Summary of Presentations

CAREC Energy Workshop on New Technologies

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Disruption

is coming to the power sector

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Examples of disruption:
Data Storage

1992

$340 /MB

Source: http://www.kotzendes-einhorn.de/blog/2011-06/the-hard-disk-youve-been-waiting-for-na-endlich/

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Examples of disruption:
Data Storage

2016

$10

$2.7 million in 1992 price

(8 GB or 8,000 MB times $340 per MB is **$2.7 million**)

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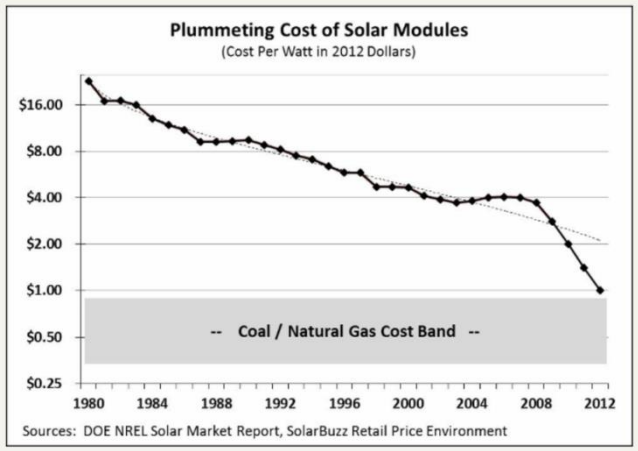
Solar

$1600



Less than **$50**

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Batteries

Nokia Senator 1982

Battery 9.8 kg

Iphone today **110 gm**

98% weight reduction!!

Batteries

$833 per kWh in 2010

Battery packs for electric vehicles, loaded with lithium-ion cells, now cost around $496 a kilowatt-hour, a 60 percent drop from 2010. That could plunge to $175 within five years, according to Sam Jaffe, an industry analyst with Navigant Consulting Inc.

Source: BloombergBusiness March 2015

http://www.bloomberg.com/news/articles/2015-03-24/cheap-batteries-under-the-hood-add-power-to-cut-fuel-consumption

$500 per kWh in 2015

$175 per kWh by 2020!

$50 per kWh by 2025??

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Current Challenges

- Supply shrinking

- Old infrastructure needs rehabilitation
- Large funding gap
- Increased Regional cooperation needed to maximize benefits

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New Challenges

- Technology Changes
- Solar power reaching grid parity
- Super efficient appliances
- Off-grid and on-grid battery storage to improve reliability
- Risk of demand stagnation

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Capacity Building and Knowledge Management (2016-2020)

Four themes

Knowledge sharing: smart meters, project management, independent regulation, tariff policy, forecasting, planning and energy efficiency

Technology adoption: smart meters, solar power, battery based storage, electric vehicles, and energy efficiency

Regulatory issues: framework for independent regulation, tariff setting for time-of-use tariffs, pre-paid meters, IPP tariffs, and benchmarking

Training: demand management, forecasting, solar power, battery storage, energy efficiency, and management of large projects

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New Technology Training

Tokyo, July 2015

- **Solar power generation** (rooftop, especially for public facilities) and solar micro-grid
- **energy efficiency and demand side** management
- Use of **electric vehicles** (for public fleet) and use of vehicle to home charging as emergency measures
- **Clean coal technology** (removal of Sox, Nox and PM10 from a power plant)

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#1 Japan's Energy Situation

- After the nuclear accident, electricity price increased **(25%** for households and about **40%** for industry) as cost of fuel increased.
- Residential tariff: **21 cents per kWh** in 2014
- Will reduce consumption by **17% by 2030**

Shinichi Kihara (Director, International Affairs Division,
Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry)

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741 MW of solar

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#2 Policy on Thermal Power Plants in Japan

- Introduced high-efficiency thermal power plants
- Plans to introduce Advanced Ultra-Super Critical generator by 2020s: efficiency increase from **39%** to **46%**.

