

**CHAdemo Europe
members meeting**



CHAdemo technical roadmap

October 20, 2015

Tomoya Imazu

Head of V2H WG

Contents of my presentation today



- Introduction of V2X applications
 - Products in the market
 - Field demonstration

- High power



Technical roadmap

V2X: Products

**by Tomoya IMAZU
CHAdemo**

Example of Market Products [1/]

- Nichicon released advanced lineup of V2H fully compatible to CHAdEMO Evs in August 2014.



EVパワー・ステーション商品ラインアップ



EVPS 高機能モデル (ZHTP1900R)

- ・目的: 充電、ピークシフト、非常用電源
- ・メリット: 室内操作&モニター、快適充電、家庭用燃料電池等との併用による使用環境拡大
- ・対象顧客: 戸建中・大型住宅のアップグレード層
- ・販売戦略: 一般顧客向拡販

Charge, peak shift, home backup, indoor monitor etc



EVPS 標準モデル (ZHTP1580R)

- ・目的: 充電、ピークシフト、非常用電源
- ・メリット: 高出力給電、倍速充電
- ・対象顧客: 戸建住宅、小規模事業所
- ・販売戦略: 一般顧客向拡販

Charge, peak shift, home backup



EVPS コンセントモデル (ZHTP1700R)

- ・目的: 充電、非常用電源(BCP対策)
- ・メリット: 15A x 2、倍速充電、低価格(工事代・急速充電器比)
- ・対象顧客: 集合住宅、避難所、自治体庁舎、事業所
- ・販売戦略: 法人向拡販(EV保有法人)

Charge, peak shift, dedicated outlet

Example of Market Products [2/]



- Mitsubishi Electric introduced grid-connected V2H, named “SMART V2H” in July 2014. Installation-by-installation permission of grid operator is required in Japan, often F2F explanation instead of paper work only.
- However you have another way to be easy now. By getting type certification at JET, the process is quite easy as in solar installation.



Example of Market Products [2/]

- **Solution of the grid, by the grid and for the grid!**



FASTO V2G CHARGING SYSTEMS

The V2G 10 charging station is a bidirectional charger, being capable of charge and discharge a car at 10kW allowing getting benefits from different grid applications: Time shift, Power balancing and Power quality support.

- FASTO V2G 10 indoor
- FASTO V2G 10 outdoor
- FASTO V2G 10 wall bolx



Technical roadmap

V2X application example

“Smart maui”

/isolated grid with renewable power source

“M-tech Labo”

/factory application

“Yokohama Smart City Project”

/city-oriented smart grid integration

by Tomoya IMAZU
CHAdEMO V2H WG

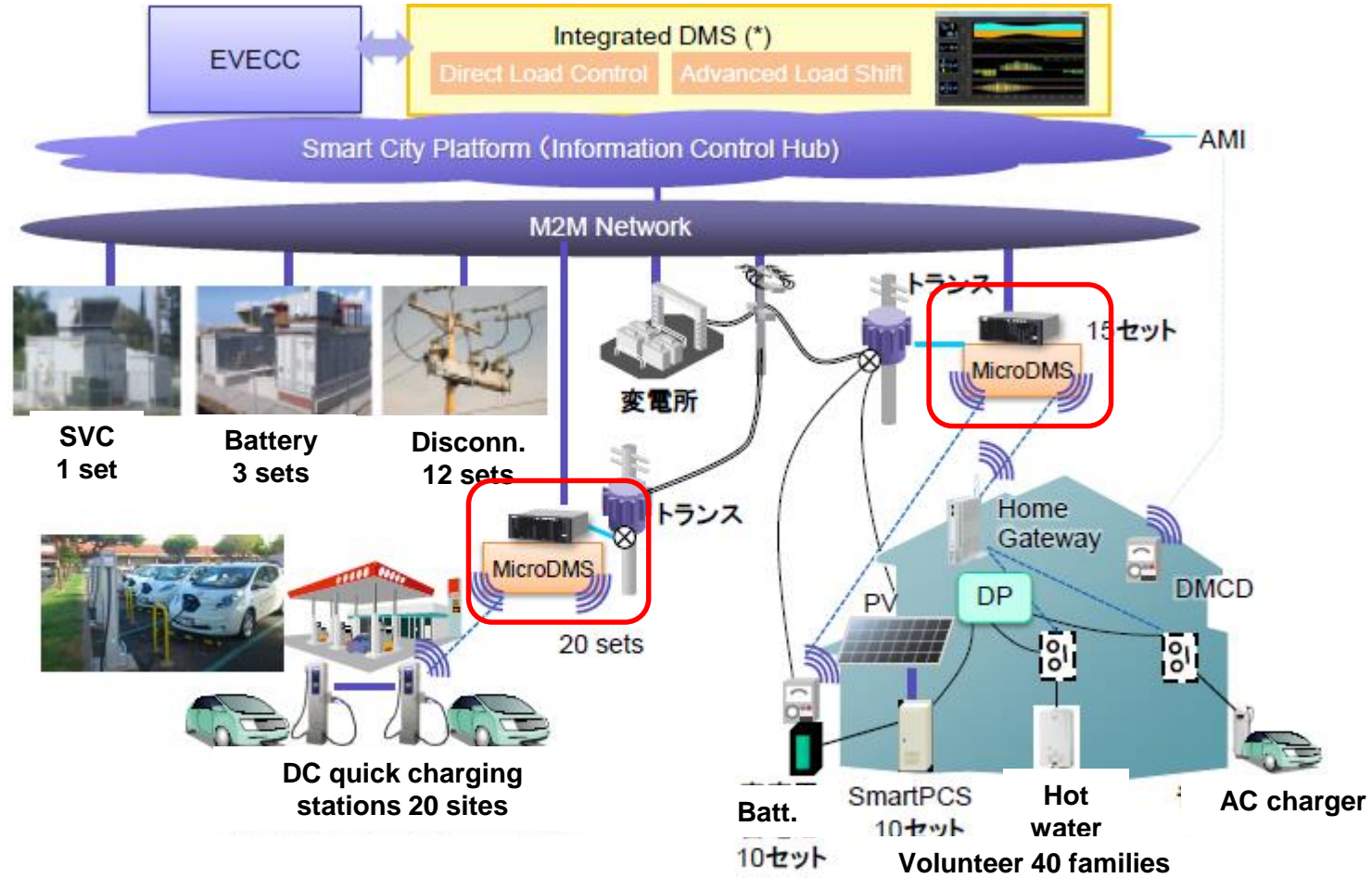
JUMP smart Maui PJ



Communication/control system is designed for total/individual optimization of operation

