

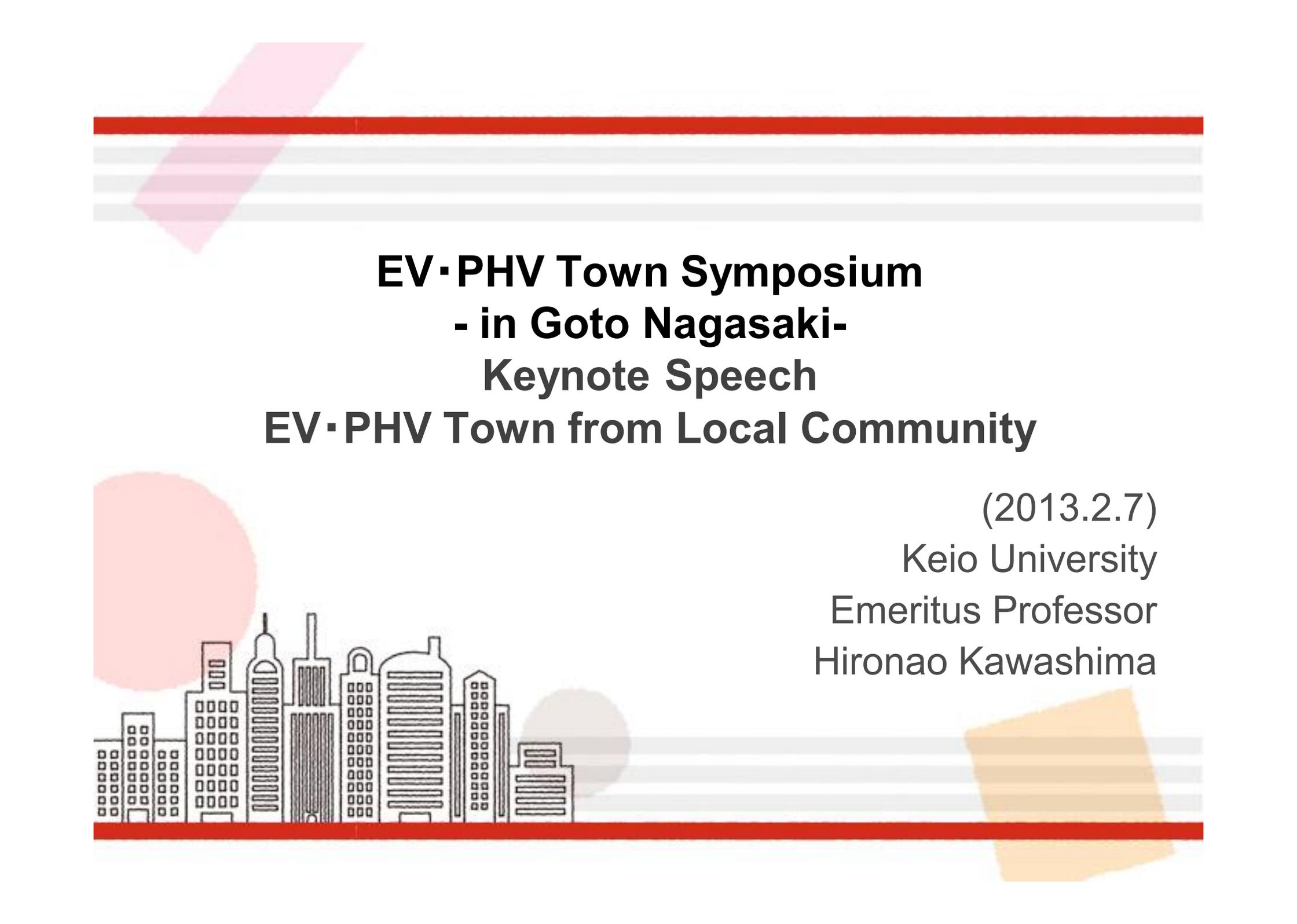
**EV·PHV Town Symposium  
- in Goto Nagasaki -  
Keynote Speech  
EV·PHV Town from Local Community**

(2013.2.7)

Keio University

Emeritus Professor

Hironao Kawashima



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1. Introduction
  2. Background of the Introduction of EV·PHV
  3. Agenda21
  4. Assessment from Auto-mobile Industry
  5.  $\mu$ -Mobility Vehicle
  6. Recent Technical Developments
  7. Socio Economic impact of 3.11
  8. Issues emerged after 3.11
  9. Roles of Local Community
  10. Roles of Central Government



# 1. Introduction

More than 5 years has passed since the EV/PHV deployment projects started

In this keynote speech several challenges are pointed out based on;

Recent developments of related technologies

Recent diversifications in socio-economical situation  
(Especially the occurrence of Great East Japan Earth Quake)



## 2. Background of the Introduction of EV-PHV

### a. Environmental Measures of Automobiles (1970~1990)

- ◆ Reduction of Pollution (fuel-efficiency was not the main concern)
  - Introduction of E was not discussed
  - Recently, the exhaust gas of new cars is cleaner than the intake air to the engine
- ◆ Environmental agencies were established in most of the countries in 1970s

### b. Emergence of the concept called Sustainable Development (1970~)

#### 1. Club of Rome "Limits to Growth"(1972)

Computer simulation was introduced

#### 2. Brundtland Commission Report "Our Common Future"(1987)

The concept of sustainability has been established

#### 3. "Earth Summit" in Rio de Janeiro (1992)

Organized by UNCED. The discussion was based on the report from IPCC

## The assertion of IPCC (International Panel on Climate Change)

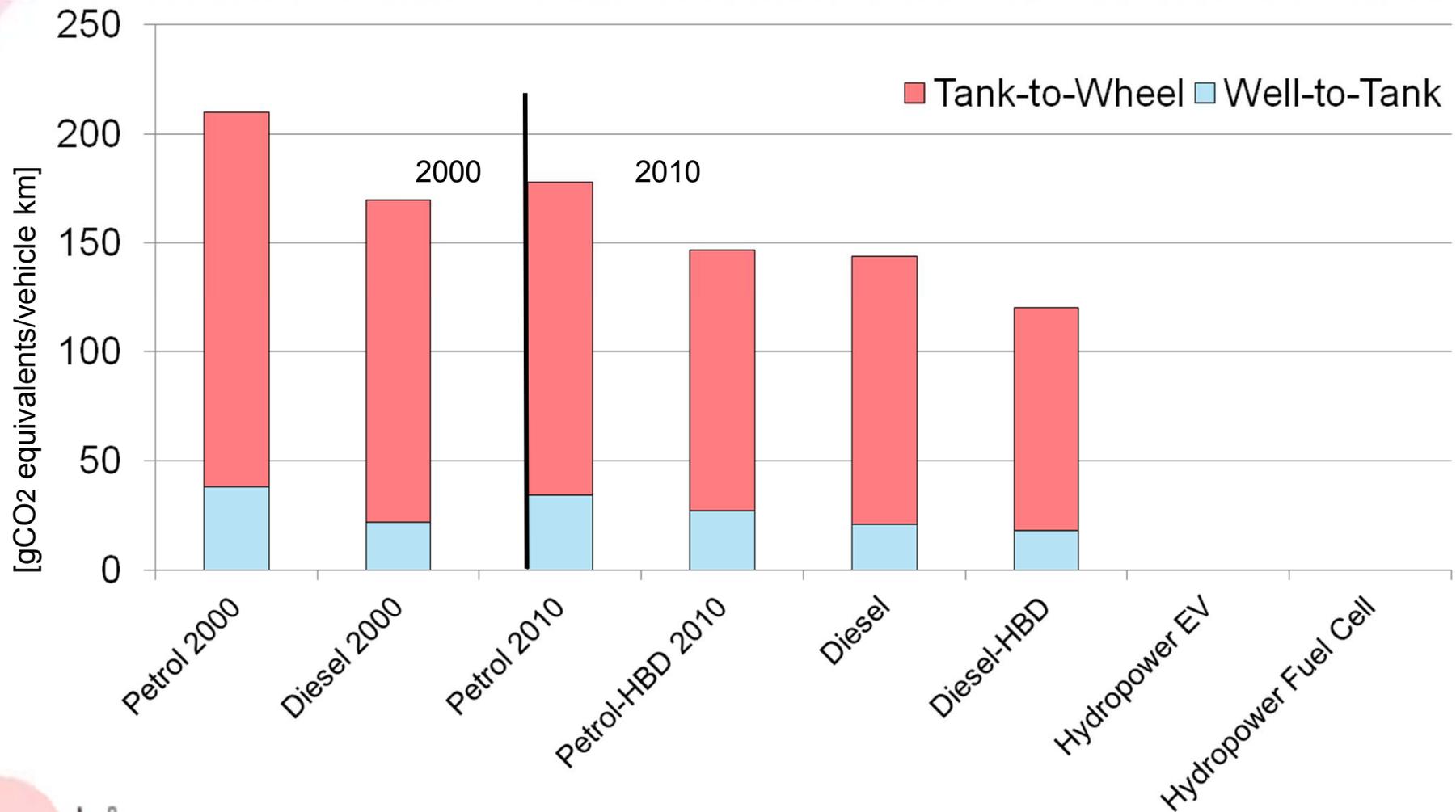
IPCC was founded in 1988 and the assertion of IPCC was adopted in the report of UNCED (United Nations Conference on Environment and Development) in the following form;

“To stabilize the Greenhouse gas concentration at the level which dangerous anthropogenic impact will not occur to the climate system”

Emission of Greenhouse gas is the consequence of human activity i.e. burning coal, petroleum, natural gas and lumber forests.



# CO<sub>2</sub> Emission of Automobile Engine

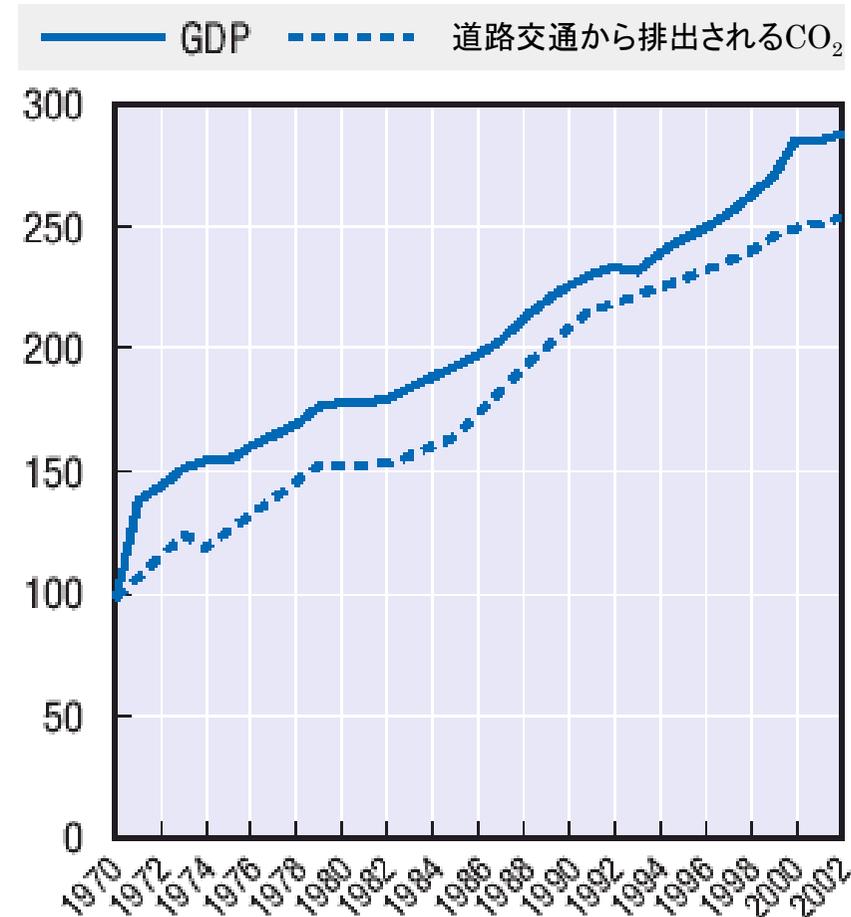
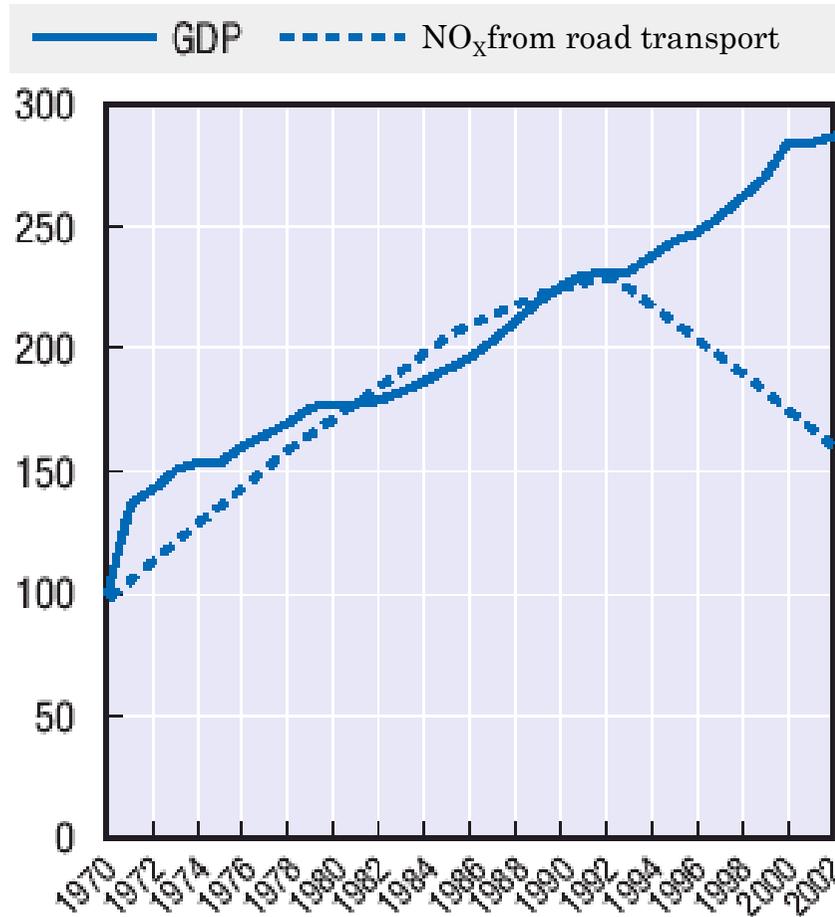


乗用車に関する従来技術と2010年頃の代替技術のエネルギー・チェーン比較: CO<sub>2</sub> 等価換算  
 (都市内・郊外を含む標準走行パターンを想定, エネルギー・チェーンはWell-to-wheelを想定)

出典 Holden, E. "Achieving Sustainable Mobility", 2007

# Decoupling the Environmental Impacts of Transport from Economic Growth

## CO<sub>2</sub> and NO<sub>x</sub> emission from road transport and GDP growth in the EU



出典: OECD (2006)

### 3. Agenda21

153 countries signed the UN Framework Convention on Climate Change and Agenda21 was issued.

