towards 2020 !

①Rapid Growth in the emerging countries

②Rapid Evolution of Mobile Communication

③Expansion of the Social Media

④Evolution of Smart Infrastructure

4 Trends :
"Emerging Countiries • Mobile • Social • Smart"

What is the meaning of “Smart”?

“Smart” means “Fusion with the Internet”

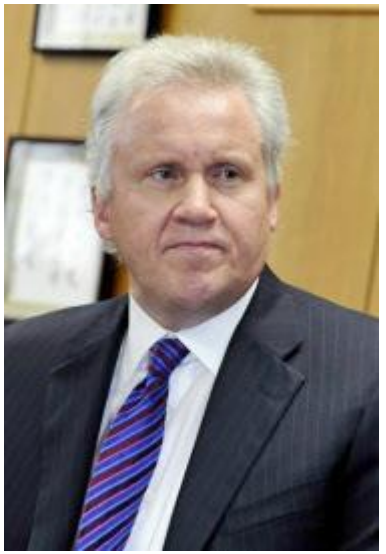
“Smart Grid ” means
“Fusion between Energy with the Internet”

“Smart Phone ” means
“Fusion between Cellular Phone with the Internet”

“Smart TV ” means
“Fusion between Television with the Internet”

Jeffrey Robert "Jeff" Immelt (President, CEO GE): *Financial Times Interview on July30,2012*

After “Fukushima” ,the cost of nuclear power plants must increase. Therefore many countries should shift to shale gas and wind power plants , etc..
This comment is similar to Peter Loescher`s talk(President,CEO Siemens AG) in Sept.2011.



“Smart CEO”

Mr. Immelt emphasized the following 3 points.

1. Shale gas revolution in the U.S.A
   ⇒Especially the cost of natural gas has been cheap , ten years since then , because of shale gas revolution .

2. Melt-down in “Fukushima”
   ⇒The nuclear power plant industry faces additional cost-up after “Fukushima” and uncertainty.

3. Cost-down of Renewable Energy
   ⇒The cost of solar panels has decreased 75% for the past 3 years.

Moore's Law and Mori's Law. What does information society bring?

Data center as the emission of enormous heat !

Mori's Law

Information Communication Industry

Broad Band Graphic increases exponentially by the number of subscriber

Moore's Law

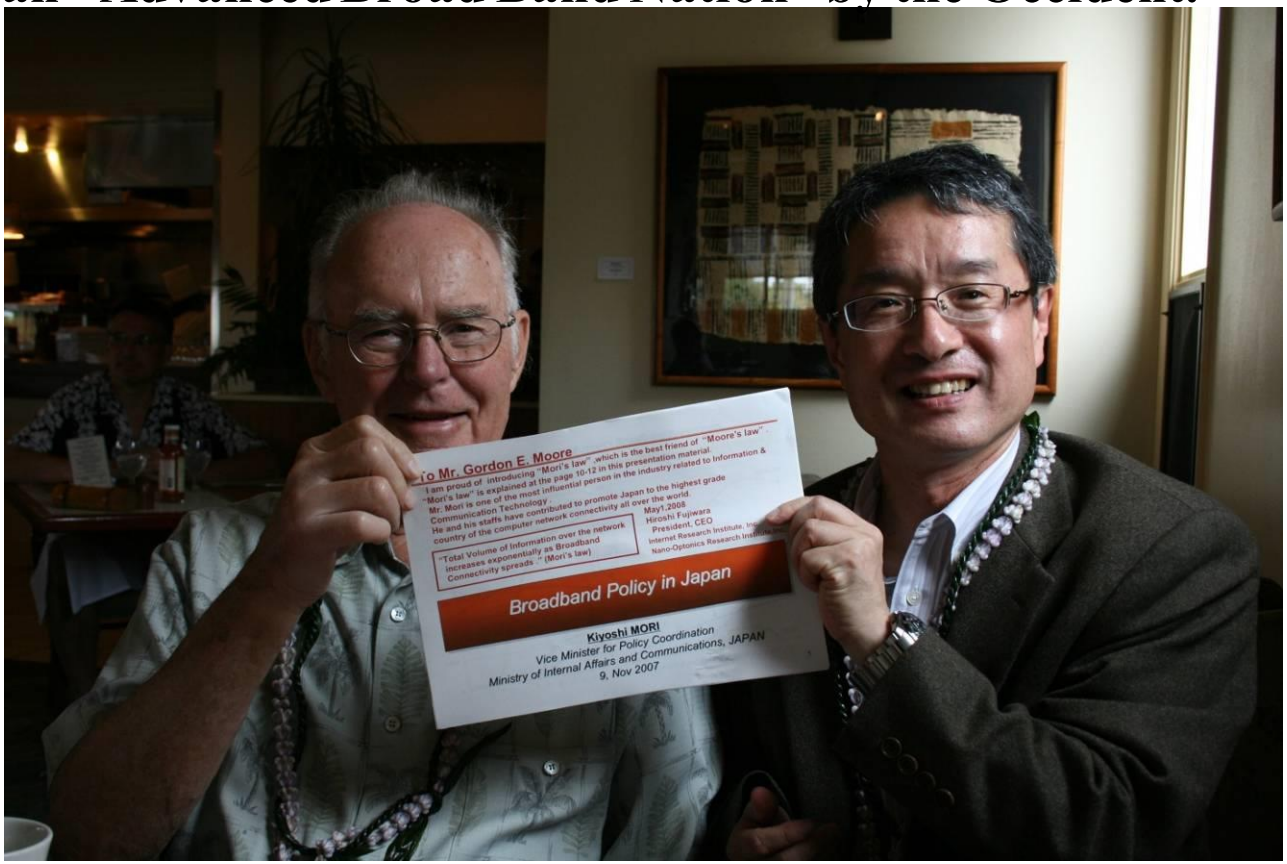
Computer Industry

Computer performance doubles in a year and a half
Integration・Speed-Up・Power Consumption
（Si Semi-Conductor）