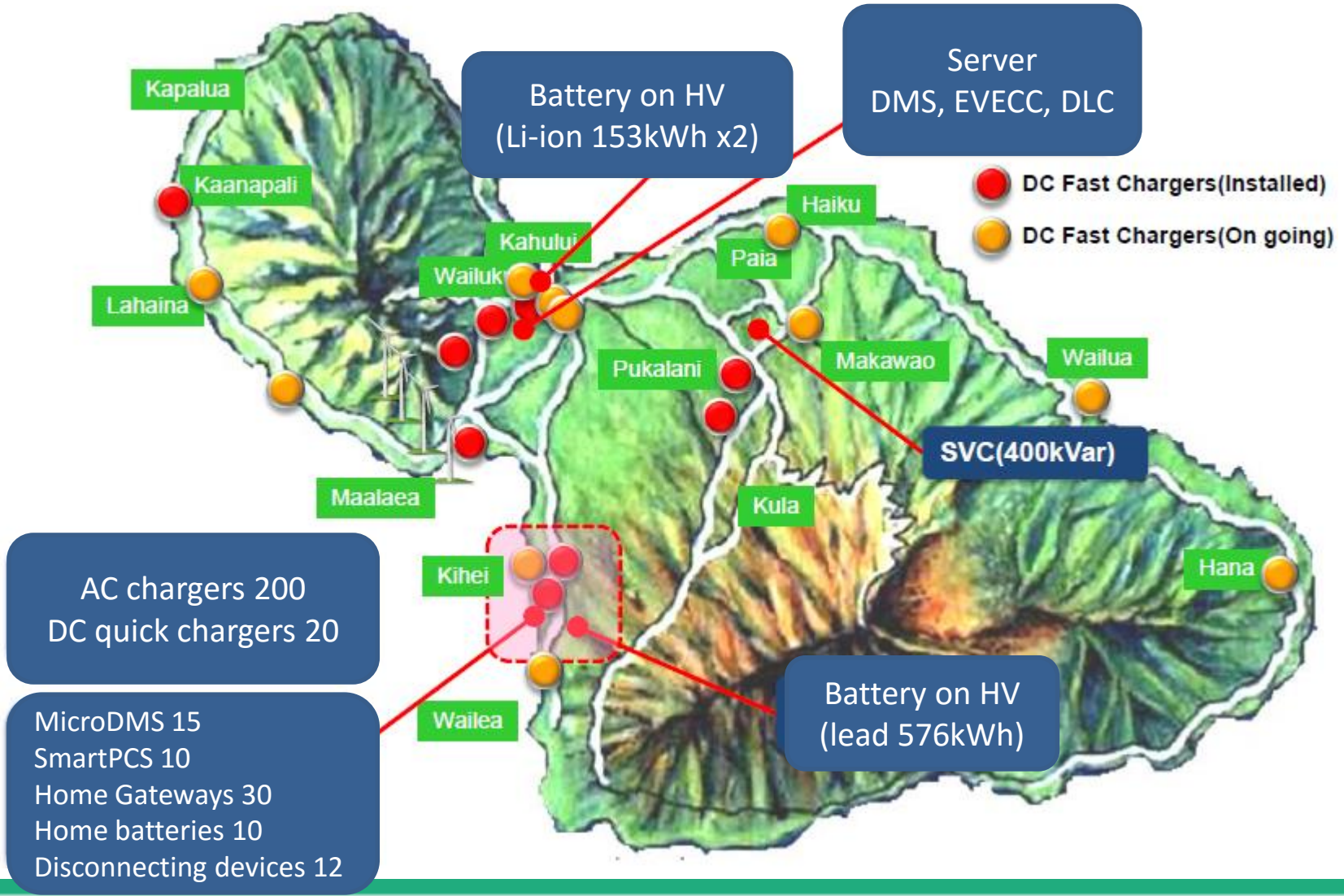
Total Optimization

Individual Optimization



EVECC: EV Energy Control Center	AMI: Advanced Metering Infrastructure	DP: Distribution Panel
DMS: Distributed Management System	M2M: Machine to Machine	PV: Photovoltaic
DLC: Direct Load Control	SVC: Static Var Compensator	PCS: Power Conditioning System
DR: Demand Response	DMCD: Data Measuring & Communication Device	

JUMP smart Maui PJ



JUMP smart Maui PJ

Cooperation of local companies and organizations and the local events are the key to success for gathering volunteers for field demonstration
We are succeeding to get 500 volunteers!