Agenda 21 is a guideline for the activities in national and international levels to attain sustainable development.

Whilst national and supra-national governments clearly have a central role in the pursuit of sustainable development, it is equally clear that local government plays a crucial part. (LocalAgenda21, Chapter 28 of Agenda21)

# The paradigm of sustainable development

- The definition of sustainable development is vague and typical examples and comment are;
  - Development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations.  
(Brundtland Commission Report, 1987)
  - Development that improves the quality of human life while living within the carrying capacity of supporting ecosystems  
(International Union for the Conservation of Nature, 1991)
  - All in all, climate change must be regarded as market failure on the greatest the world has seen.  
(The Stern Review: The Economics of Climate Change, 2007)

# Local Agenda21

Because so many of the problems and solutions being addressed by Agenda21 have their roots in local activities, the participation and co-operation of local authorities will be a determining factor in fulfilling its objectives. Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and sub-national environmental policies. As the level of governance closest to people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development

To think globally, act locally

- **Definition of Sustainable Development by the local government** (Bell, S. & Morse, S. “Sustainable Indicators”, Earthscan, 2008, p. 79)
  - Sustainability may be defined as a dynamic balance among three mutually interdependent elements;
    1. Protection and enhancement of natural ecosystems and resources
    2. Economic productivity
    3. Provision of social infrastructure such as jobs, housing, education, medical care and cultural opportunities
- **But, does it require the paradigm of sustainability as an umbrella? Politicians have been promising these long before sustainability became such a dominant paradigm.**

# Kyoto Protocol

International role based on the framework convention concerning the reduction of greenhouse gases established in 1997. Japan signed to reduce 6% from the 1990 level from 2008 to 2012.

Common but different responsibilities among developed and developing countries.

One of the resolution of UN Conference on Sustainable Development (Rio+20, June 2012) states that “The measures conducted by nations to enhance the social welfare is a sustainable development”.

New framework convention after 2020 is under-discussion from 2013 to 2020.

## 4. Assessment from Auto-mobile Industry

- **WBCSD** (World Business Council of Sustainable Development) is a coalition of 170 international companies from more than 35 countries and 30 major industrial sectors, united by a shared commitment to sustainable development via the three pillars of economic growth, ecological balance and social progress.
- Published in 2004, the final report of the Sustainable Mobility Project titled “Mobility 2030; Meeting the challenges to sustainability”.
- Most of the discussion is about to promote land use and public transport to reduce the opportunities to use cars and the penetration of EV is not discussed.

After the Kyoto Protocol, hybrid car and EV received high expectations from the society and the penetration of hybrid car and EV began from 1998 and 2009, respectively.

# Sustainable Mobility Projectのメンバー

 **General Motors**



General Motors Corporation  
Mr. Thomas A. Gottschalk  
Executive Vice President, Law &  
Public Policy and General Counsel  
Project Co-Chair

**TOYOTA**



Toyota Motor Corporation  
Dr. Shoichiro Toyoda  
Honorary Chairman, Member of the Board  
Project Co-Chair

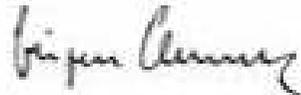



Royal Dutch/Shell Group of Companies  
Mr. Jeroen Van der Veer  
Chairman of the Committee of Managing Directors  
Project Co-Chair




BP p.l.c.  
Lord Browne of Madingley  
Group Chief Executive

**DAIMLERCHRYSLER**



DaimlerChrysler AG  
Prof. Jürgen E. Schremp  
Vorstandsvorsitzender




Ford Motor Company  
Mr. William Clay Ford, Jr.  
Chairman and  
Chief Executive Officer

**HONDA**



Honda Motor Co., Ltd.  
Mr. Takeo Fukui  
President and  
Chief Executive Officer




Michelin  
Mr. Edouard Michelin  
Managing Partner

**NISSAN**



Nissan Motor Co., Ltd.  
Mr. Carlos Ghosn  
President and  
Chief Executive Officer




Norsk Hydro ASA  
Mr. Eivind Røttum  
President and  
Chief Executive Officer




Renault SA  
Mr. Louis Schweitzer  
Chairman and  
Chief Executive Officer

**VOLKSWAGEN AG**



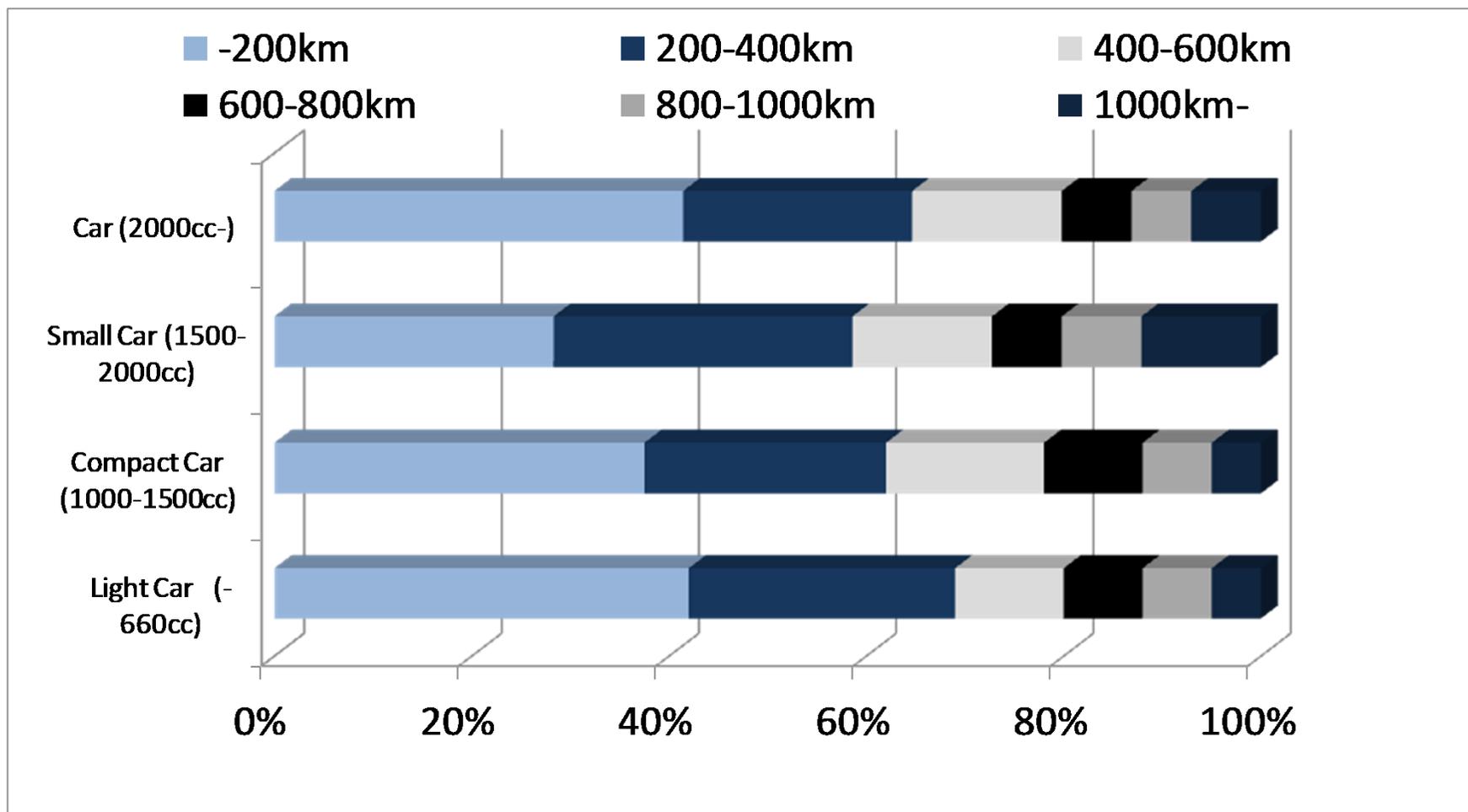
Volkswagen AG  
Dr. Bernd Pischetsrieder  
Vorsitzender des Vorstands

## 5. $\mu$ -Mobility Vehicle

In 2009, the project called “Governors coalition on the development of the vehicle friendly to elder generation” started with the governors of 35 local governments. The proposed concept is the following

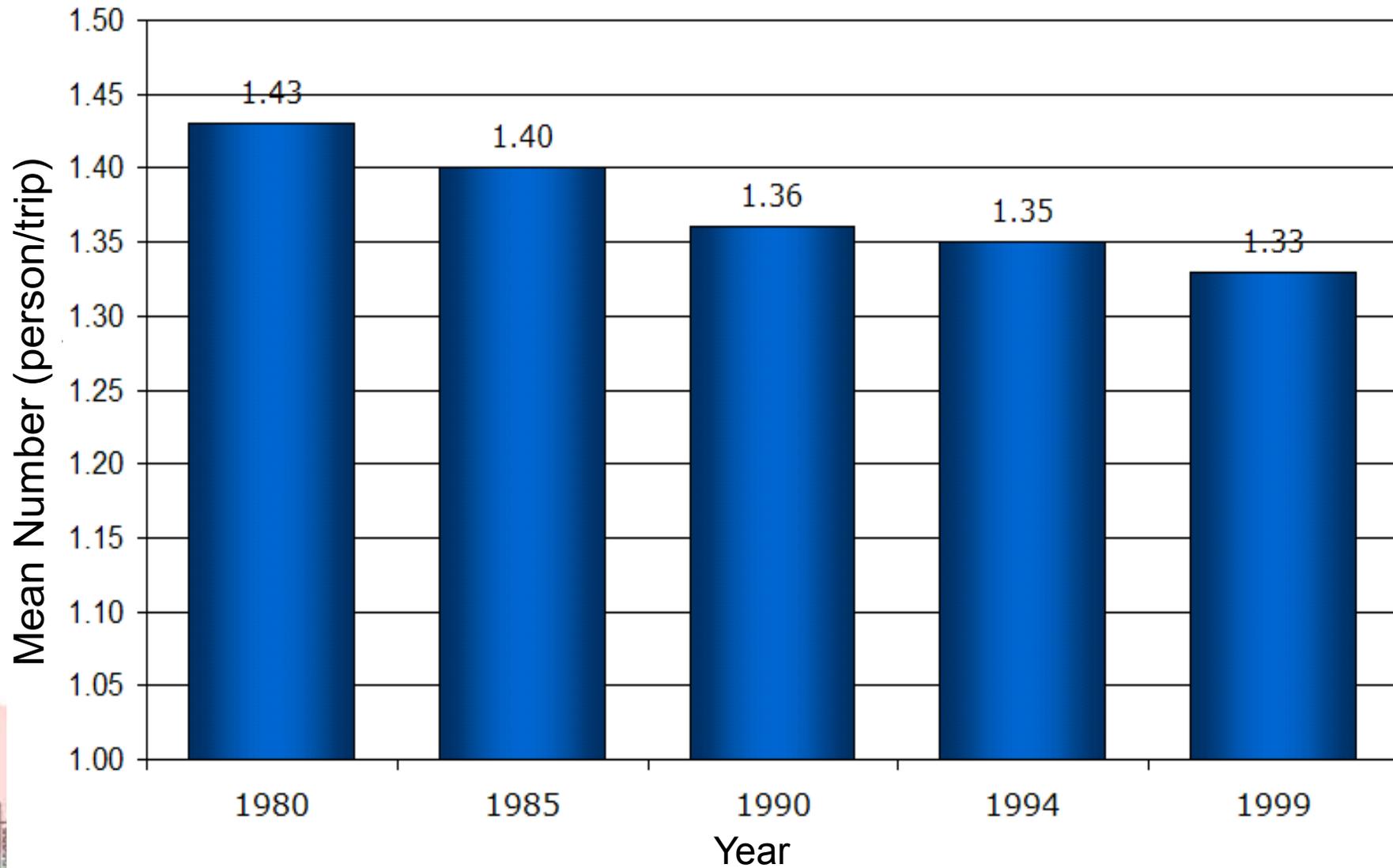
1. Vehicle with the limited speed  
(40Km/h-60Km/h, not allowed to use expressways)
2. Vehicle for two people
3. Installation of driving assist system for securing safety

# Distribution of travel distances per month



WEBを利用したアンケート調査 N=1008, 2007年実施

# Number of people traveled by a vehicle

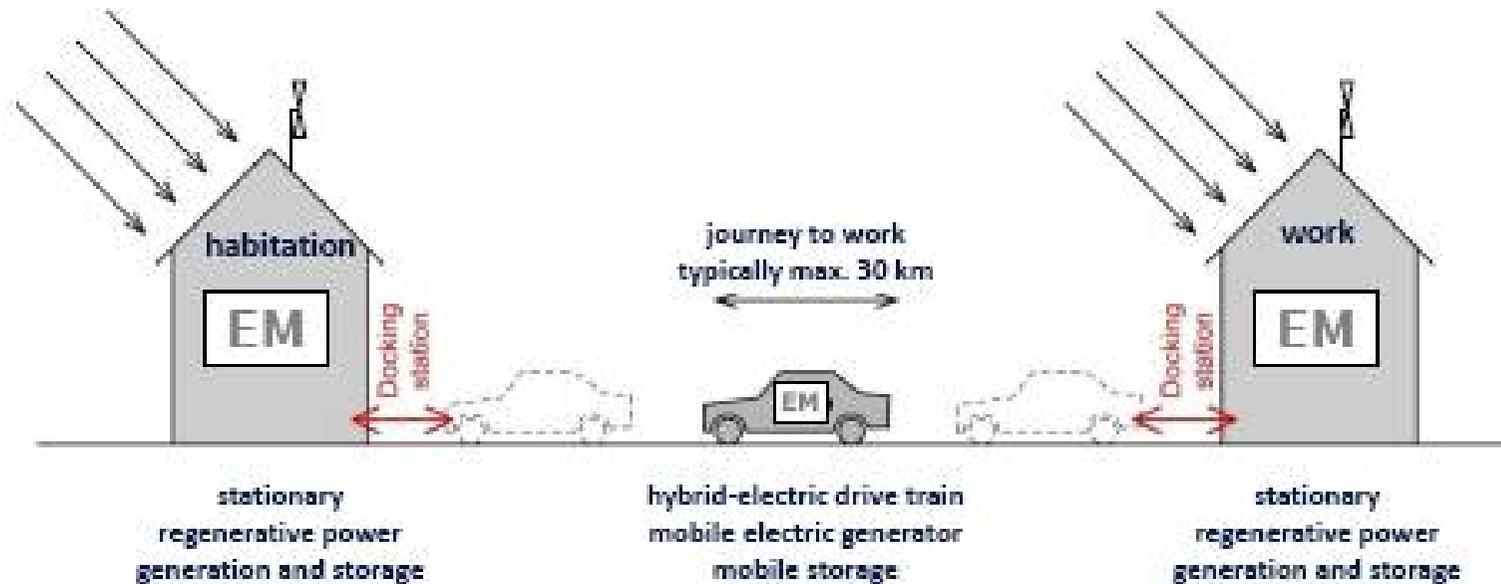


## 6. Recent Technical Developments

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- A) Efficient use of electricity –Smartgrid  
EV, PHV are the elements of HEMS, CEMS
  