The most advanced high efficiency coal thermal power generation
J-Power (Isogo Thermal Power Plant)

Yukari Hino (Assistant Director, Electricity and Gas Industry Department, Agency for Natural Resources and Energy, METI)

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#3 Promotion of Energy Efficiency and Renewable Energy Development

- Between **1973-2012** because of **industrial efficiency**

  GDP grew by 2.4 times, energy consumption grew by only 1.3 times

  (energy consumption per real GDP is down **by 40%)**

- Energy conservation is driven by (i) **Incentives: subsidies for equipment**, tax, interest and R&D with (ii) regulation and mandatory labelling

- Companies are required to report their energy consumption to Government . Law sets energy efficiency standards for new buildings and houses, which **will be mandatory for large-scale buildings to comply from 2017**

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#3 Promotion of Energy Efficiency and Renewable Energy Development

- Efficiency gained: **48.8%** fuel efficiency in cars (15 years), **32%** in air-con (20 years), **43%** in refrigerators (5 years) and **30%** in TVs (4 years).

- Feed-in tariff supported about 2,700 MW (residential PV) and **11,100 MW** (non-residential PV) in **less than 20 months in 2014**

- Utilities are suspending grid connection to renewable energy because of capacity constraints. By 2014: all households will have Smart Meters

- New opportunities in distributed power generators, and demand response. 2030 Target: **17% by Energy Saving** and 22% by Renewables

Katsushi Takehiro (Director, Office of Global Strategy for Energy Industry and the International Affairs Office, Energy Conservation and Renewable Energy Department, Agency for Natural Resources and Energy, METI)

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#4 Smart Community

- Demonstration projects (2011-2014) established community with distributed systems, energy demand-supply management systems and battery storage **(4 cities covering about 5,000 households)**

- Developed **DC power supply system from electric cars,** AC supply system from a Plug In hybrid, and demonstrated fuel-cell buses supply shelter houses

- Solar PV increased by **shared storage batteries** in a neighborhood.

Kiyoshi Aoshika (Deputy Director, Smart Community Policy Office, Energy Conservation and Renewable Energy Department, Agency for Natural Resources and Energy, METI)

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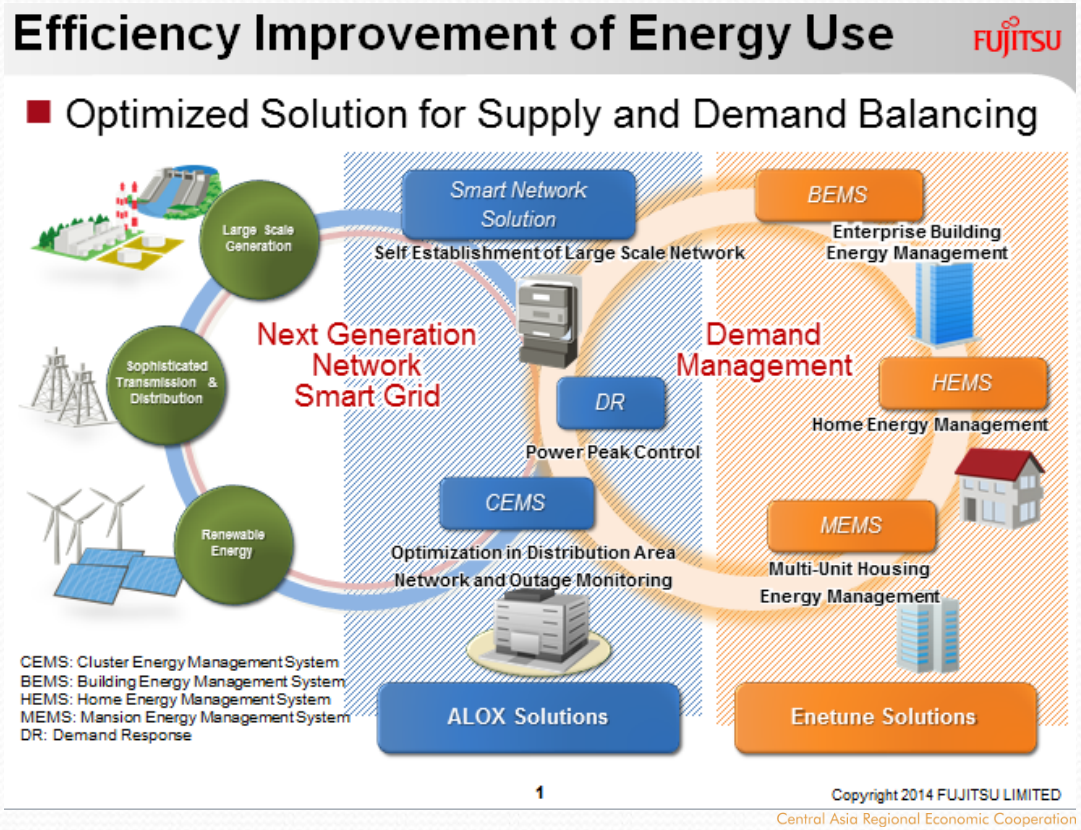
#5 Smart City Projects in Japan