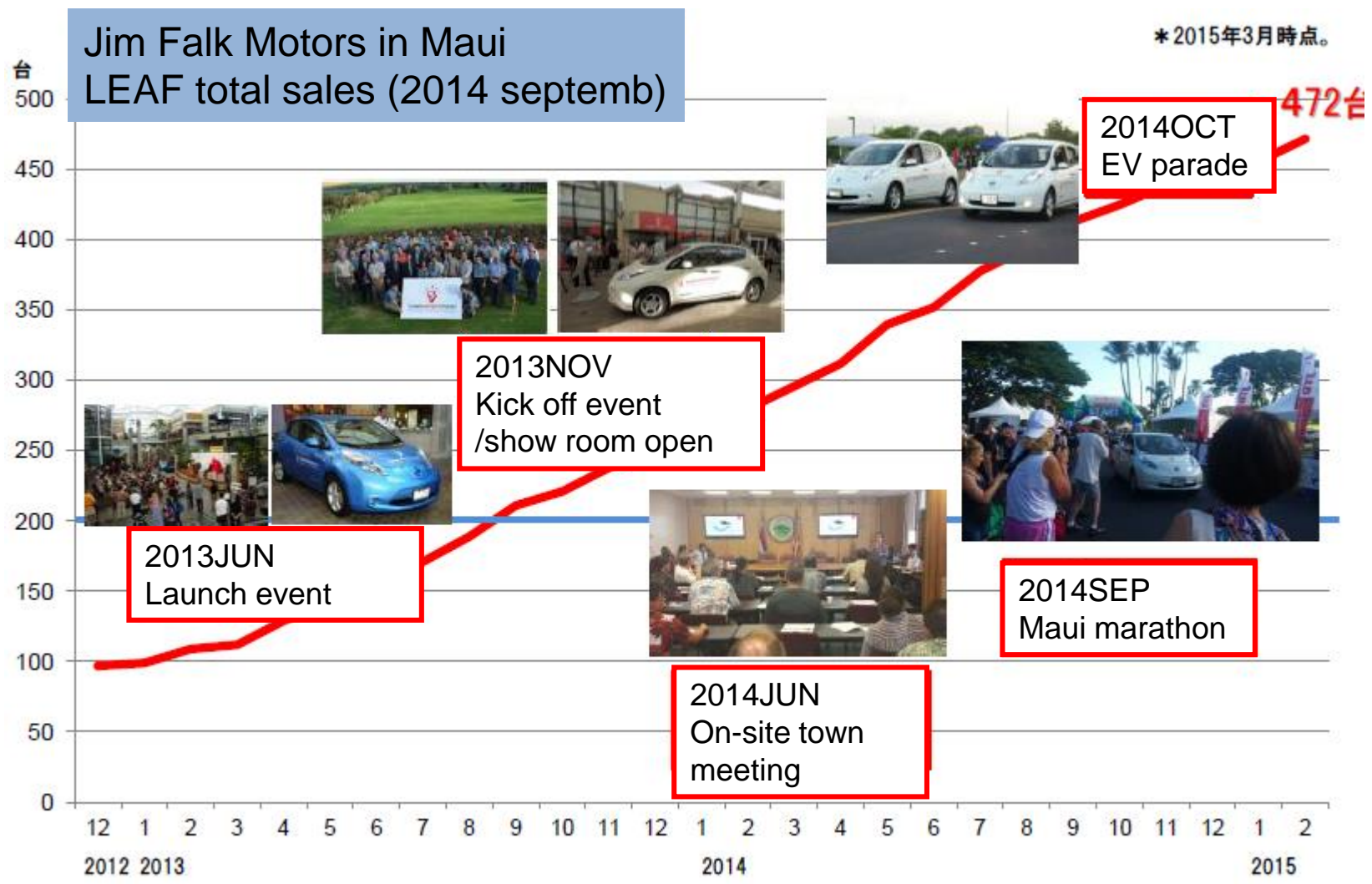
SmartMaui Project: kick off event at shopping mall



EV membership, EV parade, various events...



JUMP smart Maui PJ



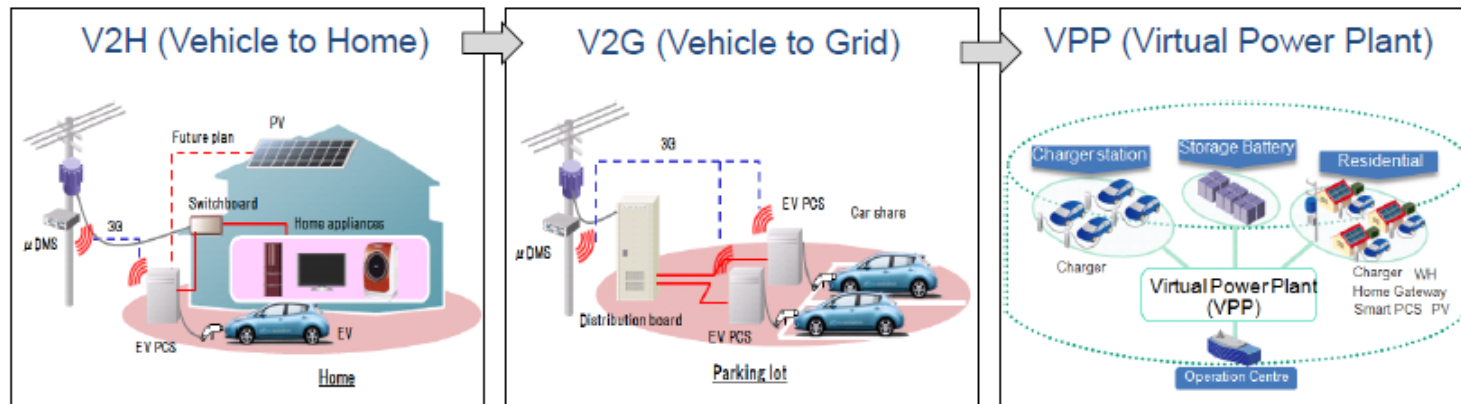
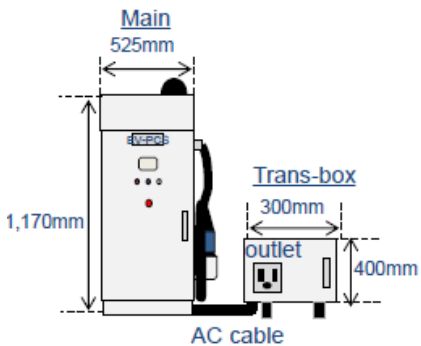
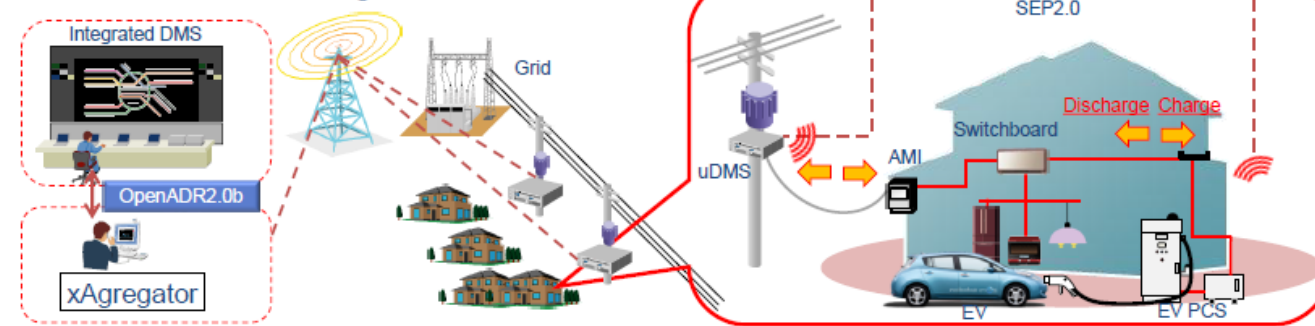
* 北米日産様よりご提供販売実績

JUMP smart Maui PJ



- Next step: application of EV battery for V2G
 - V2G-PCS: development on-going
- Target: V2G for **VPP**: Virtual Power Plant

<Hierarchical control using EV PCS>



Field demonstration #2: M-tech Labo (V2B/F)