1200
1000
800
600
400
200
0
1995
2000
2005
2010

Dr. Gordon.E.Moore, Impresssed in Mori's Law

Mori's Law became into limelight in 2007/10 when vice minister of Ministry of Internal Affairs and Communications, Kiyoshi Mori, visited North America and introduced the present status of broad band traffic in Japan. Japan was once again admitted as an "Advanced Broad Band Nation" by the Occident.

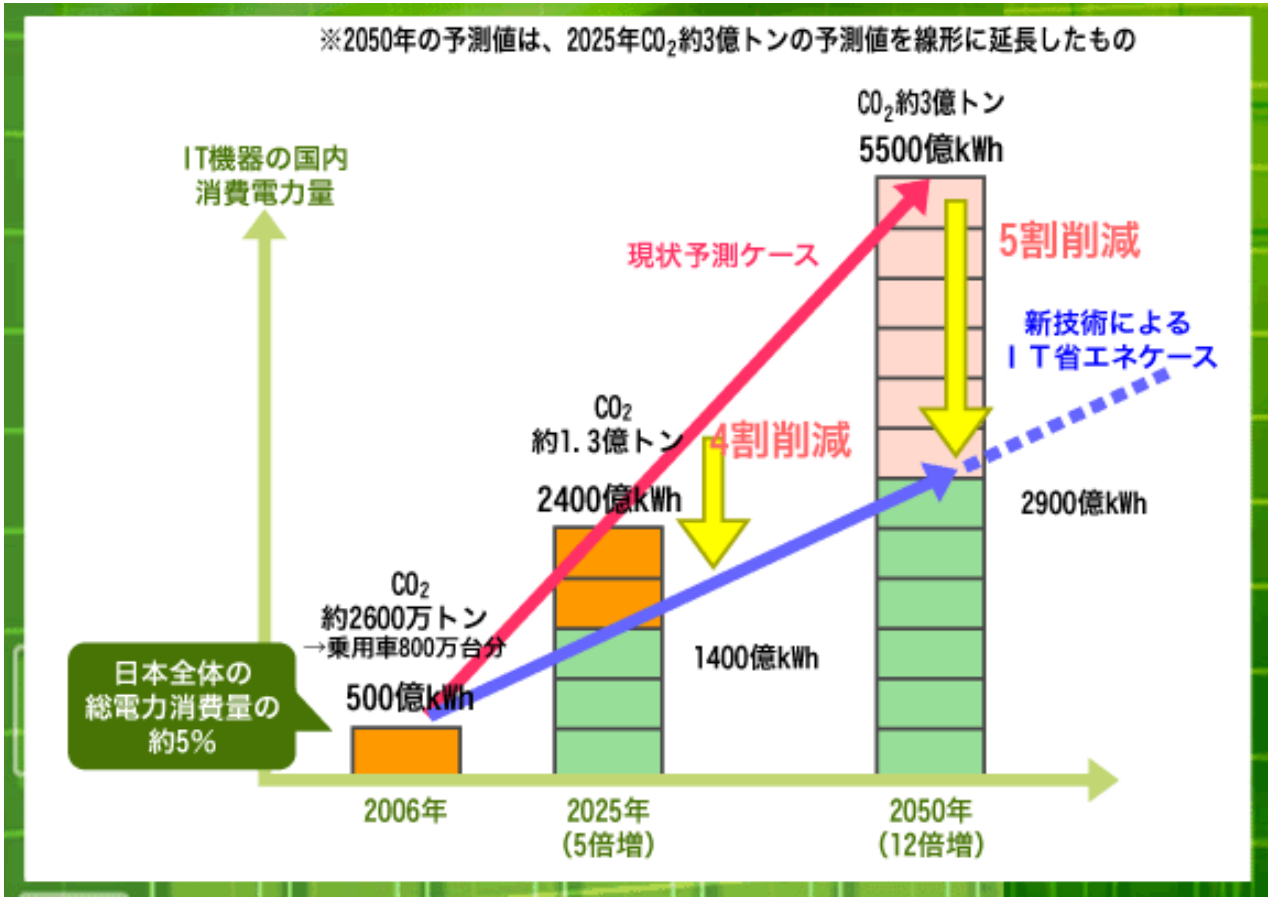


2008/5/1 Hawaii Island Keck Astronomy Observatory

Ministry of Economy, Trade and Industry Green IT Project

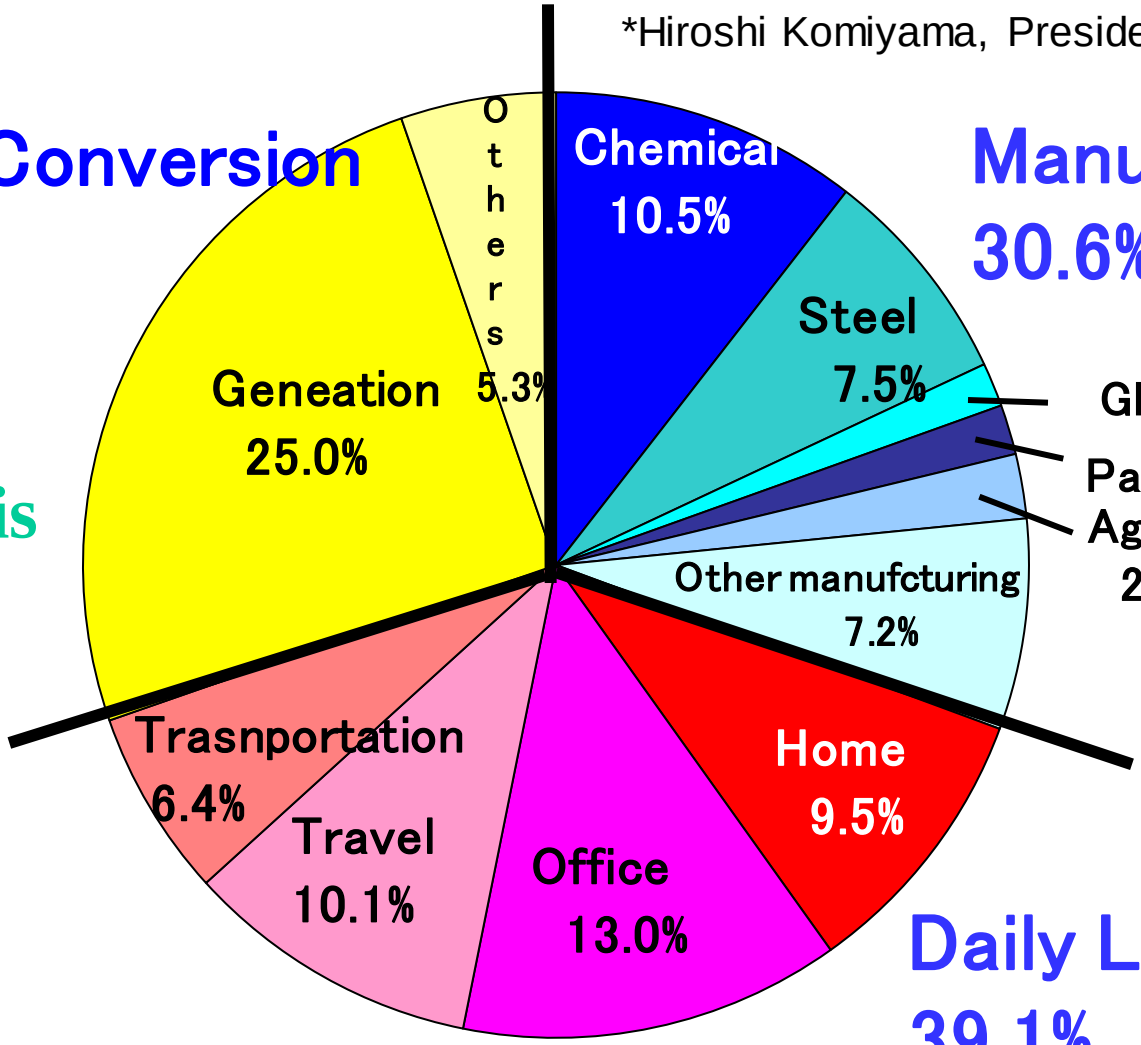
Present: IT Equipment 5 %（Total Power Consumption) ⇒50%
（2050）