- Energy Control Center to manage storage, EV and demand in a small city with real time data
- Utilizing State Vehicles as Mobile Batteries at Emergency

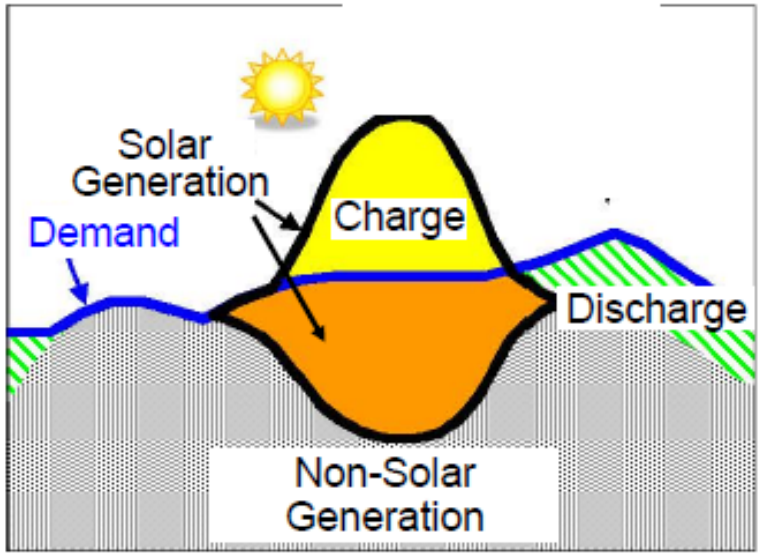
Ishibashi Yasunari (Director, ASEAN Business Development Office, Marketing Unit, Fujitsu Limited)



#6 NAS Battery Energy Storage System

- NAS (Sodium-Sulphur) Battery: a standard container **1.2 MWh** and **200 kW**
- Commercially available since 2002
- Globally installed **530 MW (3,700 MWh)**
- Uses Sodium and Sulfur and no rare materials used. Competing with Lithium

Mr. Ryugo Takeda (NGK Insulators, Ltd.)



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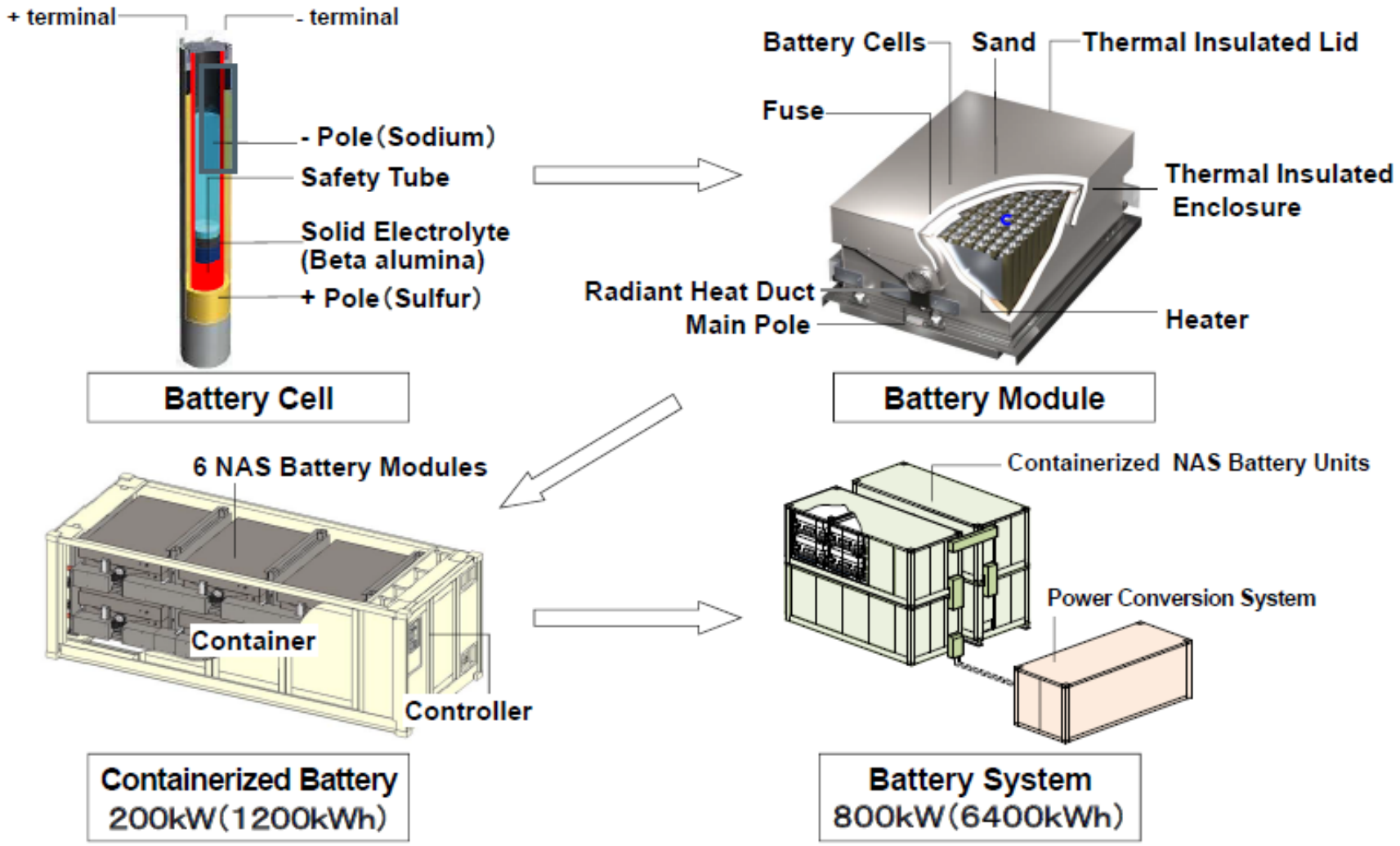
Structure of NAS® Containerized Battery System