- Factory energy management with V2B & iMEV
- Field demonstration started in 2012



スマートグリッド実証試験装置「M-tech Labo」



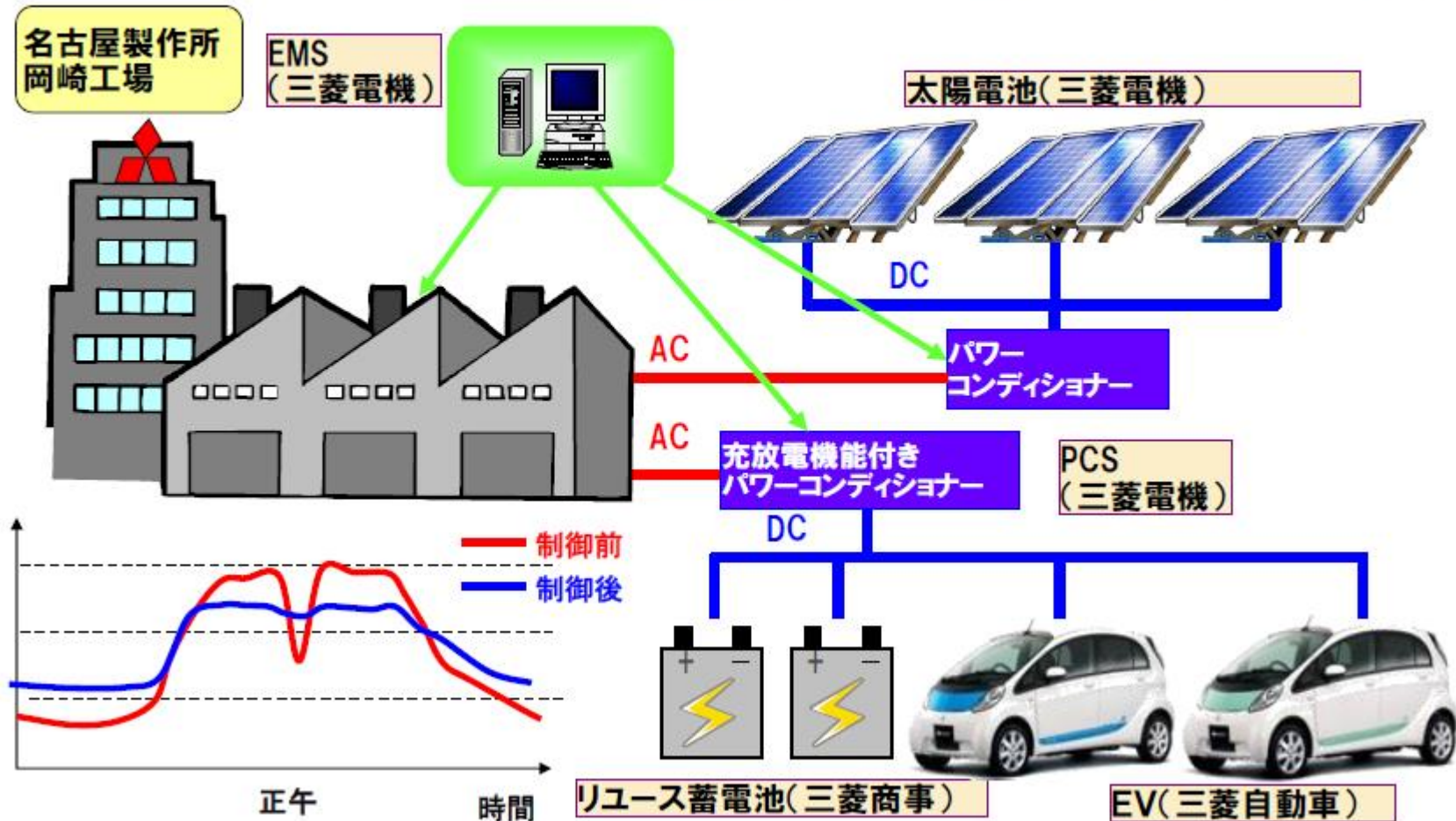
充放電スタンド



リユース蓄電池

M-tech Labo (V2B?)

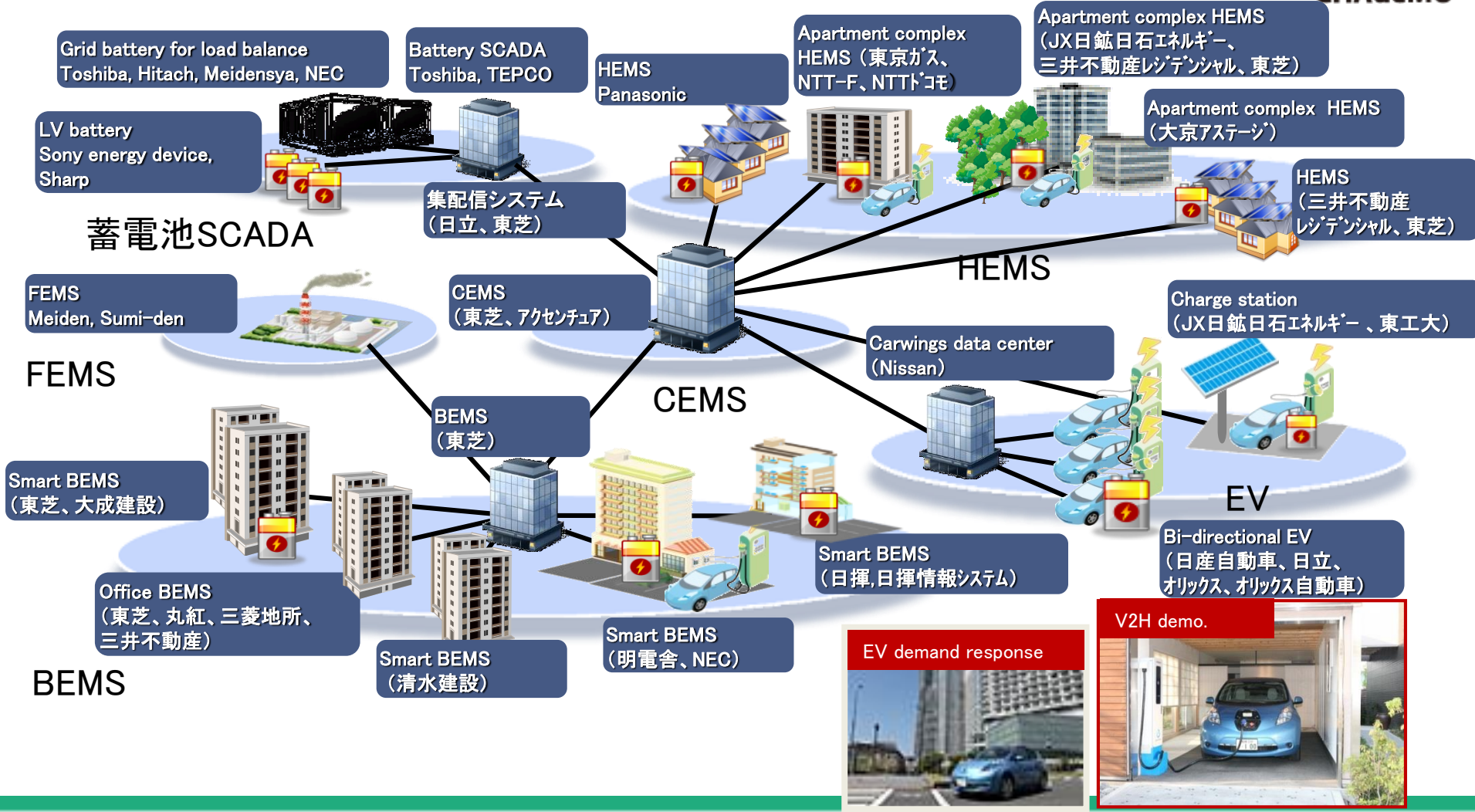
- Power management of Okazaki works, Mitsubishi Motors, with solar, EV and re-use battery for load leveling