Digital Information Revolution counts for Environmental Energy Concerns



View Points from Energy Consumption in Japan

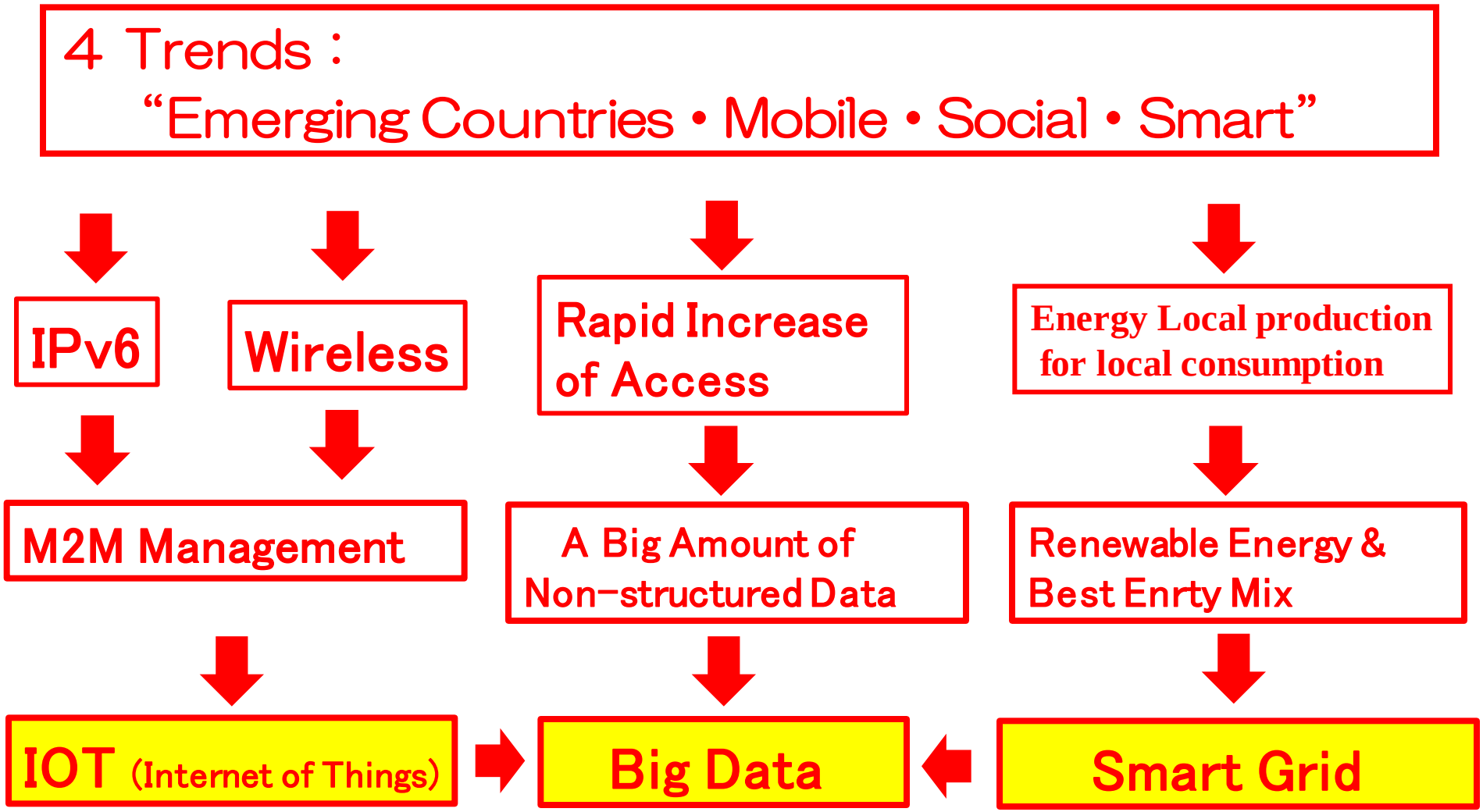
*Hiroshi Komiyama, President of Univ.Tokyo



General Energy Statistics 2007 in Japan

5. Big Data Impact on 4th.Industrial Revolution
- For creation of the best mix energy industry -

Essence of 4 IT Trends towards 2020



M2M/Social/Smart generate a big amount of non-structured data!

Big Data

International Traffic

2011=2 Zetta Bytes (10^{21})

⇒

2016=8 Zetta Bytes : IDC View

Rise of “Big Data”

●2010/10 Johan Bohlen(Associate Professor, Indiana University)predicted the stock price with 86.7% of precision, analyzing10billion active Twitter users.

⇒2008/2～2008/12 Analyzing extracted expressin for feelings out of 9.8M Twitters of 2.7M users

⇒ Focusing on Standard indicating feelings of the peace is close to movement of the Dow Jones industry stock prices average 3-4 days later, he implemented it in machine learning algorithm

⇒ Hedge fund predicting the stock price based on movement of social media

● Twitter Analysis becomes popular, for example, Box office of the movie, Voting behavior in the election, etc.

● “Big Data” to find out hidden “Meaningful information” from Very large-capacity of data , that have been difficult to handle.

●2011/10 Gartner Group listed “Big Data” in the top 10 most influential strategic technologies.

●2011/8 HP acquired Autonomy Inc., the enterprise searching technology company at the price of 10.3B$.

●2011/10 Oracle acquired Endeca, Inc., the business intelligence software company, at the price of 750M$.

3 major elements of “Big Data”

●1st. Element is rapid increase of data.
International Traffic 2011=2 Zetta Bytes (10^{21})
⇒ 2016=8 Zetta Bytes : IDC View

⇒Data Volume of each enterprise is also increasing!
- Data Volume of Google: 1Peta Bytes/h
- eBAY’s data warehouse : 84 Peta Bytes

●2nd.element is non-structured data

⇒non-structured data ratio is more than 90% : IDC View
⇒Blog images ,etc. are non-storable data as ordinary database

●3rd.element is increase of Computing Power
⇒Fast processing becomes possible, compared with the ordinaryprocessing.

◎Fast Processing of non-structured data is completely different between “Big data” and the ordinary data mining.

Core Technologies of "Big Data"

(1) Evolution of the Storage Technology

⇒Storage Cost of all Digital Music data over the world=600$: McKinsey

⇒ Storage Cost of 1 GB : 19$ (2005) →0.7 $ (2015): 1/30! For 10

(2) Evolution of Analysis Technologies

⇒Distributed Parallel Processing

⇒Rise of Large Distributed Processing, such as MapReduce, Hadoop, etc.

*Hadoop is the open source software which is used by Amazon, Facebook, etc.