- B) Penetration of fuel efficient internal combustion engines  
Diesel hybrid cars are welcomed by cost sensitive users
  
- C) Utilization of the new excavation technology of the non conventional gases  
Energy revolution by the shale gas

# A.1 Example in German



Common Project of:  
**EA EnergieArchitektur GmbH (Fr. Dr. Mikoleit)**  
**Institute of Automotive Technologies Dresden - IAD**  
**TU Dresden (Prof. Bäker)**  
Funded by European Union, Sächsische Aufbaubank and private Investors

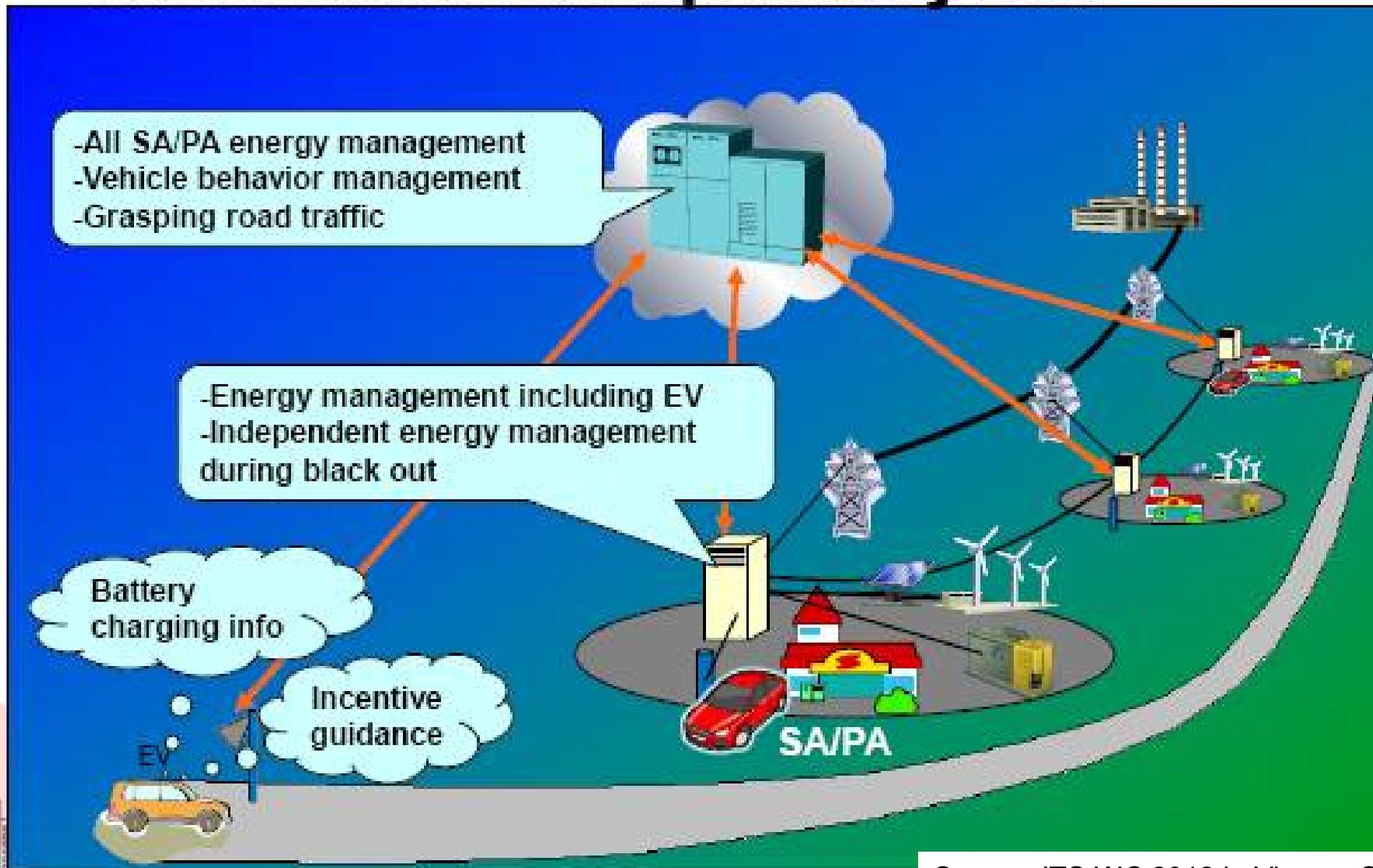


\*EM: Energy Management

Source: ITS WC 2012 in Vienna, SIS27

## A.2 Example in Japan

### Toshiba's Idea of Expressway EMS



# A.3 Example in Finland

## ElectricTraffic.fi

Finnish platform for introducing new sustainable traffic systems and smart grid services brings together “everything smart”



**electric traffic.fi**  
 coolest experiment on the planet



Source: ITS WC 2012 in Vienna, SIS32



**Tekes** • WORLD DESIGN CAPITAL HELSINKI 2012

## ElectricTraffic.fi

Finnish platform for introducing new sustainable traffic systems and smart grid services

### User-centricity

- The infrastructure as well as services are developed with special emphasis on user centric design

### Open information & interfaces

- All IT platforms enable sharing of information and providing the channel for traffic related software and application development

### Multi-entity ecosystem model

- The project enables a multi-entity ecosystem based structure and business model
- Over 20 companies, 5 cities and several research partners involved

### Intelligent electricity system

- Low CO2 electric generation, using hydro and sustainable energy as main energy sources
- High adaptation rate of smart Grid 2.0

**electric traffic.fi**  
coolest experiment on the planet



Source: ITS WC 2012 in Vienna, SIS32

## A.4 Co-Mobility Society Project of Keio University

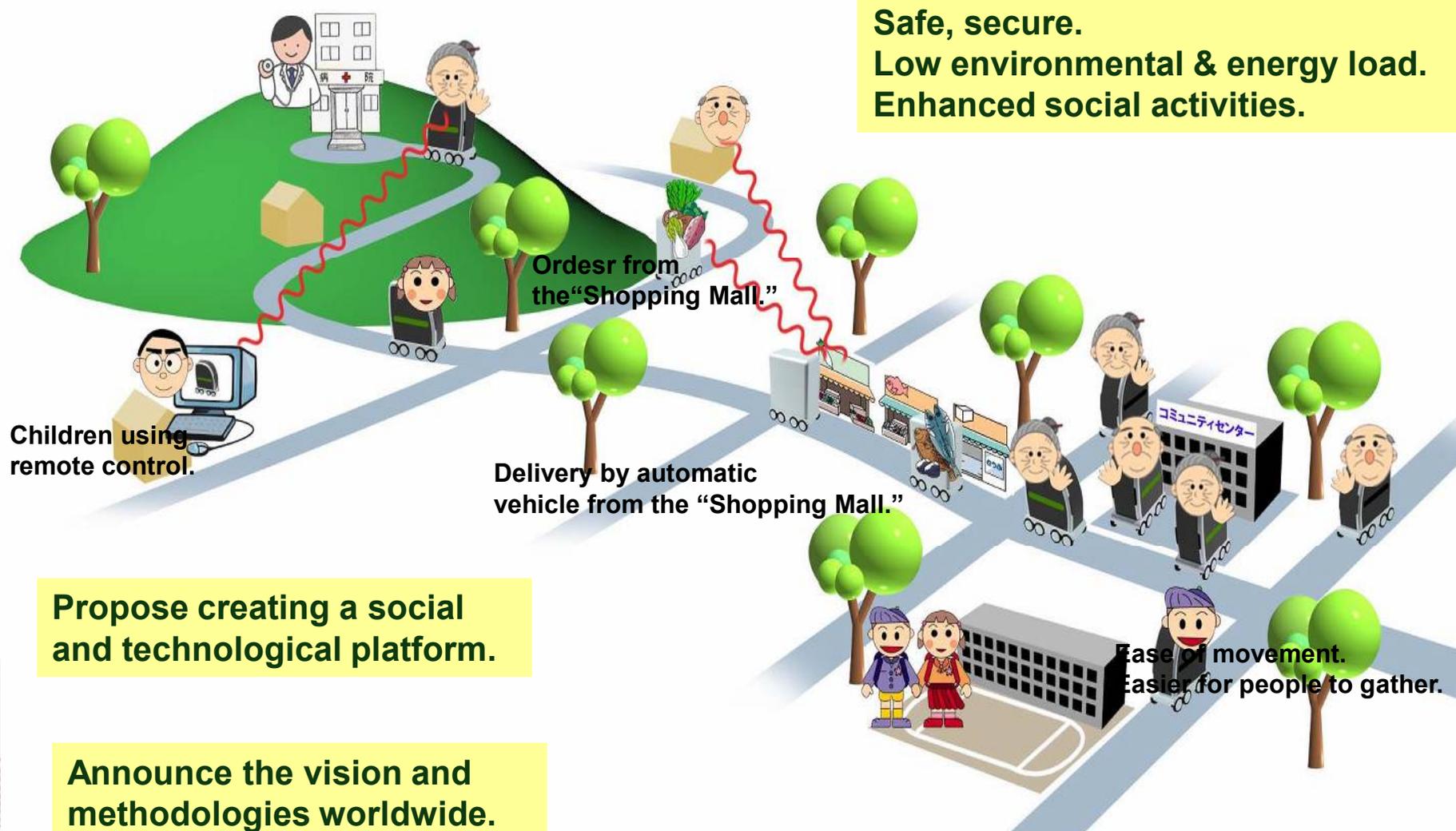
Keio University launched a research project aimed for enhancing the mobility of elder generation in local area.

1. R & D of one man automated vehicle
2. R & D of remote medi-care system and conduct field trial
3. R & D of HEMS, CEMS and conduct field trial

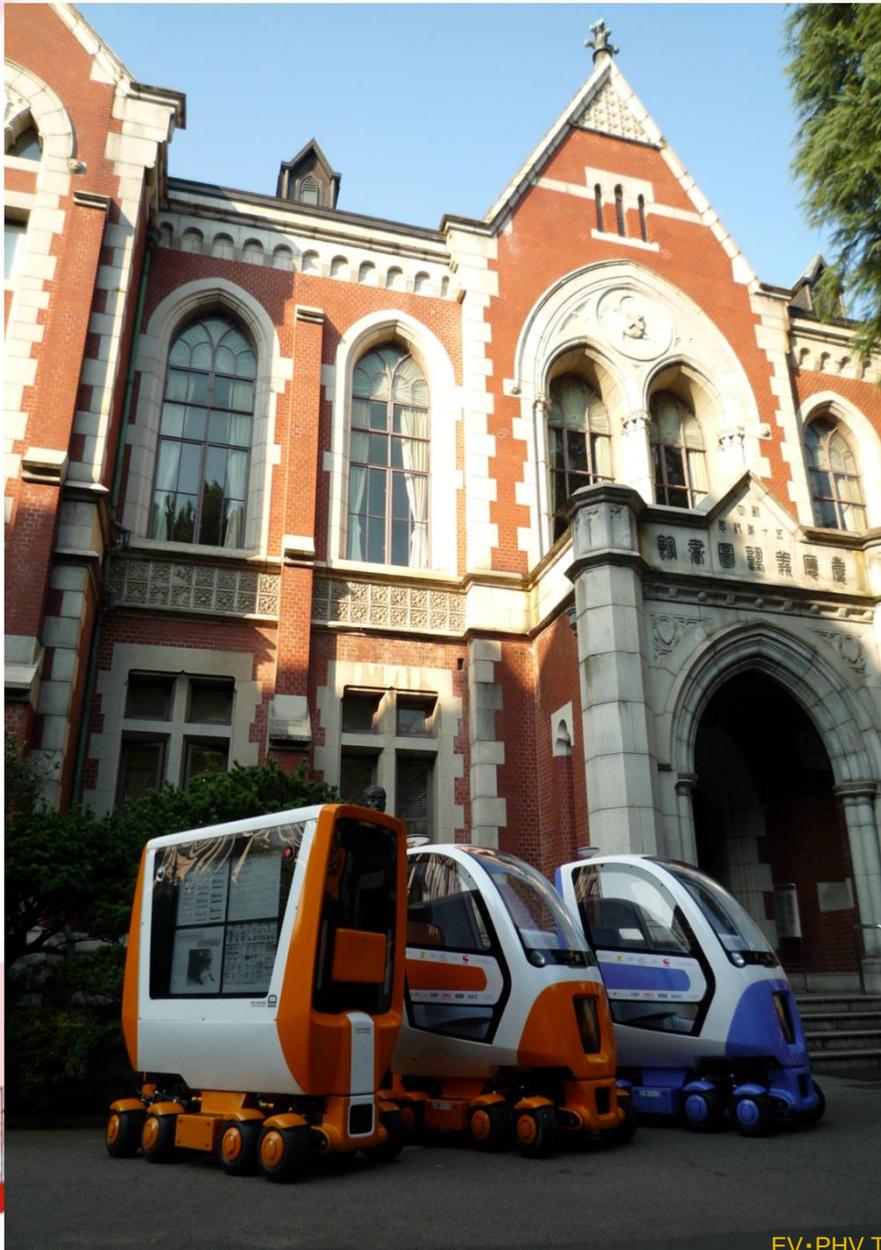
Currently a similar project (including above mentioned themes 2,3 and agriculture) using sensor networks as a core of technology called “Green Life Infrastructure” is under development.