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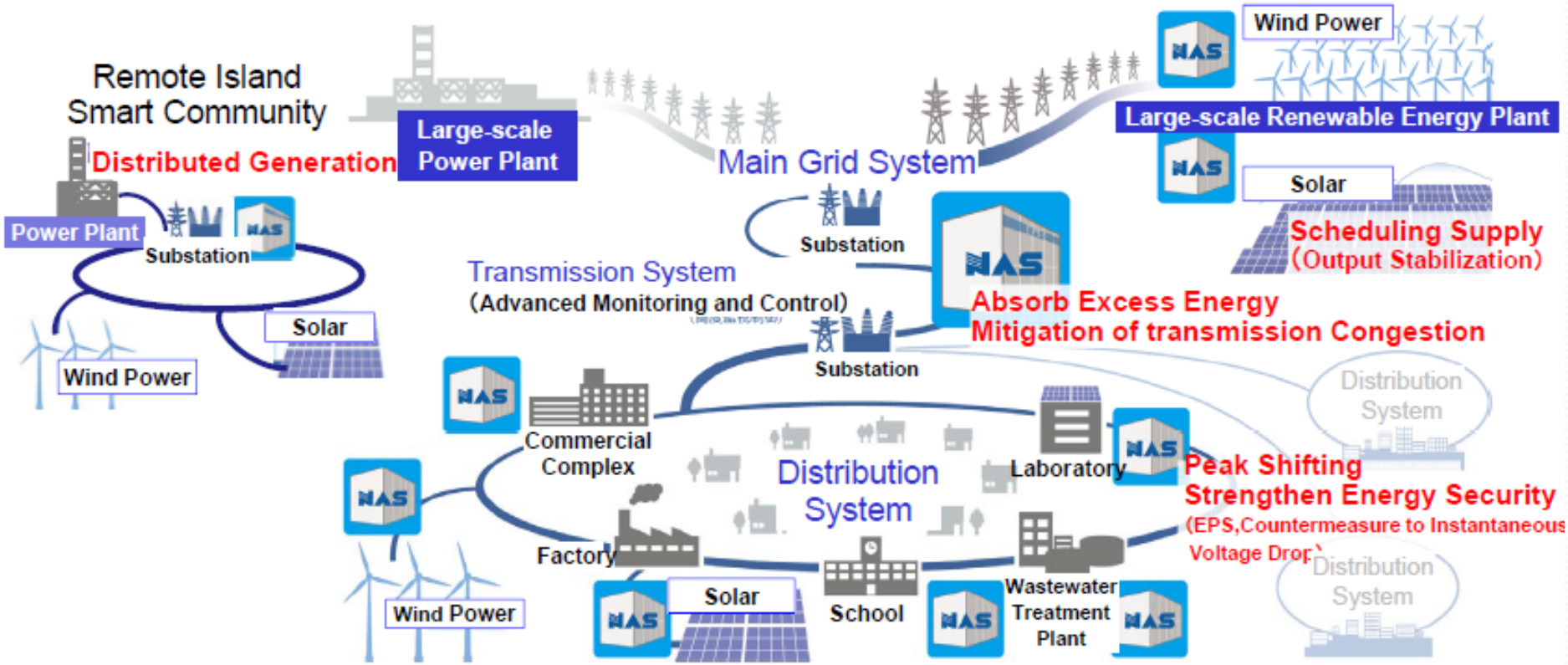
Various applications of NAS® Battery System