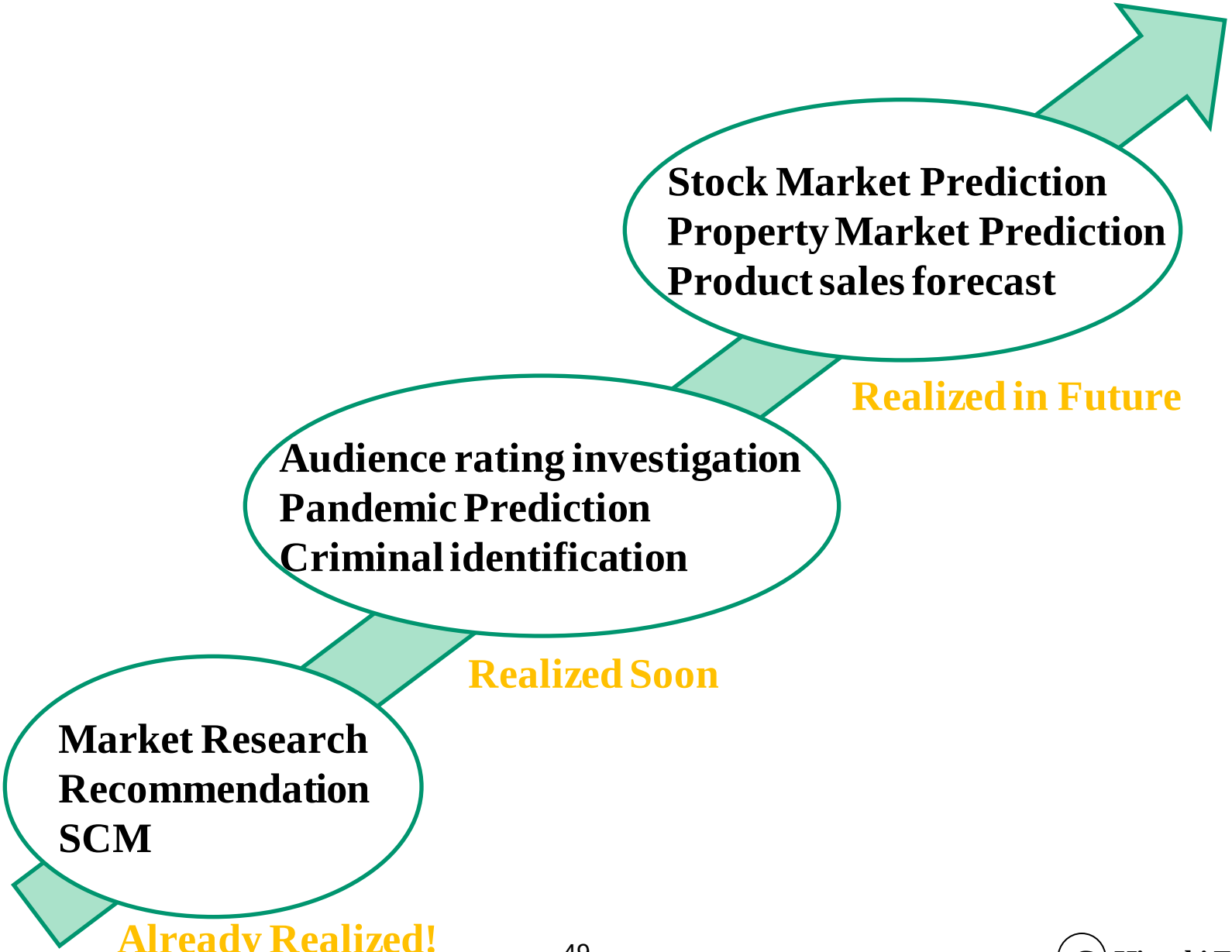
- Hbase(Distributed Database),GFS (Google File System, Distributed File System)
- The open source Programming language for statistical analyses, "R"