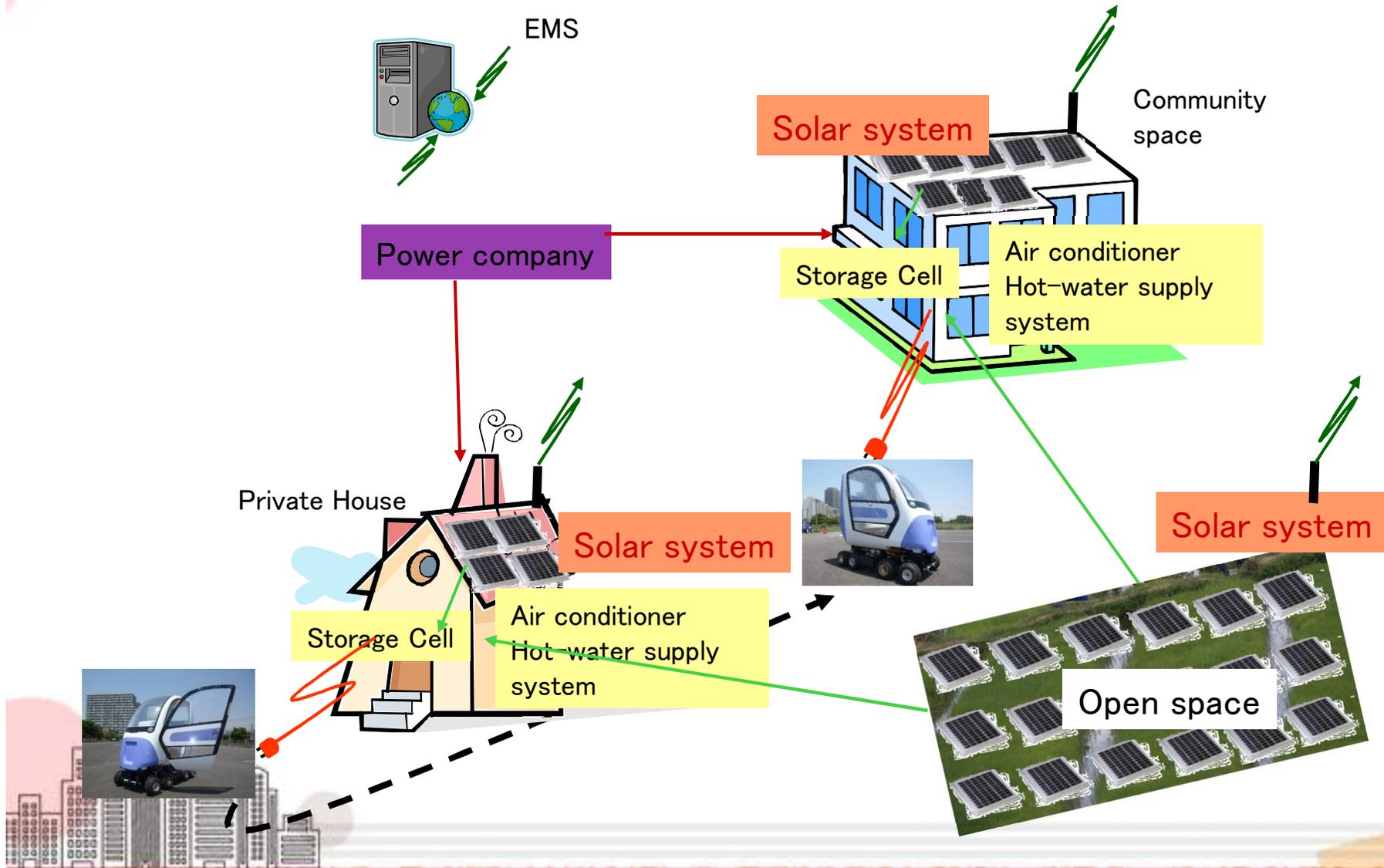
# Concept of the Co-Mobility Society



# Co-Mobility Vehicle –Recent Prototype



# Micro-grid of Co-Mobility System



# Three kinds of Mobility in Co-Mobility Society

- Automated Mobility
- Remote Controlled Mobility
- Virtual Mobility (Not Virtual Space)  
Similar or better benefits to patients by the remote medi-care system which does not require frequent visits to the hospital.



## A.5 EV & ITS Project in Nagasaki

In conjunction with the introduction of EV in Goto Islands, the following policy was determined to promote activation of the local society.

1. Integrated and efficient implementation of electric supply stations and ITS Spots is conducted.
2. Route guidance to the electric supply station is provided by using ITS Spots
3. Tourism guidance is provided by using ITS Spots
4. Contents of the tourism guidance is provided by local community
5. CEMS and HEMS are investigated to realize “Green Island”

## A.6 Example of EU Project

### ELVIRE

#### EV Limitations causing Range Anxiety

- The autonomy (driving range) of EVs is limited to 100 – 150 km.
- Charge infrastructure is sparsely distributed and slowly ramped up.
- Charging an empty battery takes 1-8 hours.
- EV drivers fear to break down.



25/10/2012

H. Luettringhaus | Continental Automotive GmbH

Source: ITS WC 2012 in Vienna, SIS49



## Range Anxiety is Limiting EV Marketability and Adoption

How far can I really go?  
Do I reach my destination?  
What if the car breaks down?  
Is there any charge station if I need one?



*Not addressing RA is limiting the market to*

- *Enthusiasts / Idealists*
- *People with limited mobility needs and radius*
- *Rich people who have more cars to choose from*

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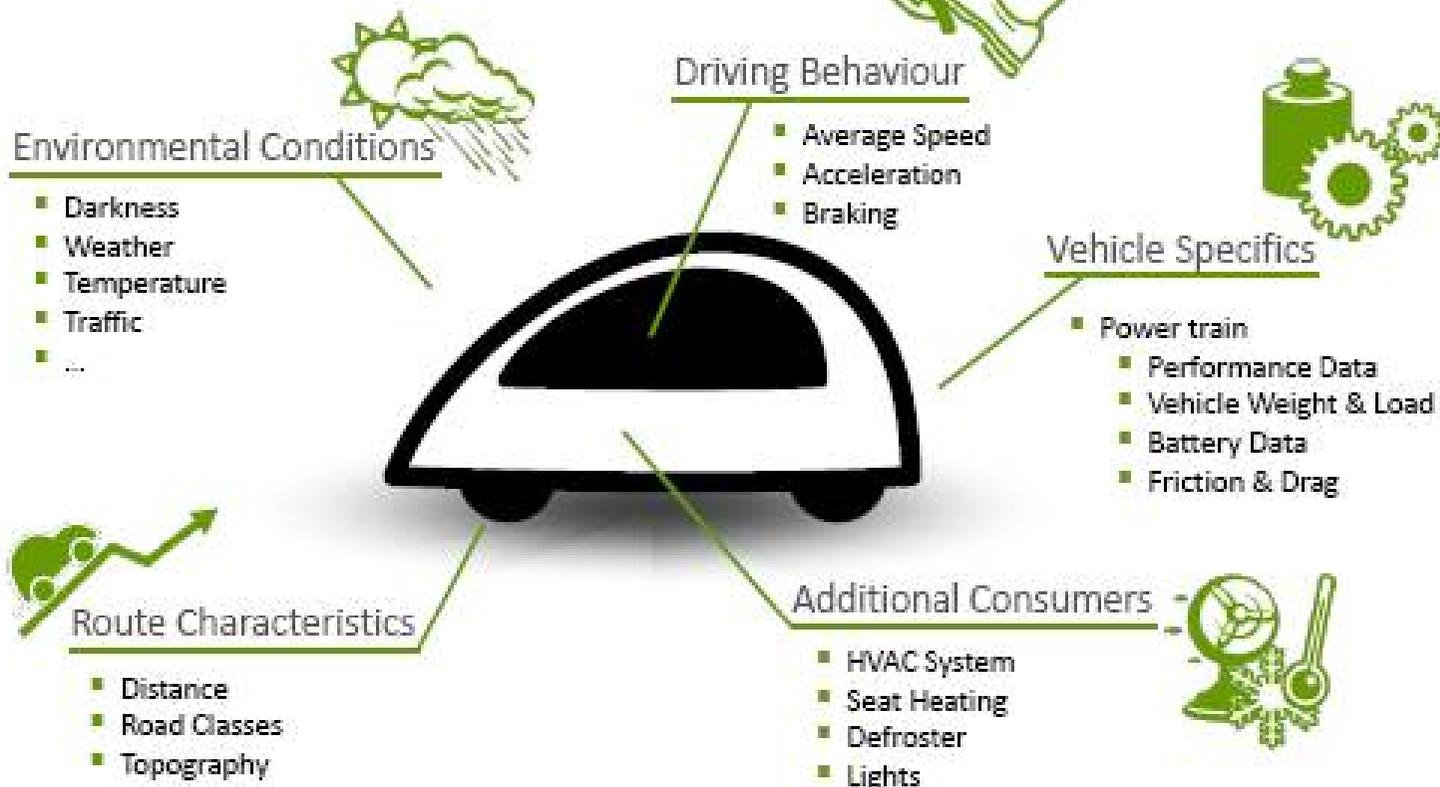
25/10/2012

H. Luettringhaus | Continental Automotive GmbH

Source: ITS WC 2012 in Vienna, SIS49

# ELVIRE

## Energy Estimation Model



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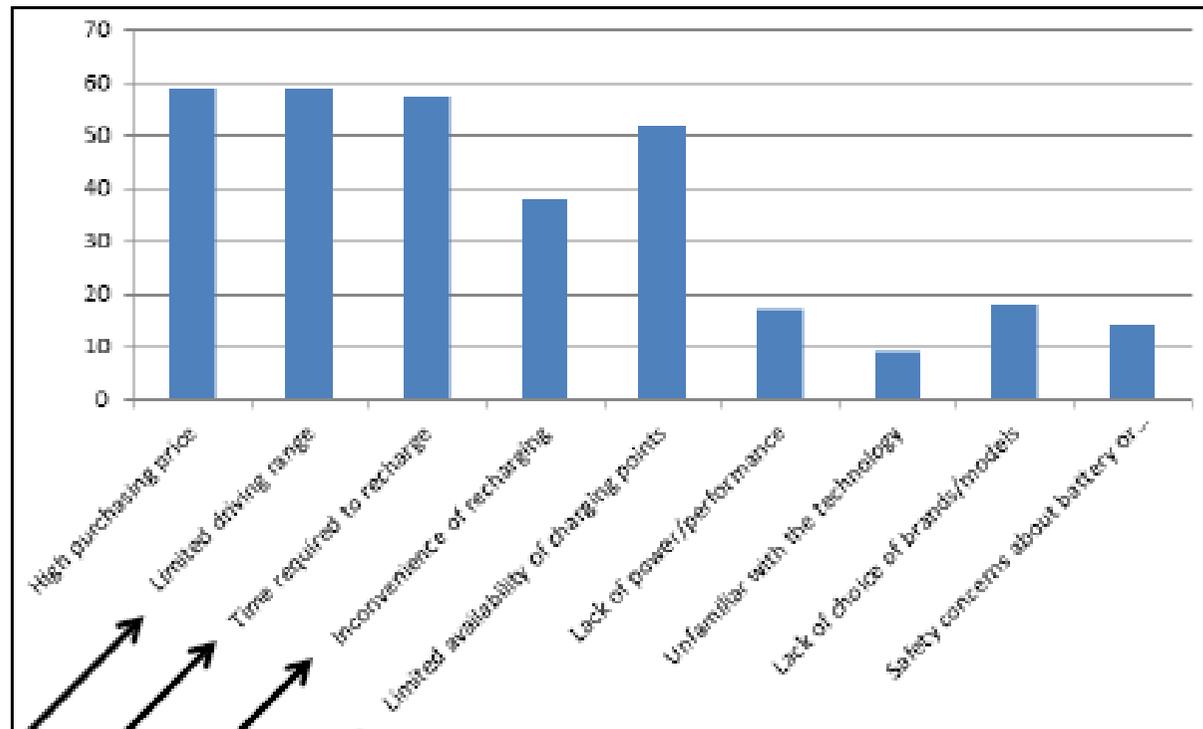
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H. Luettringhaus | Continental Automotive GmbH

Source: ITS WC 2012 in Vienna, SIS49

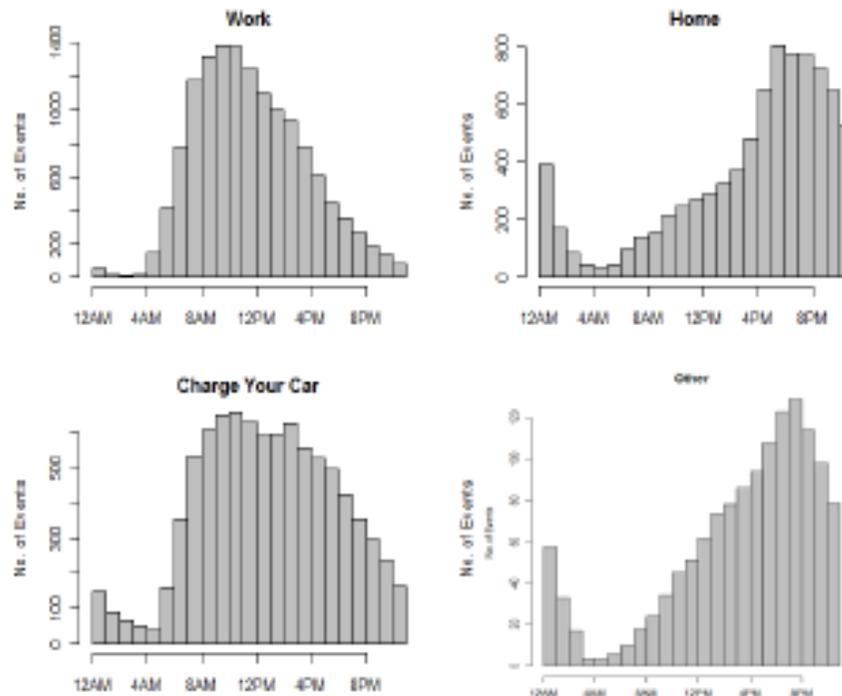
## A.7 EV Field Trial in UK

### Possible barriers to EV uptake



Source: ITS WC 2012 in Vienna, TS52

## Barrier #1: Understanding Charging events



- 'Work', 'Charge Your Car' and 'Fast Charge' all show a similar morning – afternoon charging pattern. 'Home' shows a more pronounced shift towards late afternoon to evening charging.