Yokohama Smart City Project



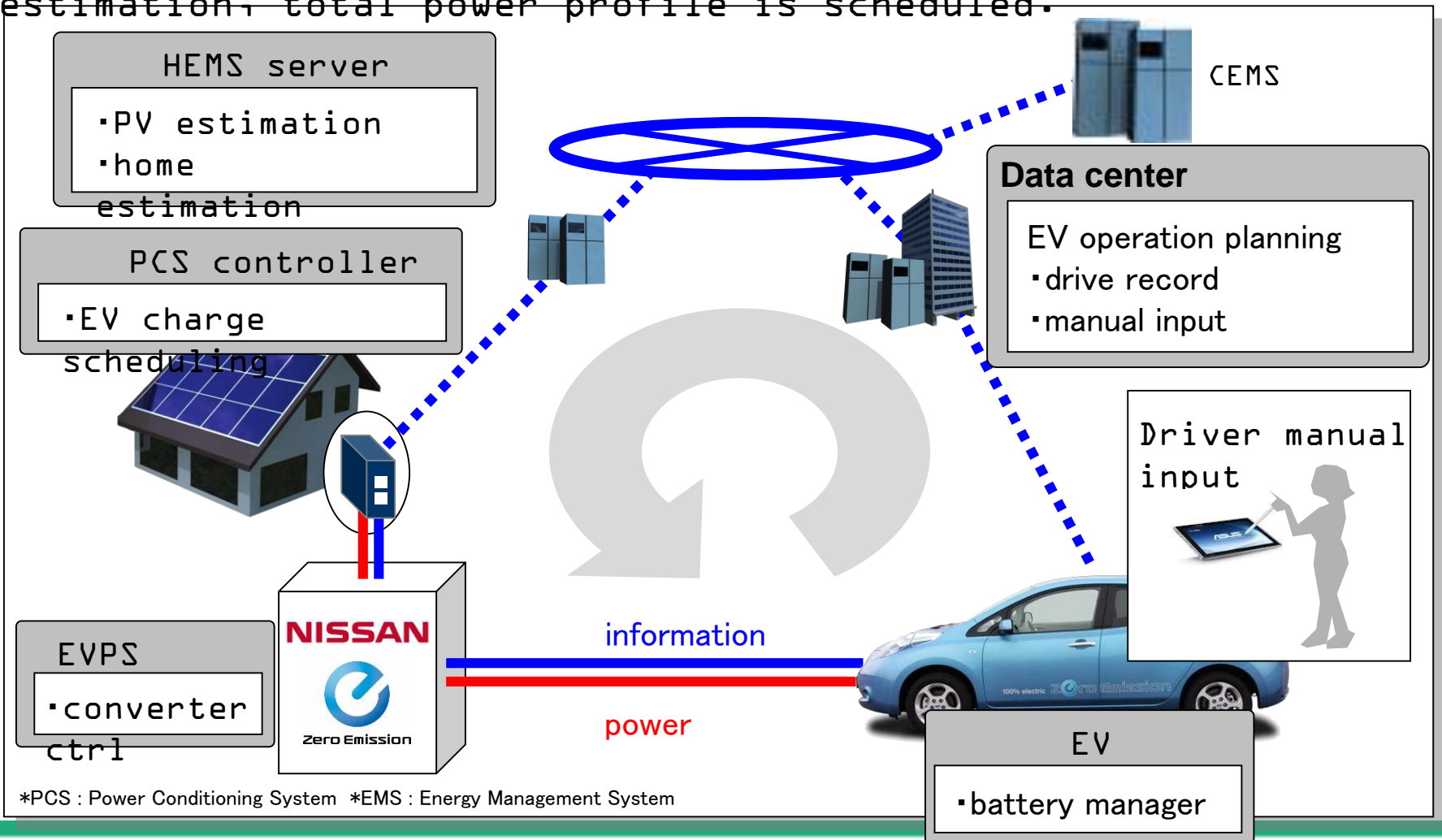
- CEMS, HEMS, BEMS, EV, SCADA
- Big city and the downtown oriented local energy management





Functional distribution

- EV operation is estimated based on drive record and manual input.
- Combined with solar generation- and home consumption estimation, total power profile is scheduled.



EV operation planning

- Basic operation planning is generated with EV operation history.
- User can edit and add his/her own schedule.