(3) Cloud Computing as the root of the big data handling

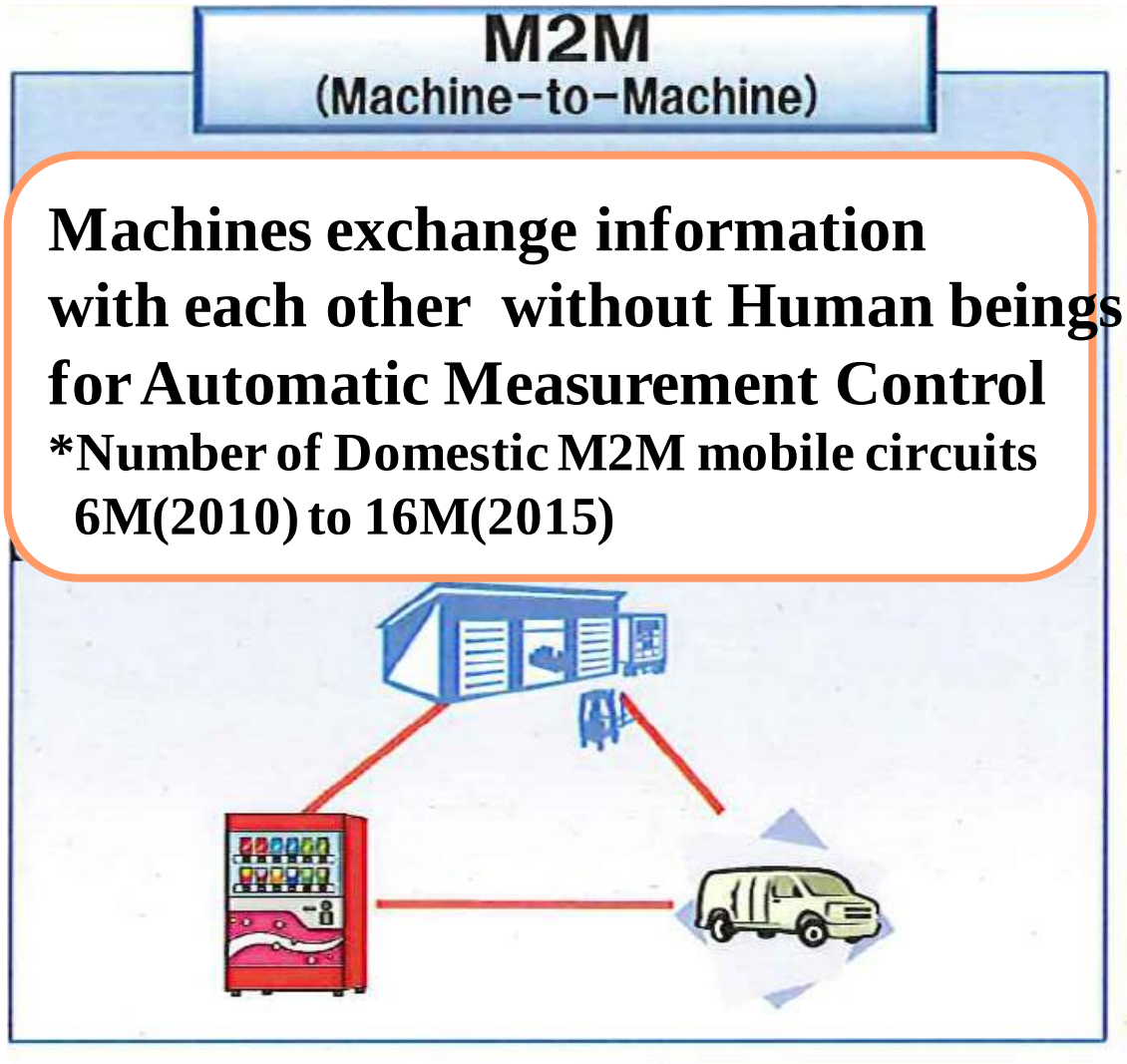
- New York Times utilizes Amazon's Cloud Service, EC2, for PDF images of the 400,000 archives files from 1851 to 1922.

⇒It took only 24 hours to rent the computing resource equivalent to 100 virtual machines.

Big Data realizes various kinds of applications!



M2M is one of the hottest topics of IT industry



Why M2M Network now?

(1) Energy Problems depriving from "Fukushima" bring necessity of Automatic Measurement Control about the operation situation, connecting all of the machines in order to realize Smart Grid, Smart Community, Smart!

(2) The Machine Oriented Communication has just started instead of the human being oriented communication, resulting in changing the history of telecommunications because of rapid evolution of wireless communication technologies!

⇒Rise of the Smart Phones accelerates changing the wireless infrastructure into IP-Network!

(3) Individual network specifications of Individual Machines are going towards convergence with IP-Network!

⇒ Sales information, Energy consumption information, etc.