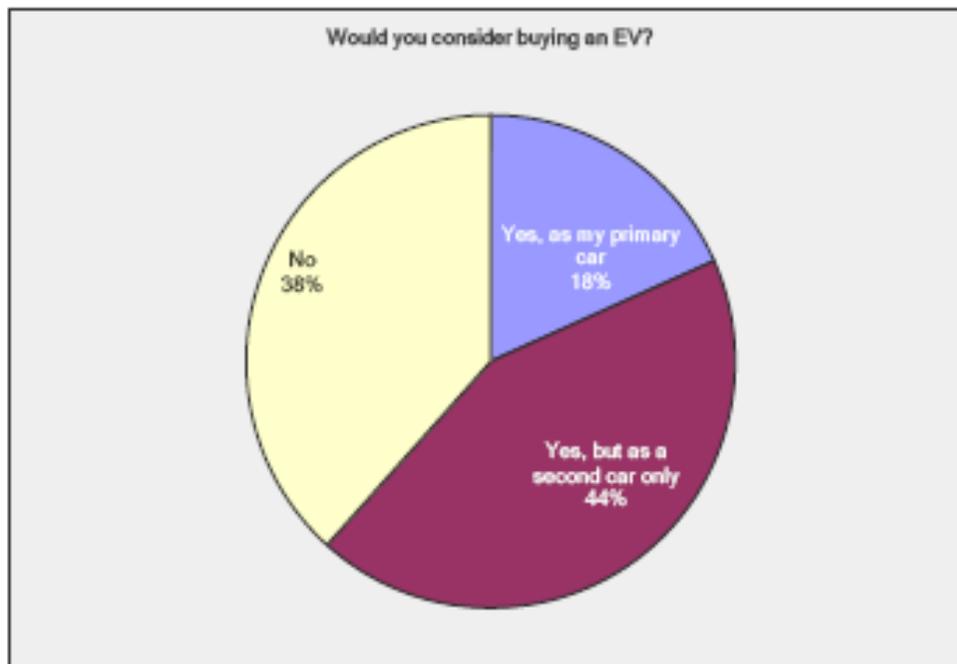


CYC= Public Charging Infrastructure

torg

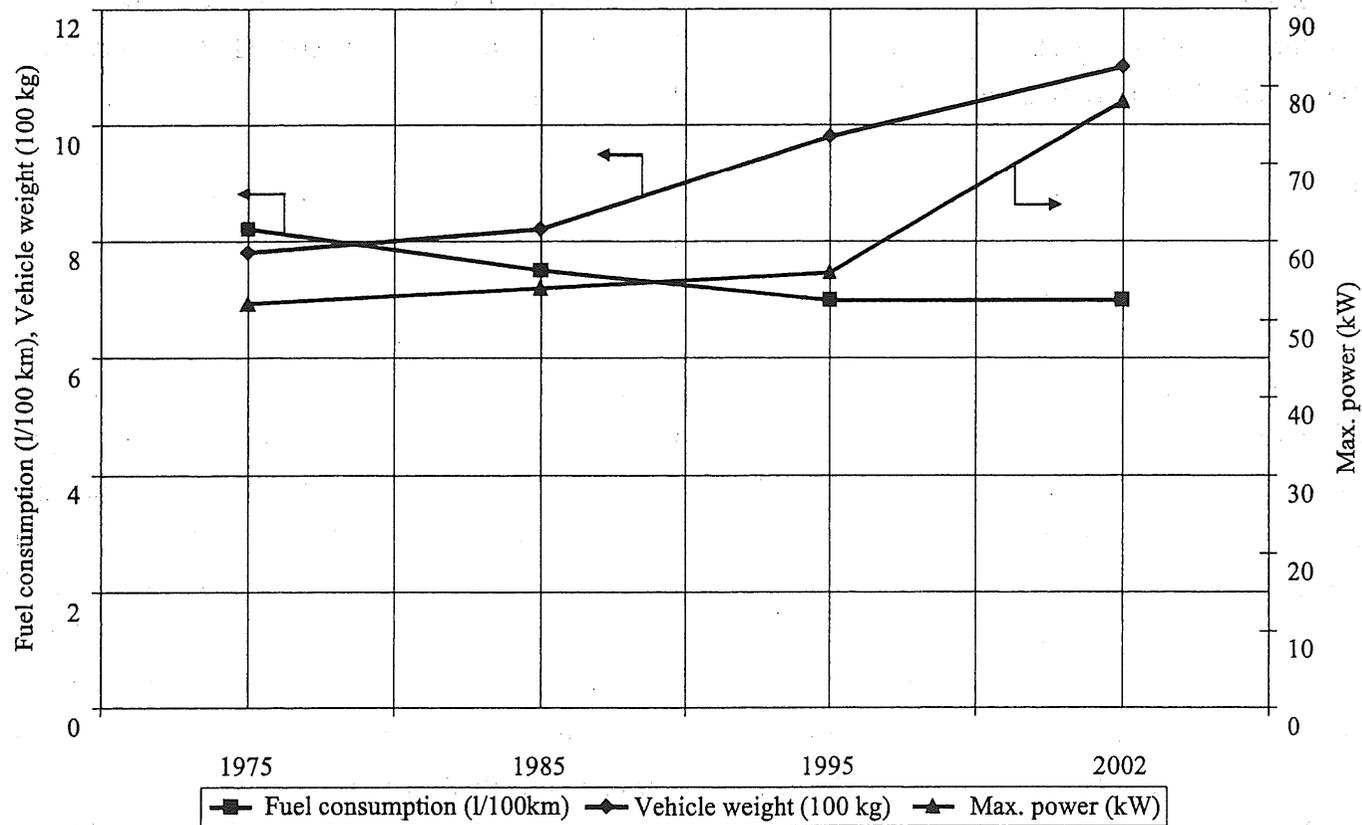
Source: ITS WC 2012 in Vienna, TS52

## Would you consider buying an EV? Post trial



Only 13% of AA members said that they "I would seriously consider buying an electric car within the next two years"

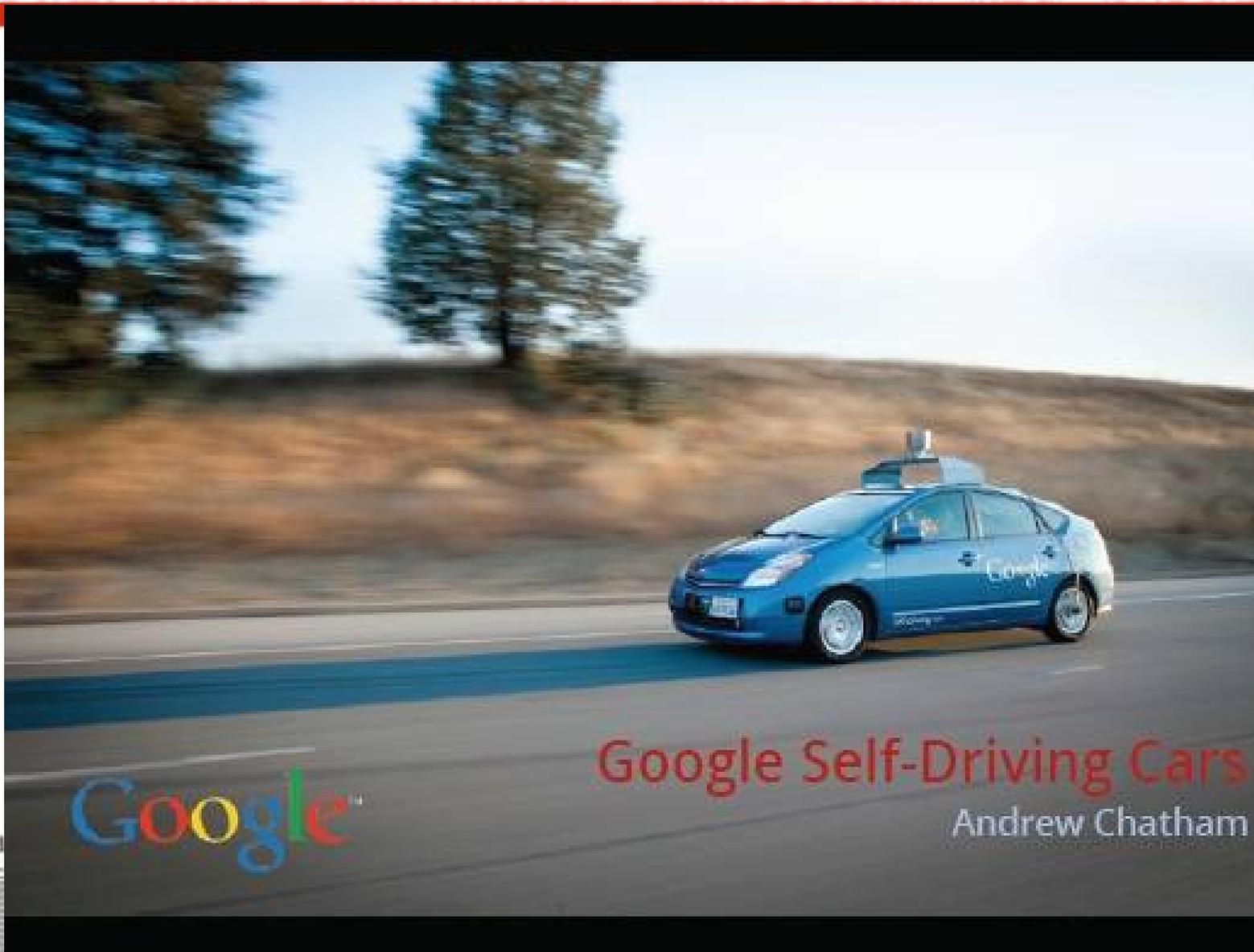
# B.1 Vehicle weight and fuel consumption



**Volkswagen Golf: Fuel consumption, vehicle weight and max. power, 1975–2002**

Source: Volkswagen.

## B.2 Trial of the automated vehicle



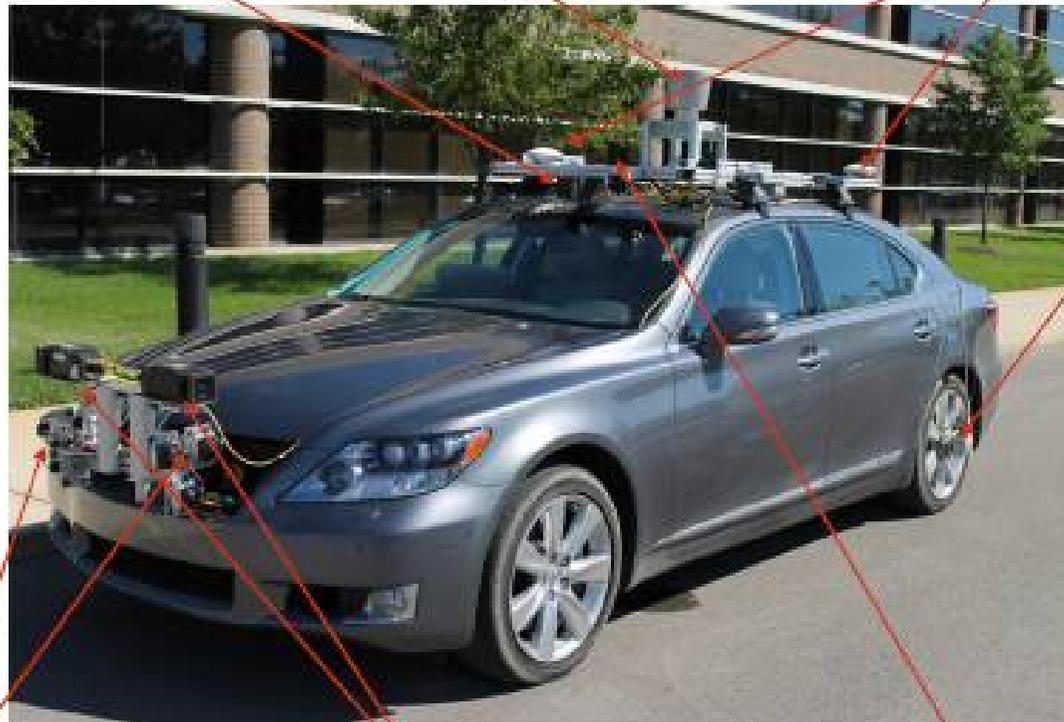
Source: International Task Force on Vehicle-Highway Automation Workshop, 21 October, 2012

# TOYOTA Test Vehicle for field test

Front Camera

360° LIDAR

GPS System



Speed  
Sensor

Side Radar

Side Camera

Front Radar

TOYOTA

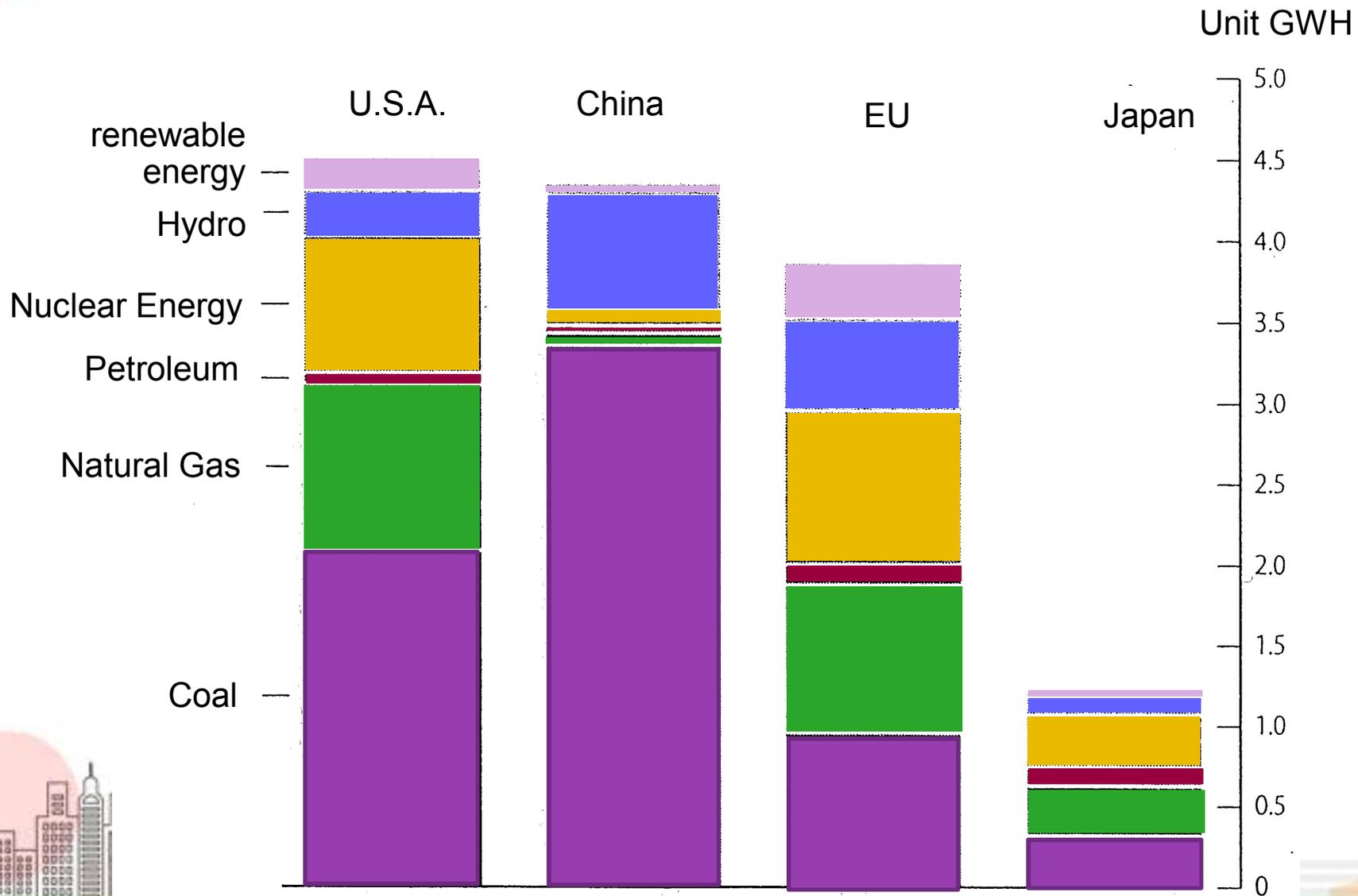
Source: International Task Force on Vehicle-Highway Automation Workshop, 21 October, 2012