Zero Emission

Remote Control | Energy Management

リモート充電 | 乗る前エアコン | 利用計画メニュー

利用計画の表示・編集 | その他の設定

● 車の利用計画の表示・編集

車両走行情報から推定された車の利用計画を表示しています。
車への充電や車からの給電は表示
利用計画を編集・削除したい場合
利用計画を追加したい場合には、

2012/08/28 10:19作成

08/28 (火)
10:00 11:00 12:00 13:00 14:00 15:00

充電量指定: 80%充電(バッテリー)

Maunal input

Weekly plan

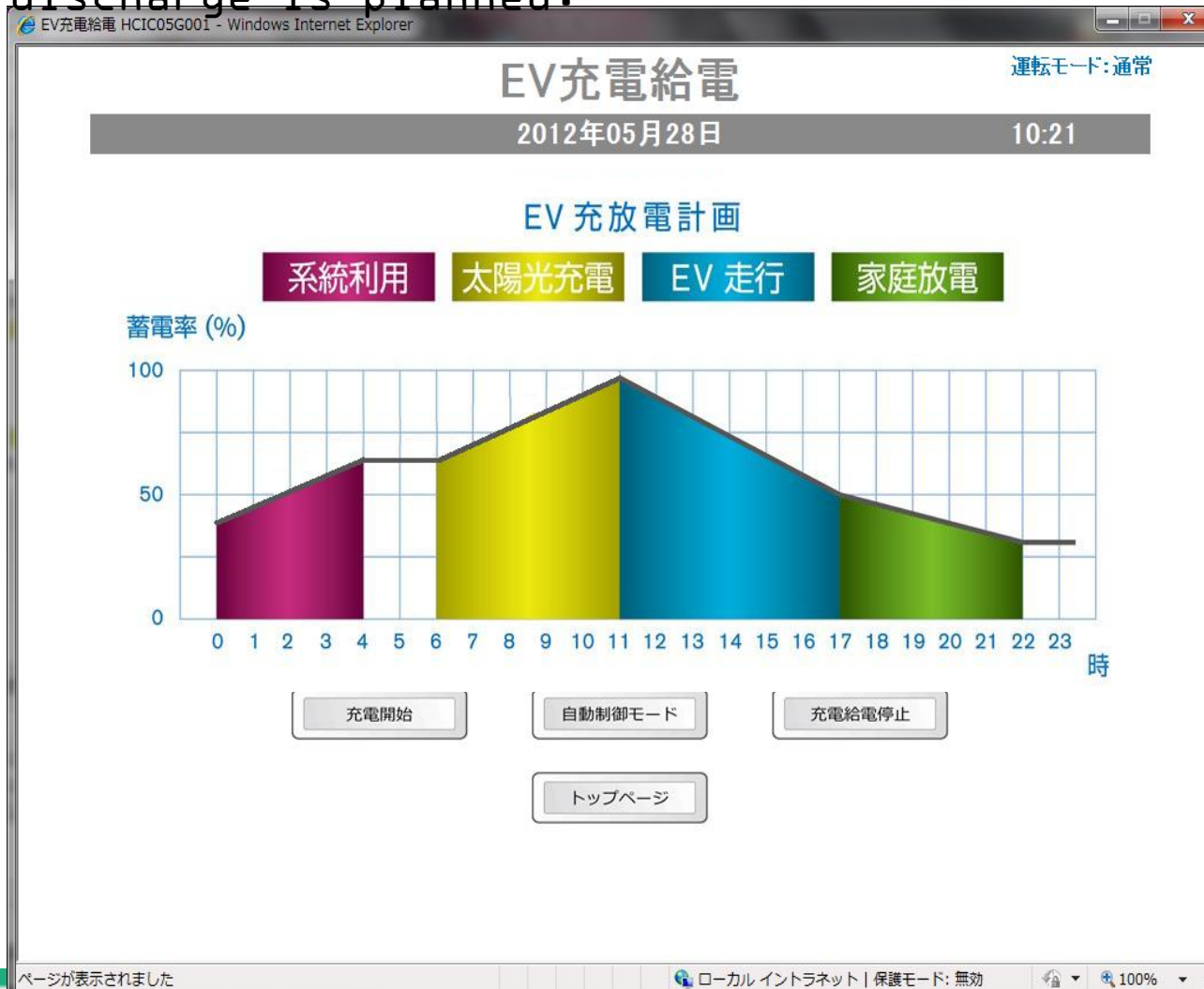
選択	利用計画時間				予定走行距離	繰り返し期間	登録状態
	利用開始		利用終了				
<input type="radio"/>	2012/08/28(火)	10:00	2012/08/28(火)	17:59	42Km		
<input type="radio"/>	2012/08/30(木)	14:00	2012/08/30(木)	16:59	22Km		
<input type="radio"/>	2012/08/31(金)	11:00	2012/08/31(金)	11:59	8Km		
<input type="radio"/>	2012/09/01(土)	13:00	2012/09/01(土)	16:59	35Km		
<input type="radio"/>	2012/09/02(日)	10:00	2012/09/02(日)	17:59	50Km		
<input type="radio"/>	2012/09/03(月)	12:00	2012/09/03(月)	13:59	20Km		
<input type="radio"/>	2012/09/04(火)	10:00	2012/09/04(火)	17:59	42Km		

編集 | 削除 | 新規登録

設定施設ID: 0000000100000001100000000000001

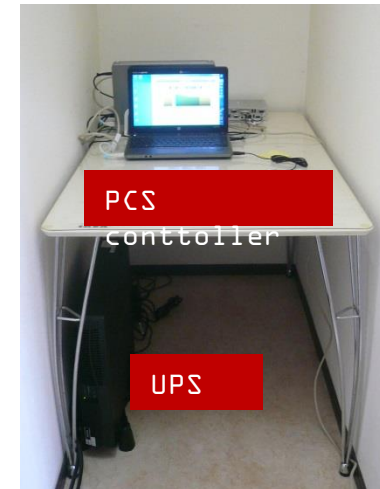
EV charge/discharge scheduling

- EV operation plan, PV generation estimation, home consumption estimation are integrated and daily charge/discharge is planned.