Examples of M2M Cloud Applications appearing one after another

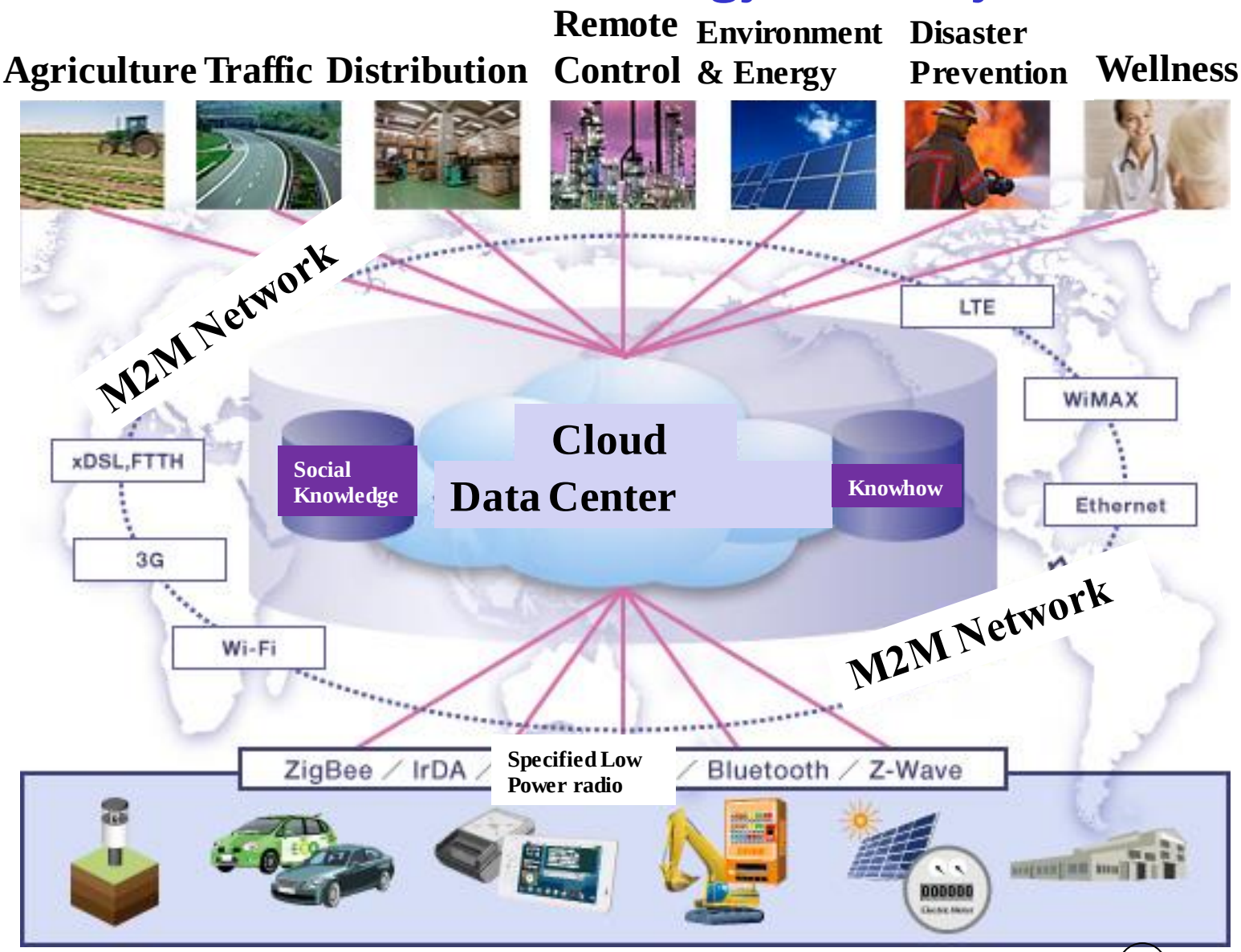
(1) Electricity consumption grasp of the manufacturing industry
⇒NEC and Mitsubishi Electric provide “IFS Applications”
⇒NS Sol., OMRON, and Oracle Japan provide
Electricity peak reduction solution, integrating PLC and ERP.

(2) EV Quick-charger Stand Management Service
⇒“Smart Oasis” of Unisys Japan,Inc.
⇒ Total Management of EV Quick-charger s set along
the Tomei Expressway
⇒ Authentication and Settlement by IC Card