## C.1 Comparison of WTW CO<sub>2</sub> emissions

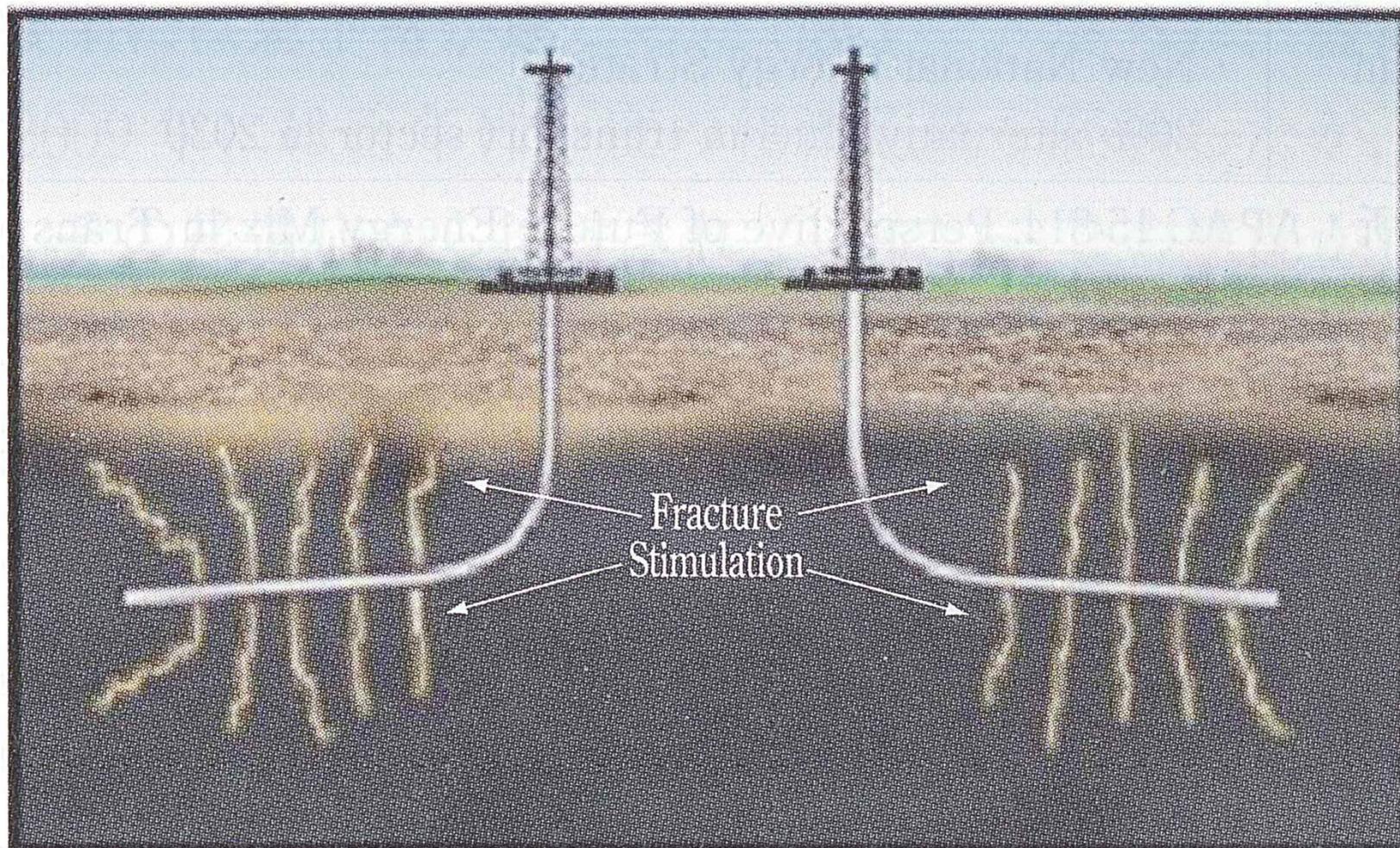
	CO <sub>2</sub> eq in g/km		
	Well to Tank (Batteries)	Tank (Batteries) to Wheels	Total CO <sub>2</sub> eq Emissions
<b>Conventional ICE Car</b>	23	120	143
<b>Biofuels</b>	17-28	97-135	114-163
<b>Battery Electric Vehicle</b> 27% Nuclear 20% Renewable 53% Fossils (EU-27 mix 2010)	67-84	0	67-84
<b>Battery Electric Vehicle</b> (Coal)	126-155	0	126-155
<b>Battery Electric Vehicle</b> 50% Wind 50% Photo Voltaic (Renewables)	0-4	0	0-4

Source: European Roadmap, Electrification of Road Transport, 2<sup>nd</sup> Edition, PPP European Green Cars Initiative, June 2012, Table 3

## C.2 Fuel for Electricity (2009)

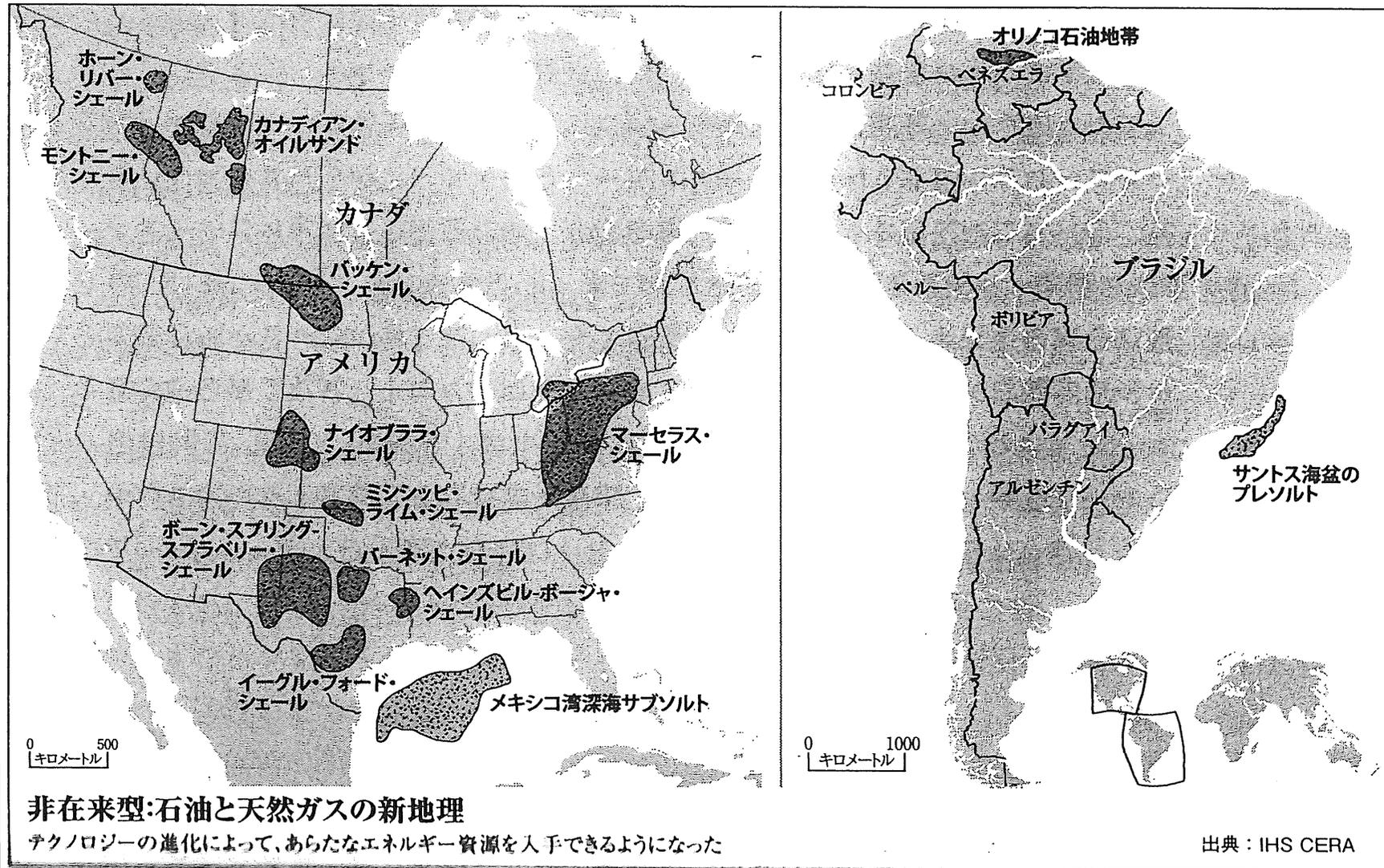


## C.3 The new excavation technology



出典: JOGMEC調査レポート

# C.4 Energy revolution and geopolitics



## 7. Socio Economic impacts of 3.11

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1. The basic assumption of promoting clean vehicles by EV is that 50% of electricity will be generated by nuclear plants.
2. Loss of electric power and break down of various communication systems.
3. Can the prevention and the mitigation of disaster and environment prevention compatible with the sustainable development ?



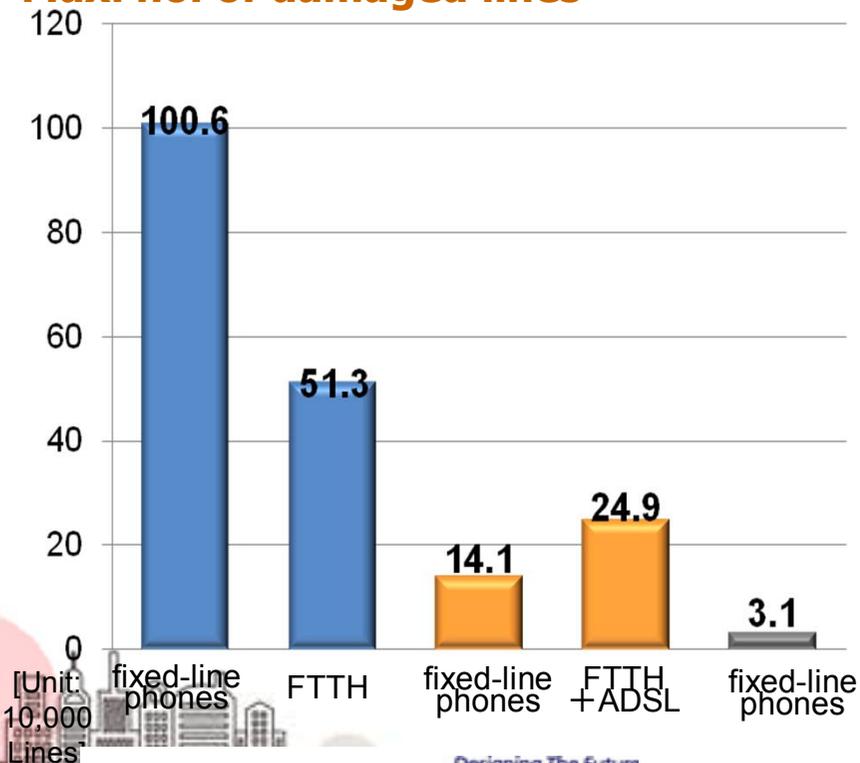
# Damage to Fixed Lines, Mobile Base Stations



## Fixed-line Communications

In total, around 1.9 million communication lines were damaged.