Energy Storage will enable..
- storage of electricity which was not feasible up till now
- balancing demand and supply instantaneously (location and time not restricted)
- efficient and reliable supply of electricity throughout system



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#8 Global Battery Storage and Solar Energy

- 100 year old battery manufacturer that has supplied Lithium-ion batteries to airlines and Mitsubishi iMiev
- Demonstrated small solar lanterns, solar UPS, solar street lights, solar school kits and emergency lighting kits

Hatsumi Yamada (GS Yuasa Technology Provider)

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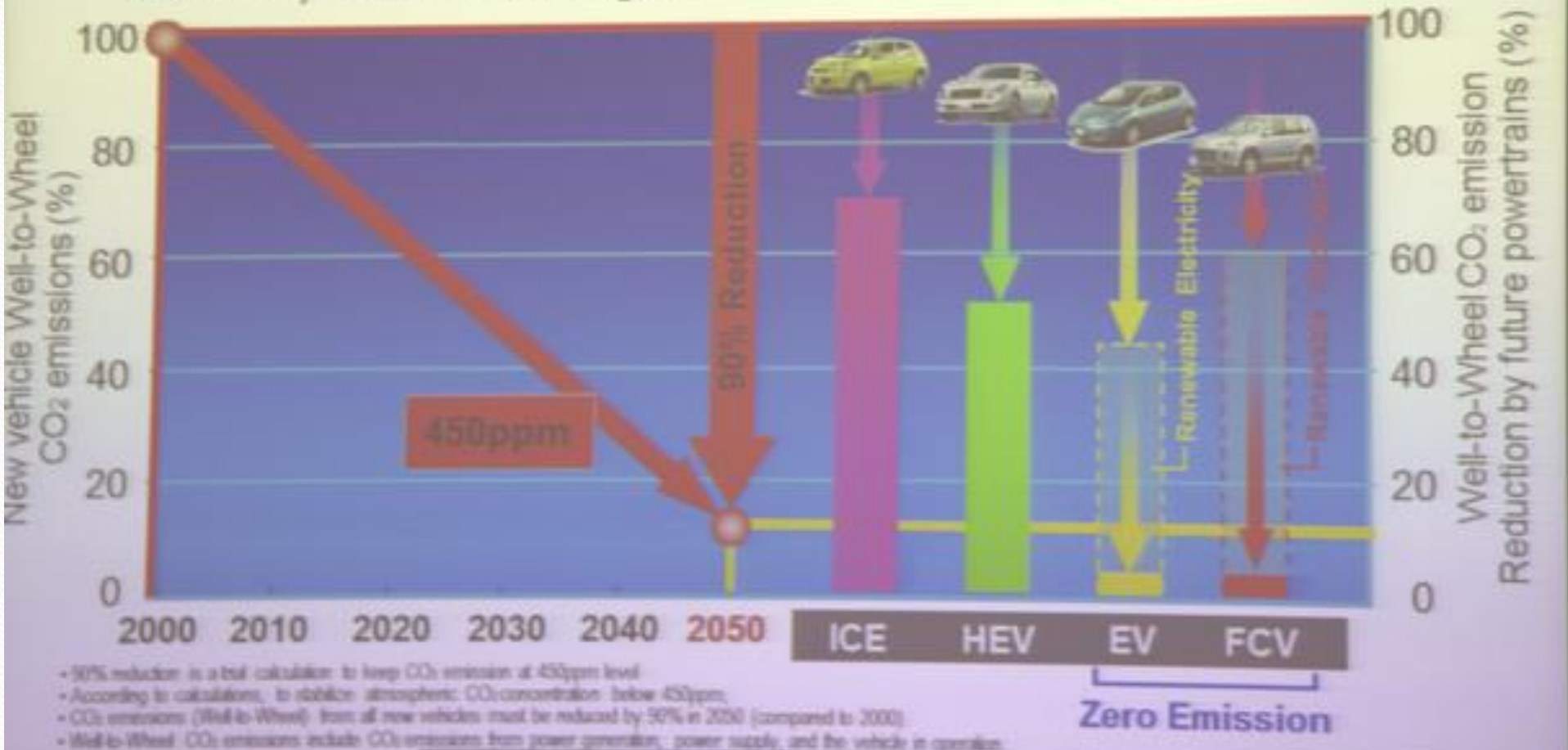
Long-term targets for CO2 reduction