⇒ EV Quick-charger Space Stand information for Cellular Phones

(3) Management & Control of the water-related facilities
⇒MetaWater,Inc.(NGK Insulators,Ltd., Fuji Electric)
⇒GSA(Gadget service adapter) Connect Data Acquisition and Water-related facilities
⇒Repair the obsolete water environment facilities

(4)「物聯網」Test bed of Smart City & Smart Grid
⇒ NEC Participated in it with RFID.

Big Data Impact on 4th. Industrial Revolution
- the best mix energy industry-



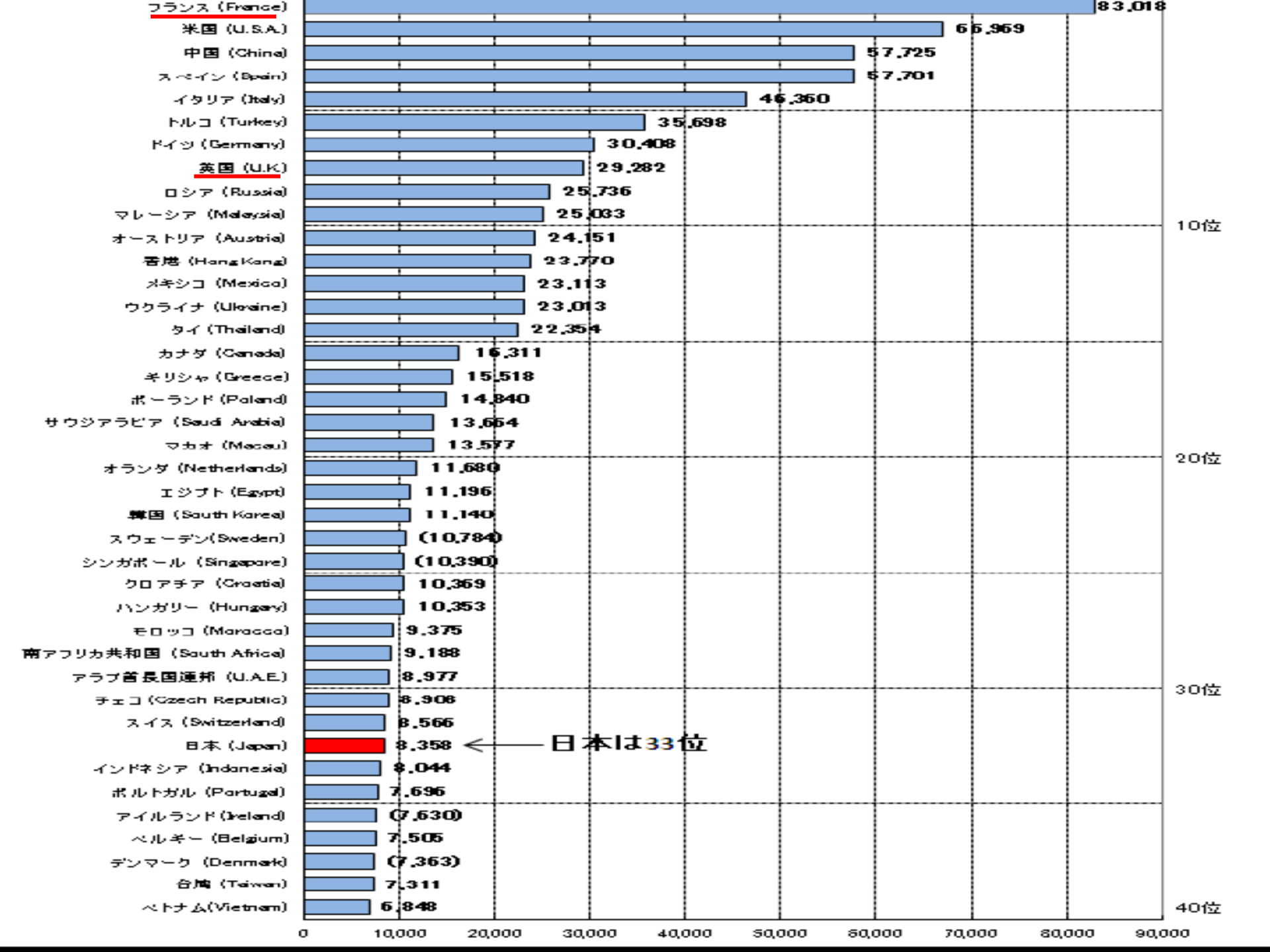
What was result of the accident in Manchester?