V2H demonstration at home

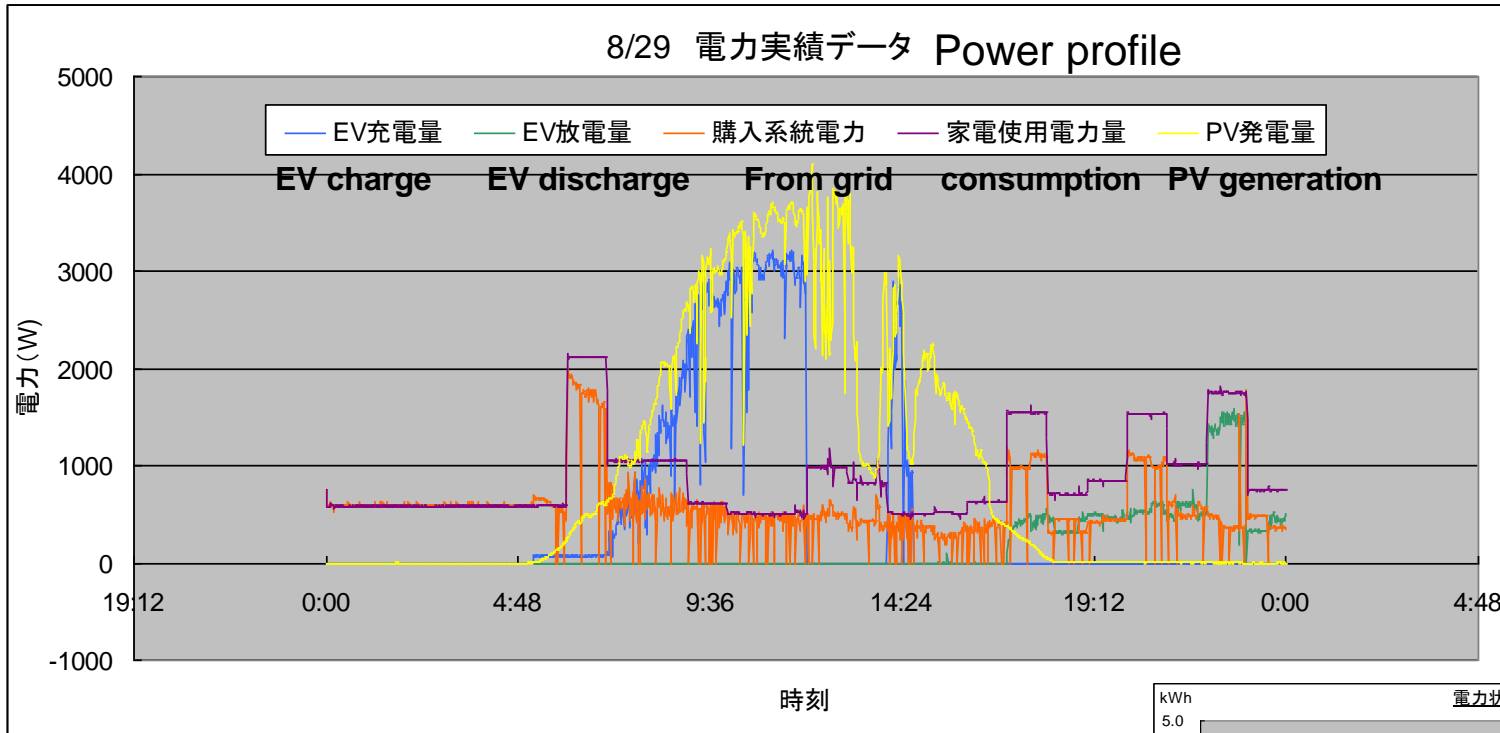
--- installation



This transformer is just for single phase 3 wire distribution in stand-alone mode (Japan specific)

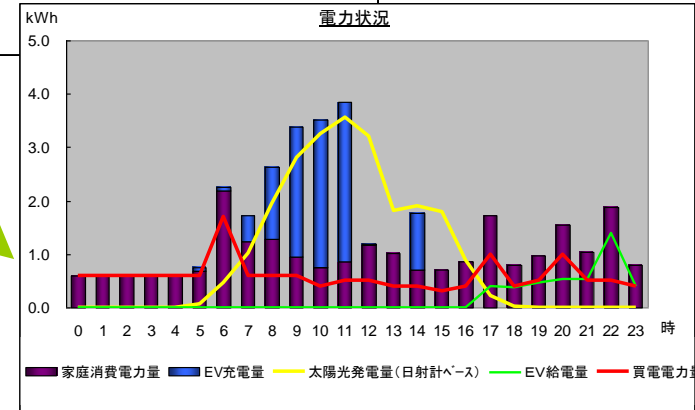


■ Data is sent to laptop per minutes.