- IPCC(Intergovernmental Panel on Climate Change) requires 450ppm of CO2, which corresponds to 90%* reduction of new vehicle's CO2 emission by 2050
- "Zero emission vehicles" and "Clean energy generation" are necessary to achieve the goal

*: Nissan's estimation



- 90% reduction is a trial calculation to keep CO_2 emission at 450ppm level
- According to calculations, to stabilize atmospheric CO_2 concentration below 450ppm,
- CO_2 emissions (Well-to-Wheel) from all new vehicles must be reduced by 90% in 2050 (compared to 2000)
- Well-to-Wheel CO_2 emissions include CO_2 emissions from power generation, power supply, and the vehicle in operation

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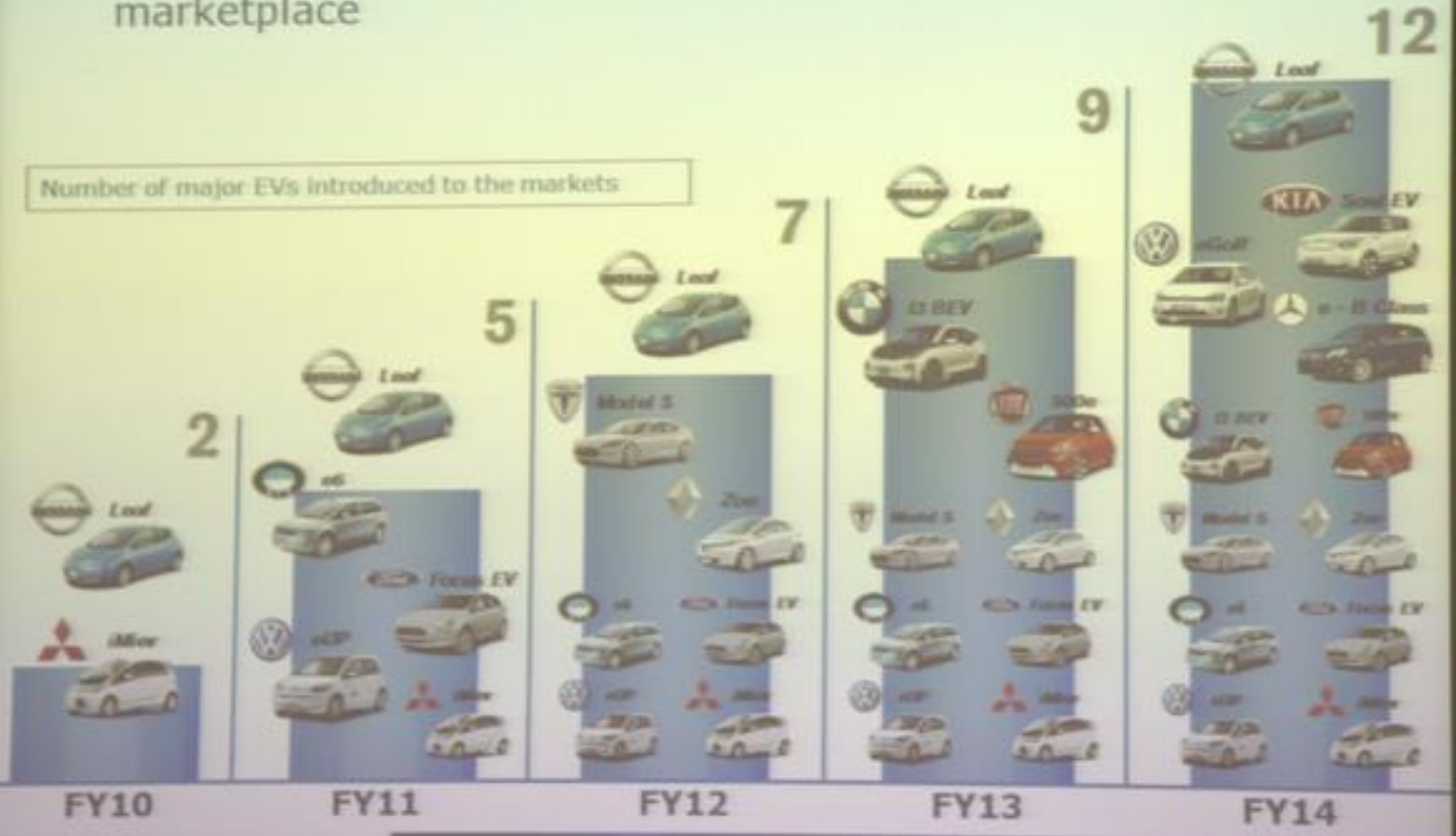
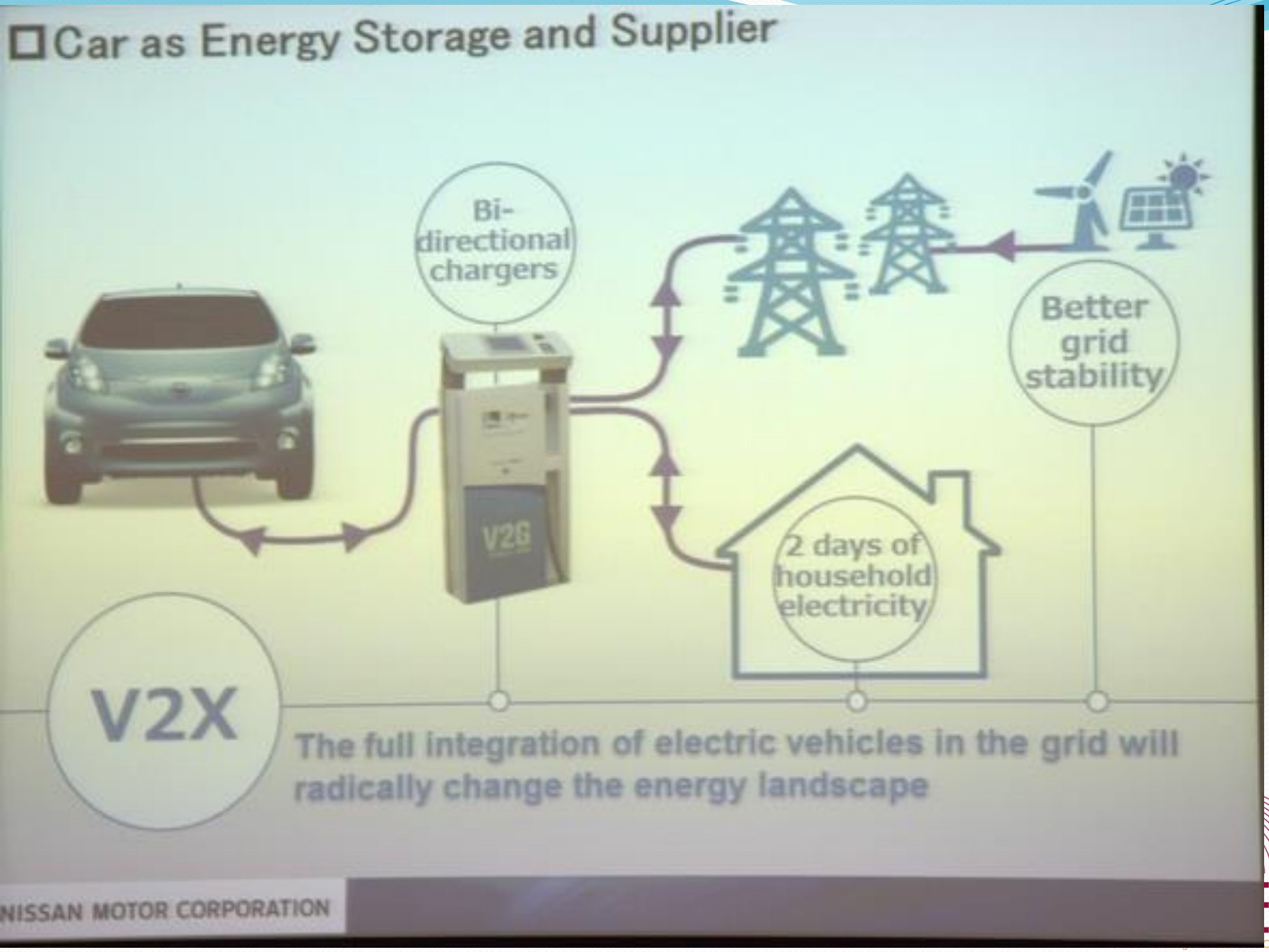
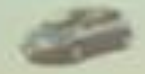
EV Product Offering in the Market