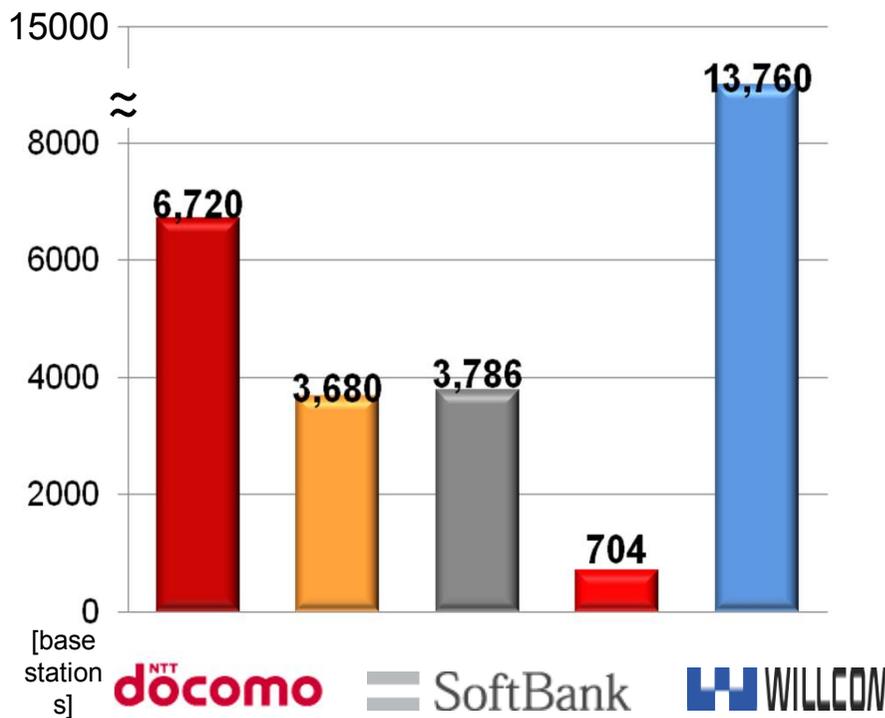
Max. no. of damaged lines



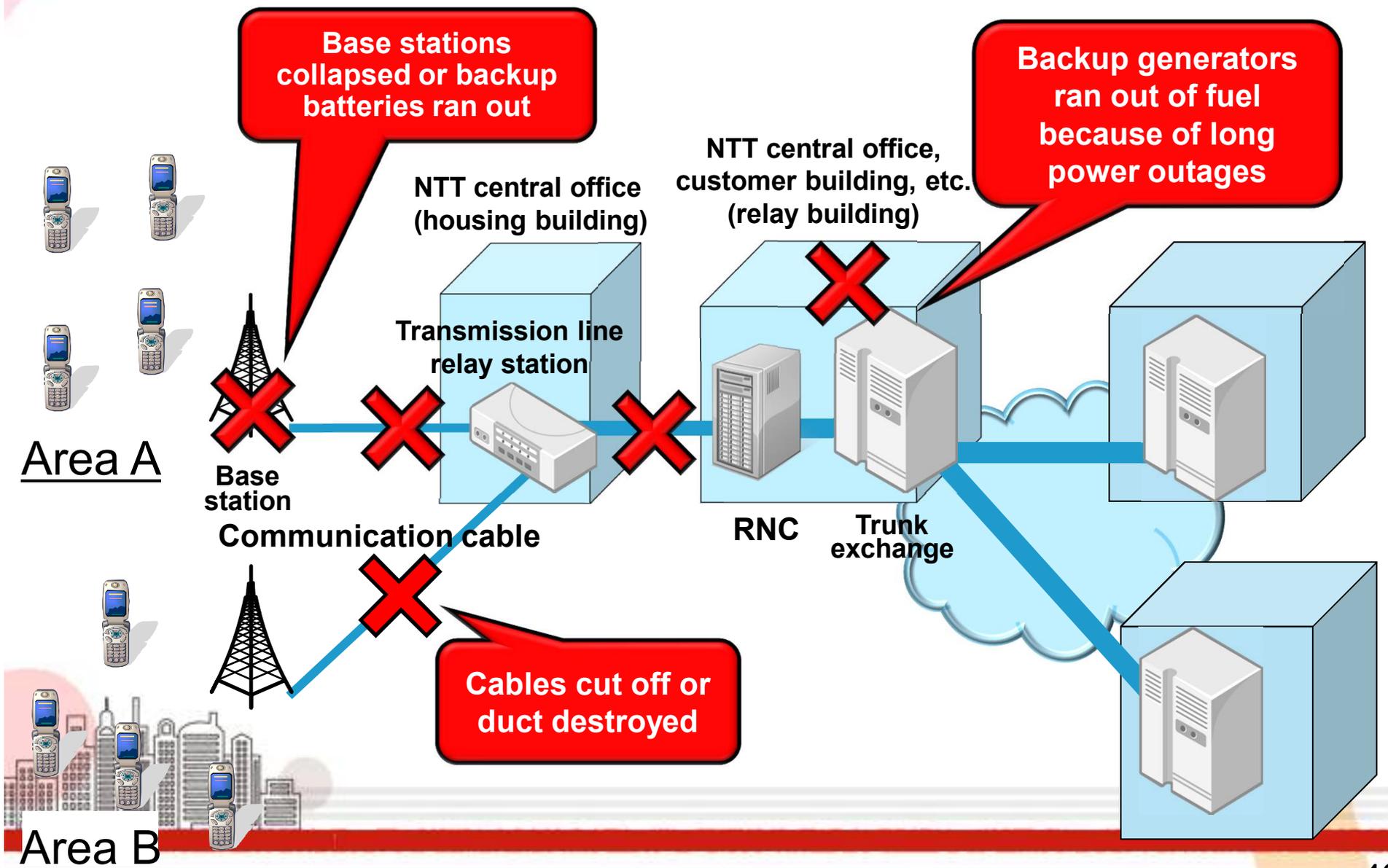
## Mobile Communications

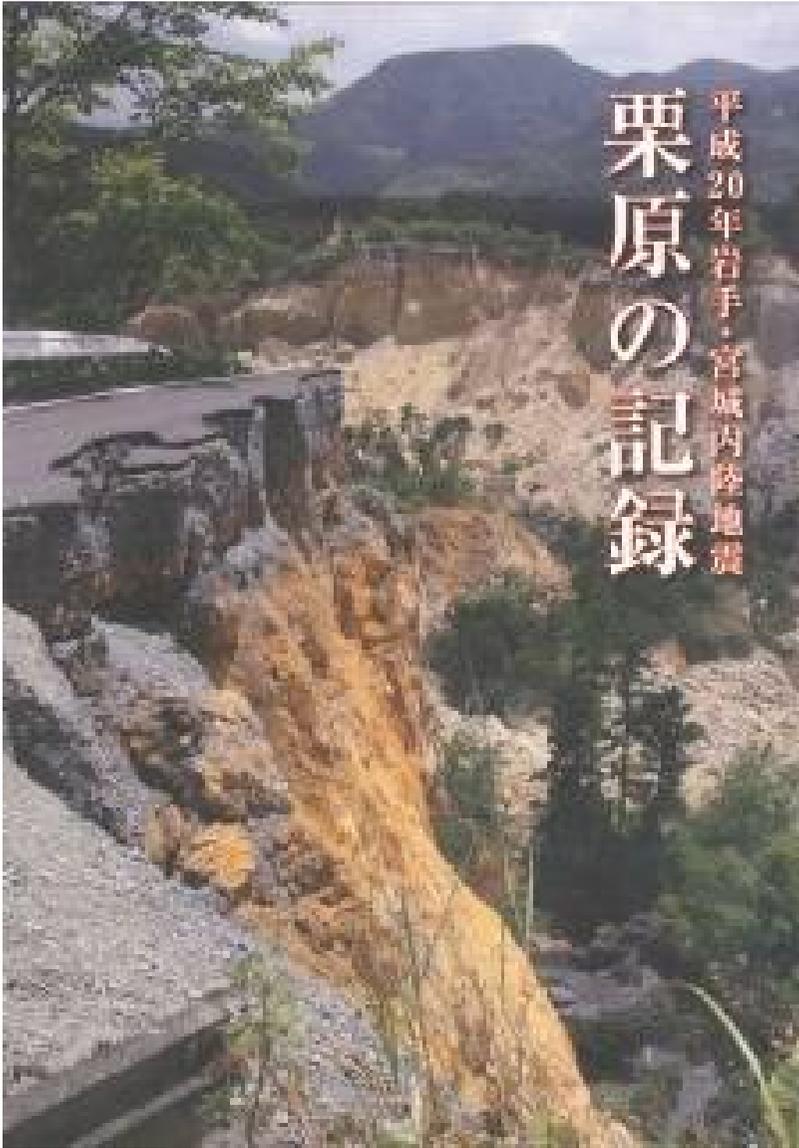
In total, about 29,000 base stations were damaged.

Max. no. of damaged base stations



# Locations of Damage to Mobile Networks



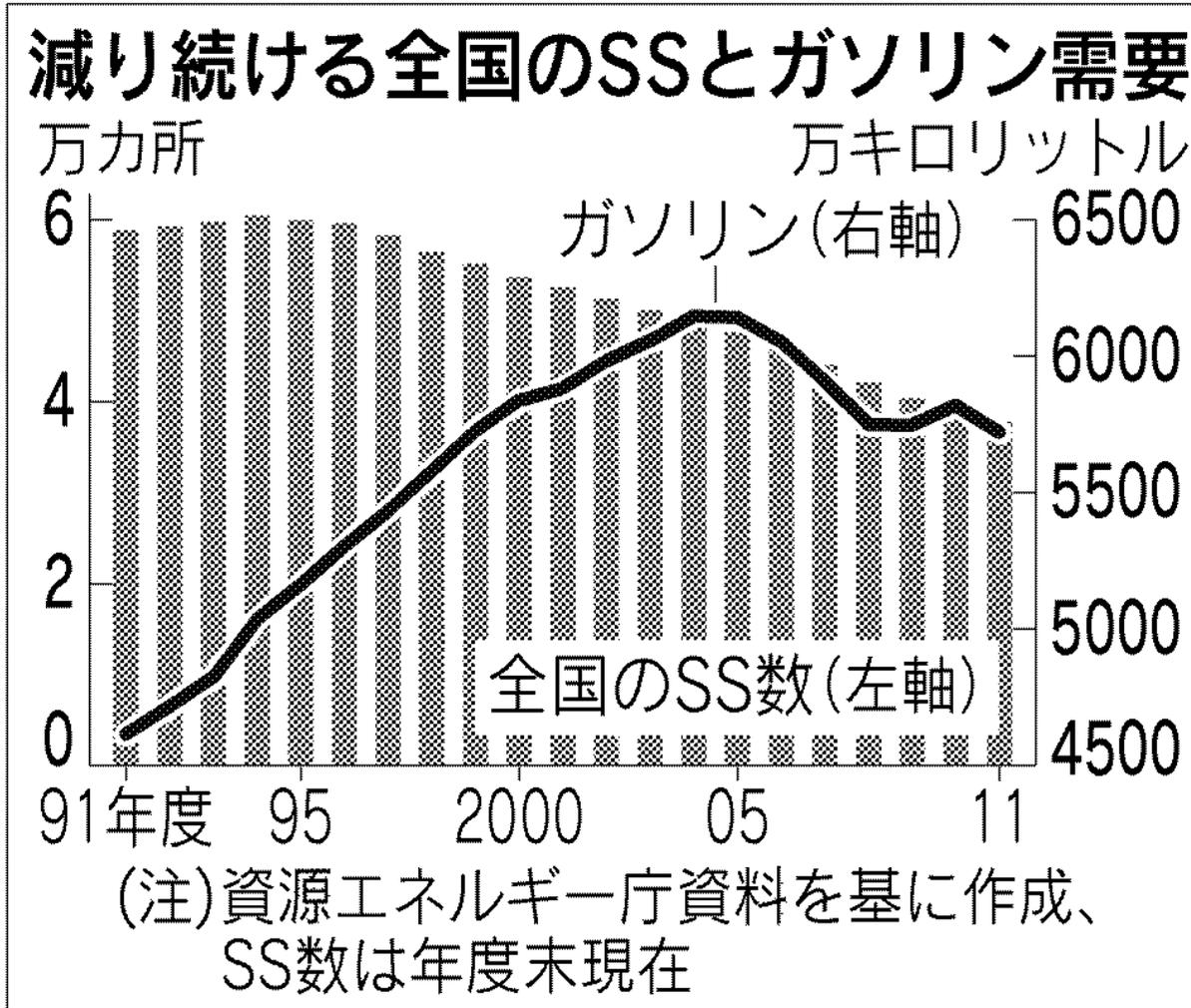


**栗駒地区（荒砥沢ダム上流部）**  
国内最大規模の地すべりが発生した荒砥沢ダム上流部。そこを通過していた市道荒砥沢線が3、300メートルにわたり消滅してしまいました。

出典：平成20年岩手・宮城内陸地震「栗原の記憶」

# Sharp decrease of Gas Stations

## 消える給油所 住民奮闘



インフラ維持、地域ぐるみ

SS過疎地、238市町村に

Source: Journal of Nikkei, 24 December, 2012

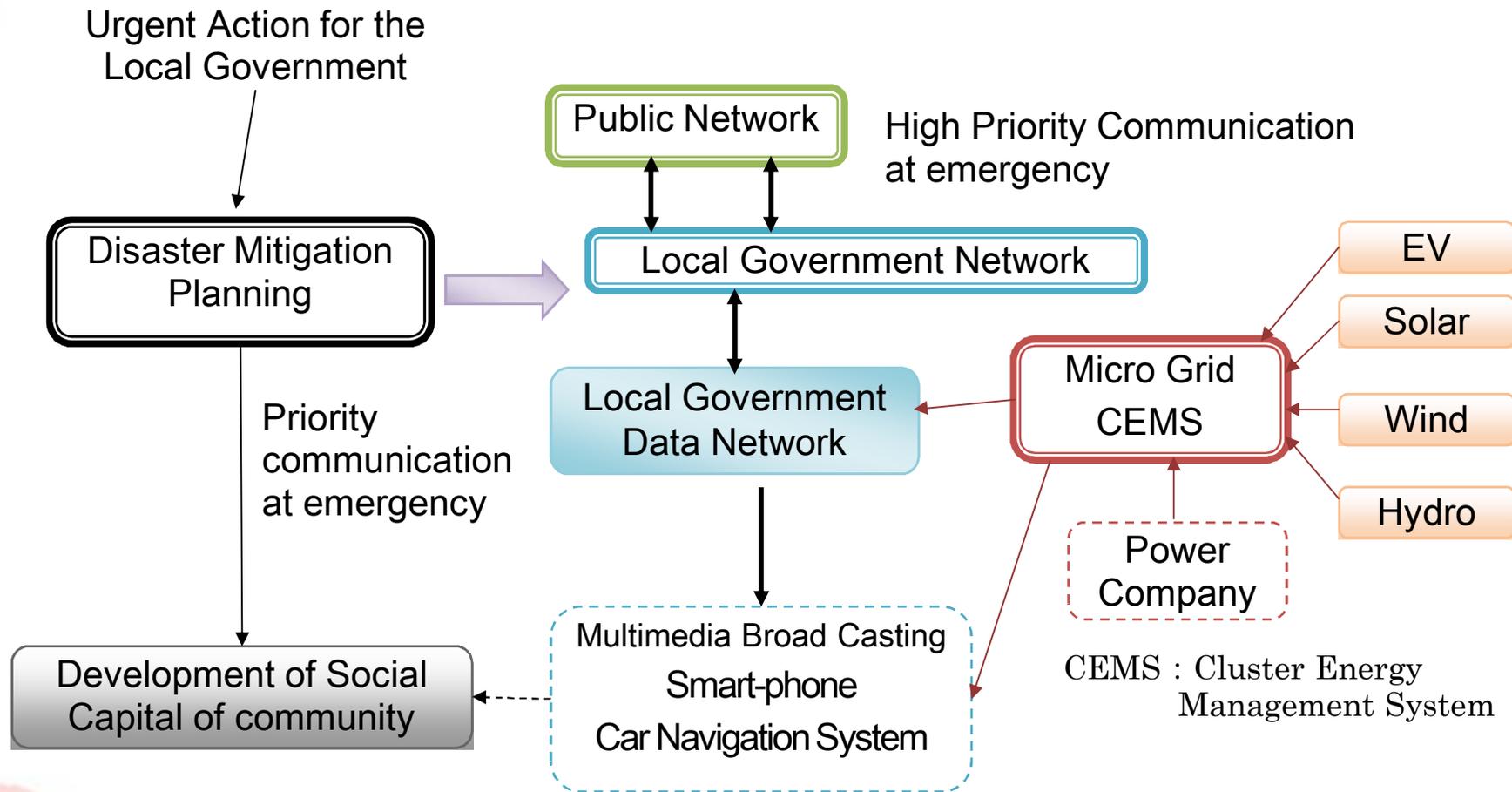
## 8. Issues emerged after 3.11

### Technical issues related to EV·PHV after 3.11

- ◆ Depending on the energy mix policy of Japan, EV is no longer cleanest vehicle
- ◆ EV and PHV can be utilized to secure electric power and means of communication after disasters
- ◆ **General issues of the penetration of EV**
  - Difficulty to supply electricity to EV during the peak hours of electric demands (EV requires electricity equivalent to the demands of two houses for 24 hours)
  - Difficulty to construct the information to guide EV of various manufacturers to electric supply stations
  - Safety of Lithium-ion battery

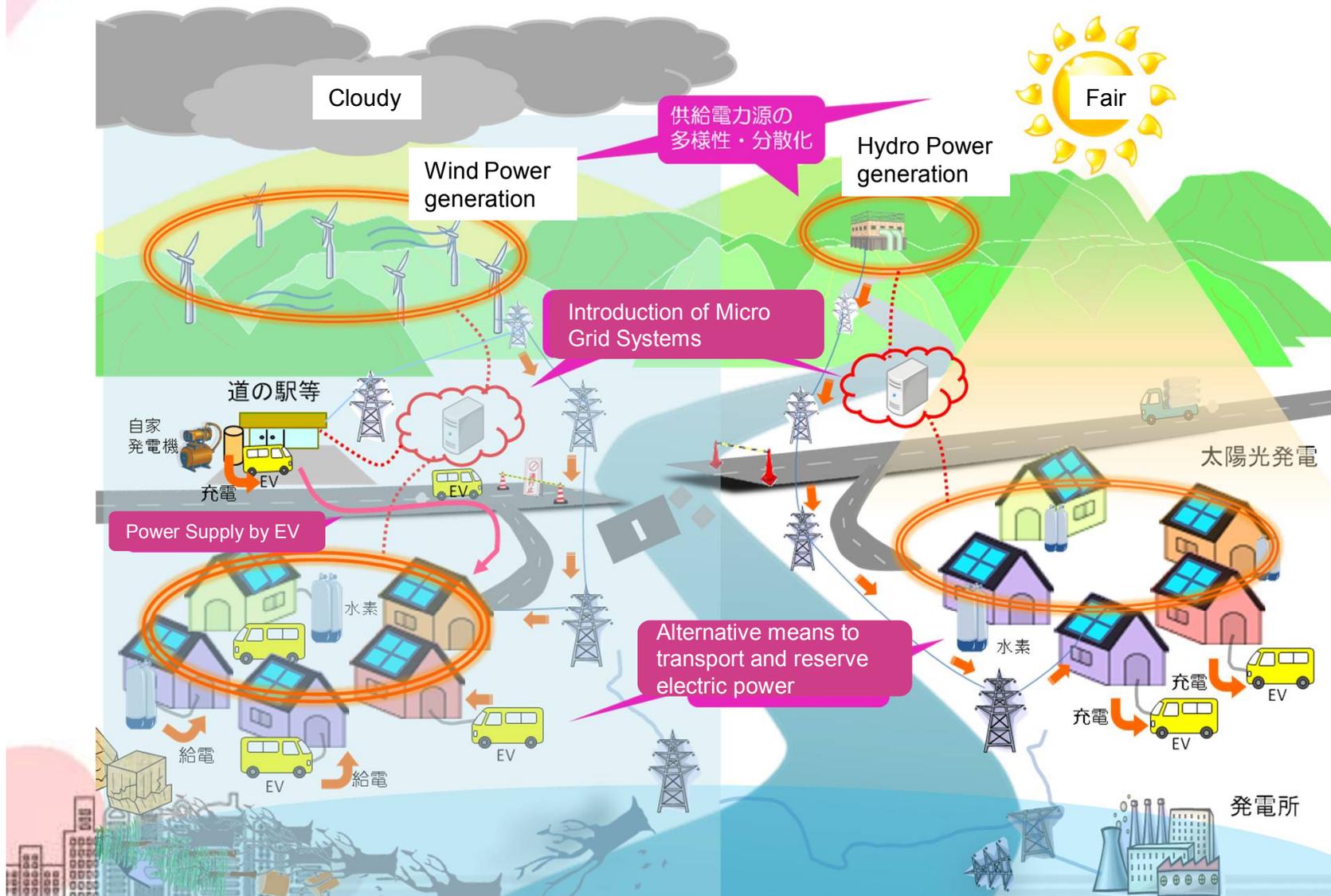


# Development of Resilient Society



Source: Material of Co-Mobility Society Research Center, Keio University

# Electric Management System for Local Community for population of 5 to 10 X 10<sup>4</sup>



Source: The report of "Integrated Reserch and Survey Team on Disaster Mitigation Measures using ICT", 13 July, 2011

# Issues related to the development of EV-PHV Town

## Integrated approach of the local community is inevitable

(Since Agenda21 was a top-down approach to members states, the bottom-up approach such as Local Agenda21 did not bring out enough attention to Japan)

1. Resolve the problem of mobility issues
  - Sharp decrease of petroleum stations
  - Support the life of elder generation who do not have driving license
2. Activation of Local Community
  - Utilization to tourisms
  - Develop applications in other fields of local community such as agriculture
3. Utilization of EV-PHV after disasters
4. R & D of ICT for supporting the above mentioned themes 1-3.