-Where is My Passport?-

The UK controlled my accident!

The memo written by the owner of the auto-repair shop was attached at the closed gate!

Japan has to control “Fukushima” for the foreign tourists, as the UK controlled my passport accident.


フランス (France) 83,018
米国 (U.S.A.) 65,969
中国 (China) 57,725
スペイン (Spain) 57,701
イタリア (Italy) 46,360
トルコ (Turkey) 35,698
ドイツ (Germany) 30,408
英国 (U.K.) 29,282
ロシア (Russia) 25,736
マレーシア (Malaysia) 25,033
オーストリア (Austria) 24,151
香港 (HongKong) 23,770
メキシコ (Mexico) 23,113
ウクライナ (Ukraine) 23,013
タイ (Thailand) 22,354
カナダ (Canada) 16,311
ギリシャ (Greece) 15,518
ポーランド (Poland) 14,840
サウジアラビア (Saudi Arabia) 13,654
マカオ (Macau) 13,577
オランダ (Netherlands) 11,680
エジプト (Egypt) 11,196
韓国 (South Korea) 11,140
スウェーデン(Sweden) 10,784
シンガポール (Singapore) 10,390
クロアチア (Croatia) 10,369
ハンガリー (Hungary) 10,353
モロッコ (Morocco) 9,375
南アフリカ共和国 (South Africa) 9,188
アラブ首長国連邦 (U.A.E.) 8,977
チェコ (Czech Republic) 8,908
スイス (Switzerland) 8,566
日本 (Japan) 8,358
インドネシア (Indonesia) 8,044
ポルトガル (Portugal) 7,696
アイルランド (Ireland) 7,630
ベルギー (Belgium) 7,505
デンマーク (Denmark) 7,363
台湾 (Taiwan) 7,311
ベトナム(Vietnam) 6,848
日本は33位
10位
20位
30位
40位
0
10,000
20,000
30,000
40,000
50,000
60,000
70,000
80,000
90,000

Economic Effect of Tourism

X 2 =

X 3

France exports 55M cars every year!

Tourism consists of both clean energy and environment!

Paradigm Shift of the Energy Industry(Japan)

Fukushima 2011 → ①Promotion of Renewable Energy
②Increase of Alternative Energy
③Centralized Energy(Thermal:92%)
④Energy Market = 160B$

Big Data Science → Energy & Resource Management

Liberalization of Telecommunications Businesses(1985)

Liberalization of Energy Businesses (2016-2018)

Centralized Energy 2020 → Distributed Energy(30%)
Energy market=200B$

+ Economical Impact of Tourism= 600B$!

Condition of Industrial revolutions
(Why? Where? How?)

1. Driving Force Science:

⇒ Mechanics/Material Science/Mathematical Science/Big Data

2. Geographical condition

3. Social System

⇒Manchester, Rhine River , Silicon valley

History & Future Industrial Revolutions

1st.Industrial Revolution Principle:"*Mechanics*"

⇒Motive Power → "*Britain*" Spinning /Transportation

→ "Energy = Coal + Water Power"

2nd.Industrial Revolution Principle:"*Material Science*"

⇒Heavy & Chemical Industry →"Germany" Steel/Automobile

→"Energy = Oil"

3rd.Industrial Revolution Principle:"*Mathematical Science*"

⇒Digital Information→"USA"/Computer/Semiconductor/Network

→"Energy = Nuclear/Natural Gas"

4th.Industrial Revolution Principle: "Big Data Science"

⇒Energy & Environment→ "Asia" / Energy & Resource Management

→"Energy = Best Mix Energy + Tourism"

Thank you very much for your attention!

The 4th. Industrial Revolution
Written by H.Fujiwara
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