- EVs are gaining more exposure and acceptance in the global marketplace




Car as Energy Storage and Supplier
Bi-directional chargers
Better grid stability
2 days of household electricity
V2G
V2X
The full integration of electric vehicles in the grid will radically change the energy landscape
NISSAN MOTOR CORPORATION

Car as Energy Storage and Supplier

EV Battery Capacity		Electricity Consumption
1 	24 kWh	 A House 10 kWh/day
100 	2.4 MWh	 A Building ~10MWh/day (Nissan GHQ, 10MWh)
27,000 	648 MWh	 Yokohama city Nishi district 53,000 Households ~530MWh/day

Nissan LEAF

Electric Vehicle Sedan

107 miles (pure electric)
$29,000

full review
photos
news

The Nissan LEAF is by far the most popular EV in the world. It is a well-equipped, all-electric hatchback that seats five adults and can travel up to 107 miles on a single charge. The LEAF is available to test-drive and purchase at Nissan dealerships throughout the United States.

Tesla Model 3

Electric Vehicle Sedan

200 miles (pure electric)
$35,000

full review
photos
news

Tesla would have to defy all expectations to achieve success on the Model 3, while avoiding all the potential pitfalls—not only for the 200-mile $35,000 Model 3, but a massive new battery factory, and the Model X that comes first. Can Tesla do it again?

http://www.plugincars.com/cars

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Proposed Investment Projects by Each Country

(Based on brainstorming session on 29 July in Tokyo and updated on 9 September in KL)

Project No.		AFG	AZE	KAZ	KGZ	MON	PAK	TAJ	TKM	UZB
	A. Supply Side									
1	Solar powered micro-grid for remote areas	✓			✓			✓		
2	Adoption of clean coal technologies in power generation			✓		✓	✓			
3	Improve efficiency of solar industry / establish new industry					✓			✓	
4	Solar off-grid to reduce demand from diesel	✓			✓	✓	✓	✓		
5	Recycling of municipal waste for power generation	✓		✓			✓	✓		✓
	B. Electric Vehicle and Storage									
6	Battery based grid storage for reliability improvement of renewable energy			✓		✓		✓		✓
7	Electric vehicles (bus, cars, motorcycles and scooters) pilot for government fleet and public transport	✓	✓	✓			✓	✓	✓	✓
	C. Demand Side and Distribution Efficiency									
8	Demand responses through smart meters and diversified tariffs									✓
9	LEDs for public lighting and offices	✓	✓		✓		✓			
10	Efficiency in distribution efficiency and loss reduction			✓	✓		✓	✓		✓
11	Improve load dispatch systems and distribution control with SCADA	✓			✓	✓		✓		✓
12	Reduce heat losses in office buildings by retrofitting				✓	✓				

✓ Proposed in Tokyo on 29 July 2015 and confirmed in KL on 9 September 2015 (AZE and TKM did not participate)

✓ Proposed on 9 September 2015 in KL; For AZE and TKM, proposed in Tokyo on 29 July 2015

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Project No.		AFG	AZE	KAZ	KGZ	MON	PAK	TAJ	TKM	UZB
	B. Electric Vehicle and Storage									
7	Electric vehicles (bus, cars, motorcycles and scooters) pilot for government fleet and public transport	✓	✓	✓			✓	✓	✓	✓
	Electric bus	✓		✓			✓	✓		✓
	Electric cars	✓		✓			✓	✓		✓
	Electric motorcycles							✓		
	Electric scooters							✓		

✓ Proposed in Tokyo on 29 July 2015 and confirmed in KL on 9 September 2015 (AZE and TKM did not participate in KL)

✓ Additional information provided on 9 September 2015 in KL; For AZE and TKM, proposed in Tokyo on 29 July 2015

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Leapfrogging…

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