## 9. Roles of Local Community

EV,  $\mu$ -Mobility are not the alternatives of current automobiles. They are new means of mobility for specific mobility purpose

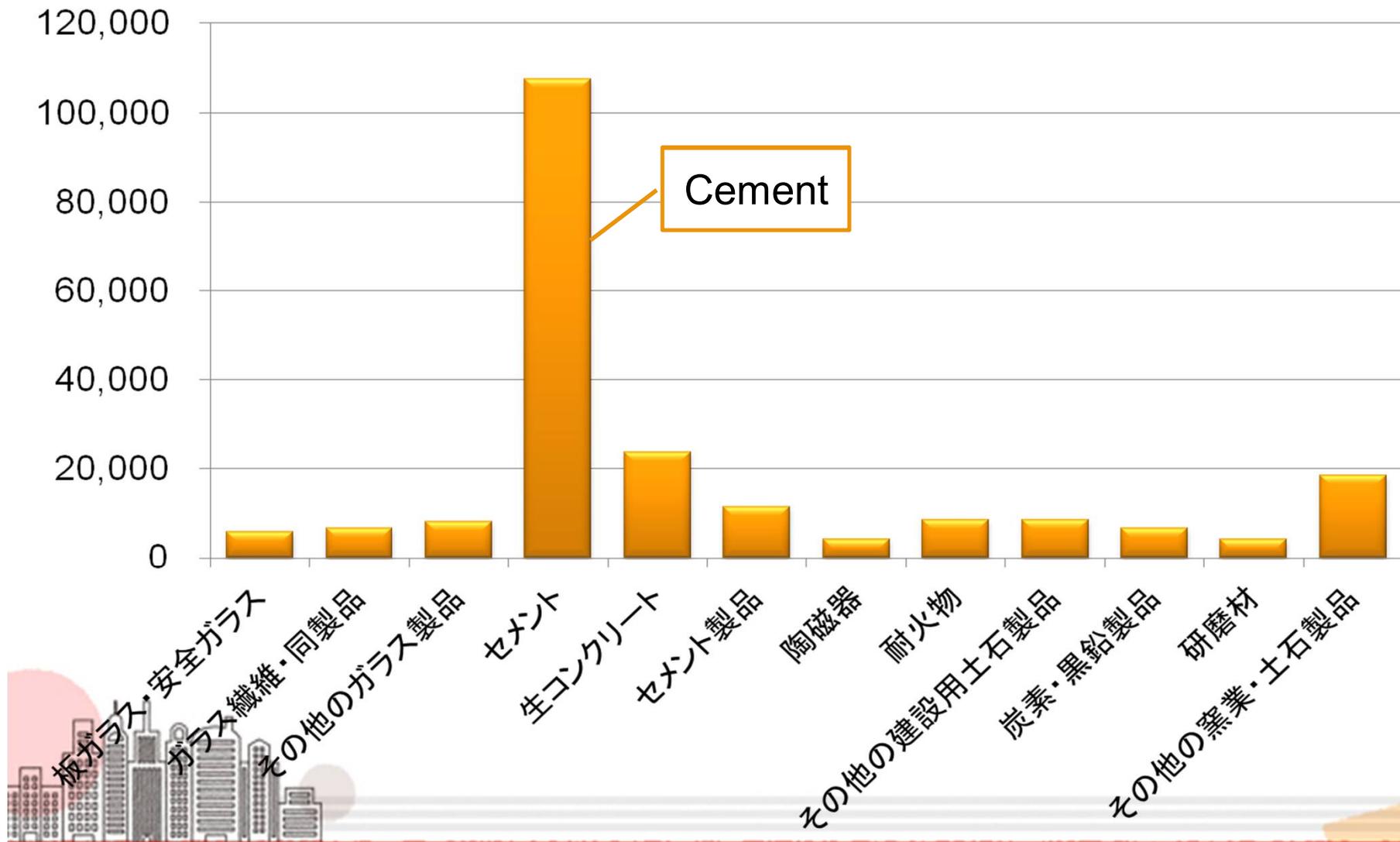
1. Determine a suitable unit of EV·PHV Town  
If the tourism is the main concern of the community, information exchange among local communities who have similar interest is inevitable.
2. Increase job opportunity by implementing integrated plan for the penetration of EV·PHV and  $\mu$ -Mobility and for the enhancement of associated business such as tourisms, maintenance of vehicles. Not only to possess vehicles but also to share the use of vehicles.
3. Consider the financial aspect of introduction EV·PHV Town
  - What kind of mechanism is needed for financing the administrative and the management cost?
  - What is the business plan for the introduction ?

## 10. Roles of Central Government

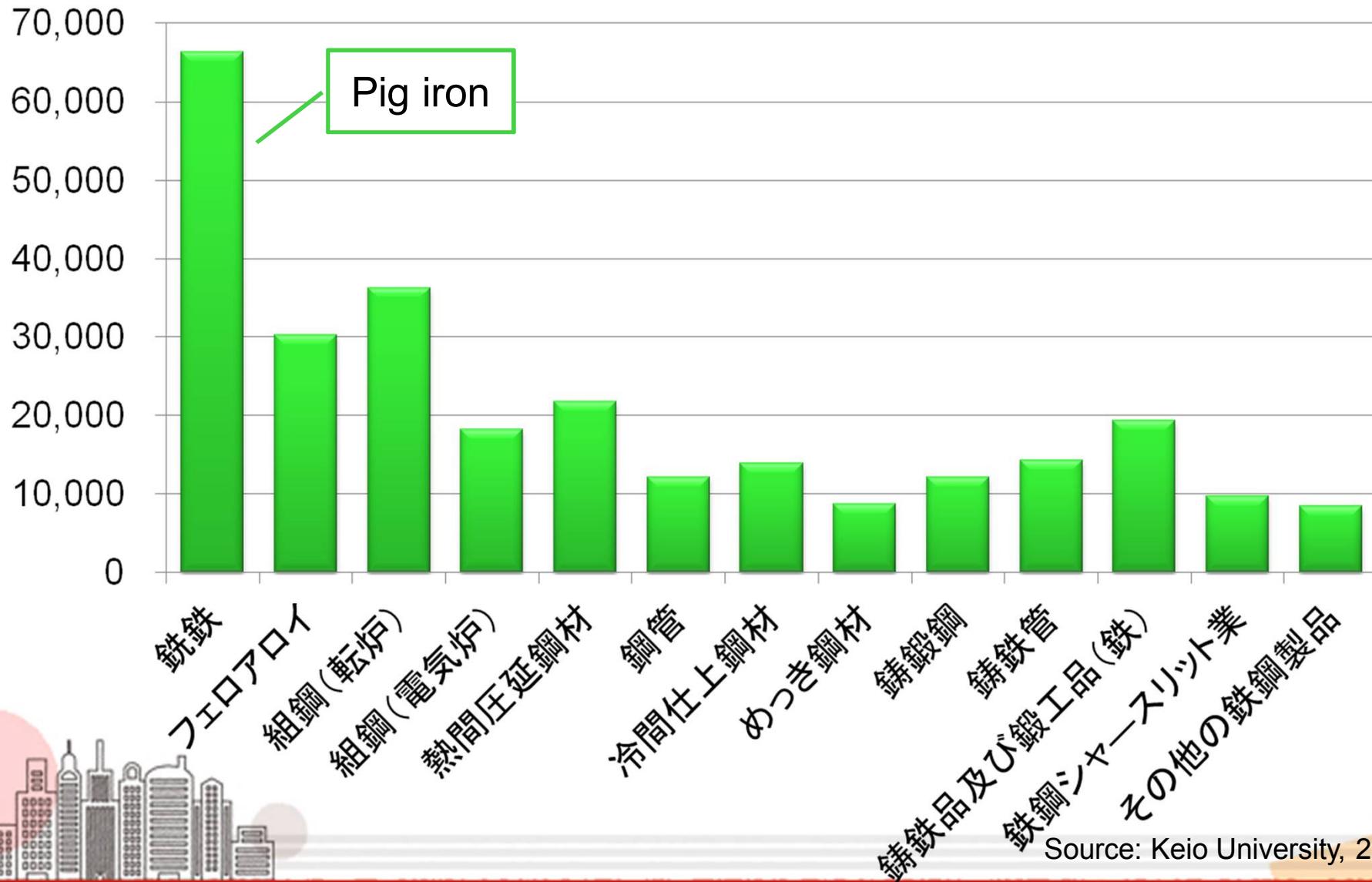
1. Establishment of technical framework, guidelines standards related to vehicle, sensor network. Especially, the standardization of classics platform and the modulization of driver assist safety systems of  $\mu$ -Mobility are urgently needed
2. Establishment of technical framework for electric power supply and communication systems which can be utilized for every day use and emergency use such as after disasters
3. Japan should lead the discussions of post Kyoto Protocol of United Nations in conjunction with the relationship between disaster management and mitigation and sustainable developments and how local communities should prepare for the future occurrence of disasters which are intrinsically local phenomina

# Can traditional Disaster Prevention coexist with Sustainability ?

Induced CO<sub>2</sub> of Ceramic and Cement Products calculated from I/O Analysis



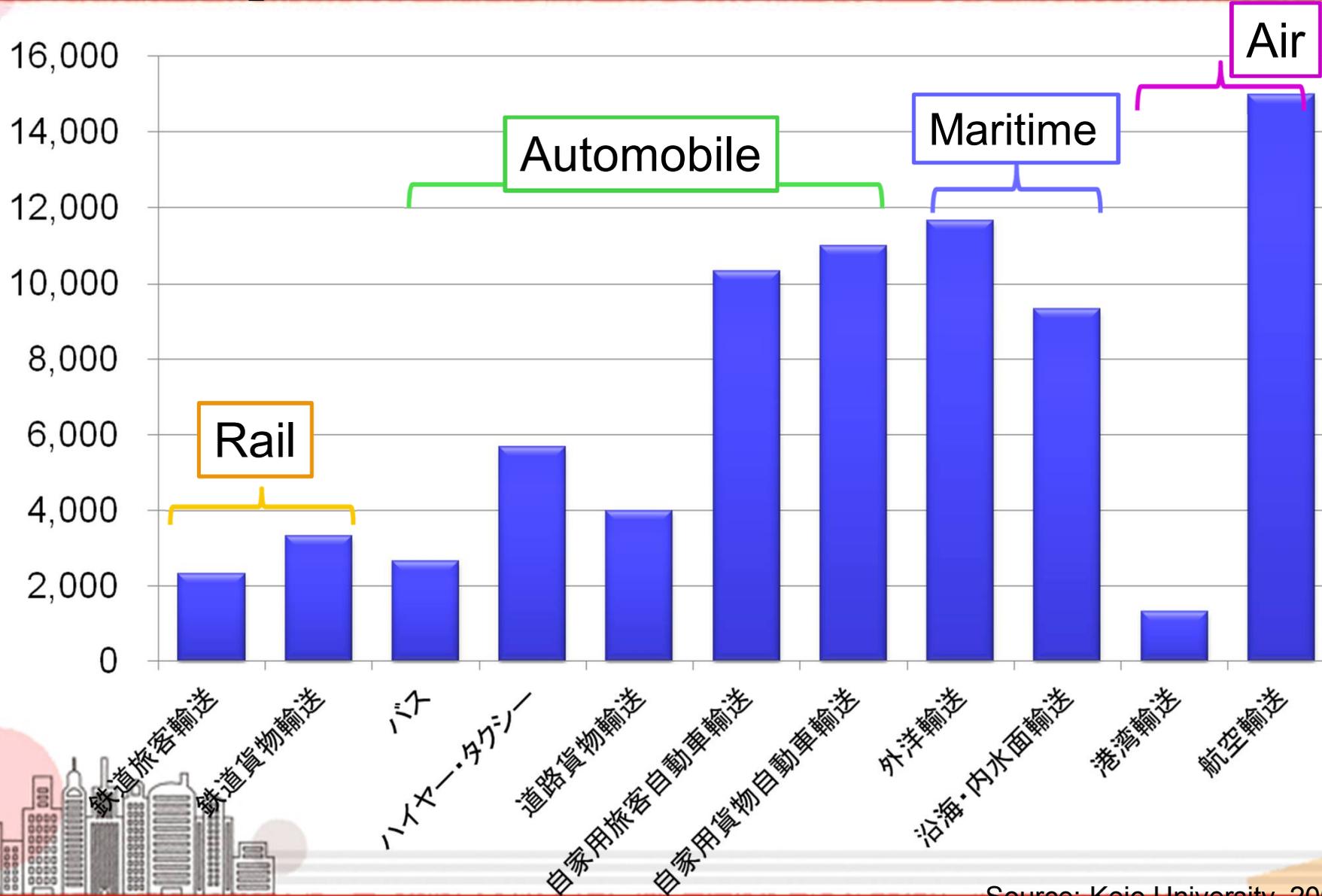
# Induced CO2 of Iron Products calculated from I/O Analysis



Source: Keio University, 2001

# Comparison with the Transport Sector

Induced CO<sub>2</sub> Transport Sector calculated from I/O Analysis



Source: Keio University, 2001