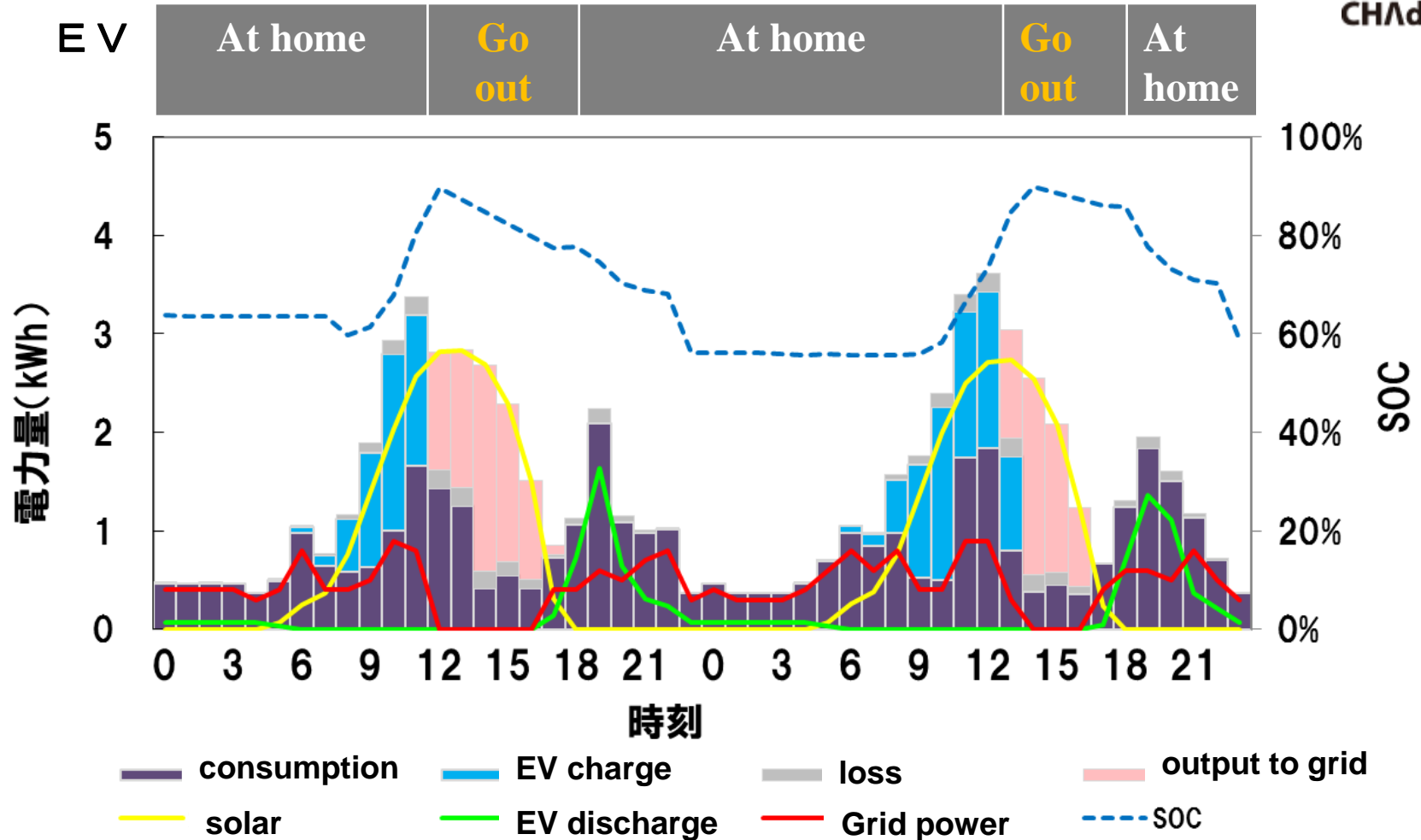
時刻

Minute ⇒ hour



Charge/discharge operation example

- All power flow is monitored/logged and used for future scheduling optimization.





Technical roadmap

High Power!

Why? How?
What' the issues?

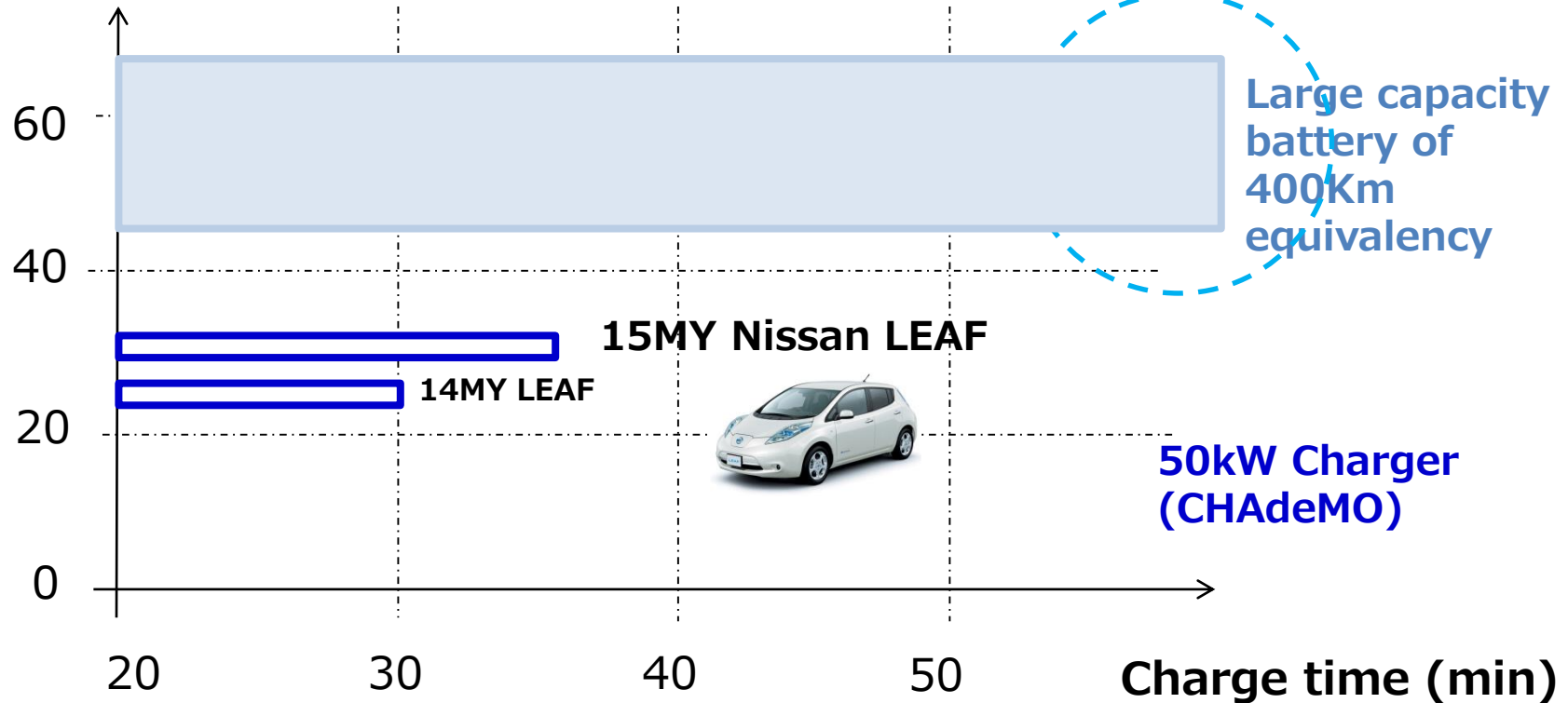
by Tomoya IMAZU
CHAdeMO V2H WG

High Power: Background

- Charge time with becoming macroscale



Battery Capacity
[kWh]



Background

- It is higher than a 100kW in the standard, but 50kW is considerable by the practical use.







	Max power in the standard	Max power in the practical use
CHAdEMO	500 V 125 A (62.5 kW)	50kw (400V, 125A)
Combo	850 V 200 A (170 kW)	50kw equivalency
China	750 V 250 A (187.5 kW)	50kw equivalency
Tesla	400 V 300 A (120 kW)	120kw

Hypothesis



- Measure by increasing of the electric current
- To secure compatibility between
 “New High Power QC or Current Existing QC”
 AND “New High Power applied EV”

EV Compatibility	Voltage increase		Current increase	
	Charger	Old Spec	 Not fully Charged	 Chargeable
		New Spec	 Chargeable	 Chargeable

Hypothesis

■ Target Current: 250A



Simulation Result

1. Accessible Cable Diameter is expected around 70sq.
2. 250A is effective in Duration Reduction.

Charge Time Simulation of the 400km equivalency battery

Output Electric Current [A]	125	250	375
Charge Time <Ratio>	100%	55%	47%

Tasks for 100kW



■ Hardware

- ✓ Cable; High Current/ Low Temperature
Lightweight/ Ease of Bending/ Cost
- ✓ Electronic Magnetic Compatibility Design

■ Standard

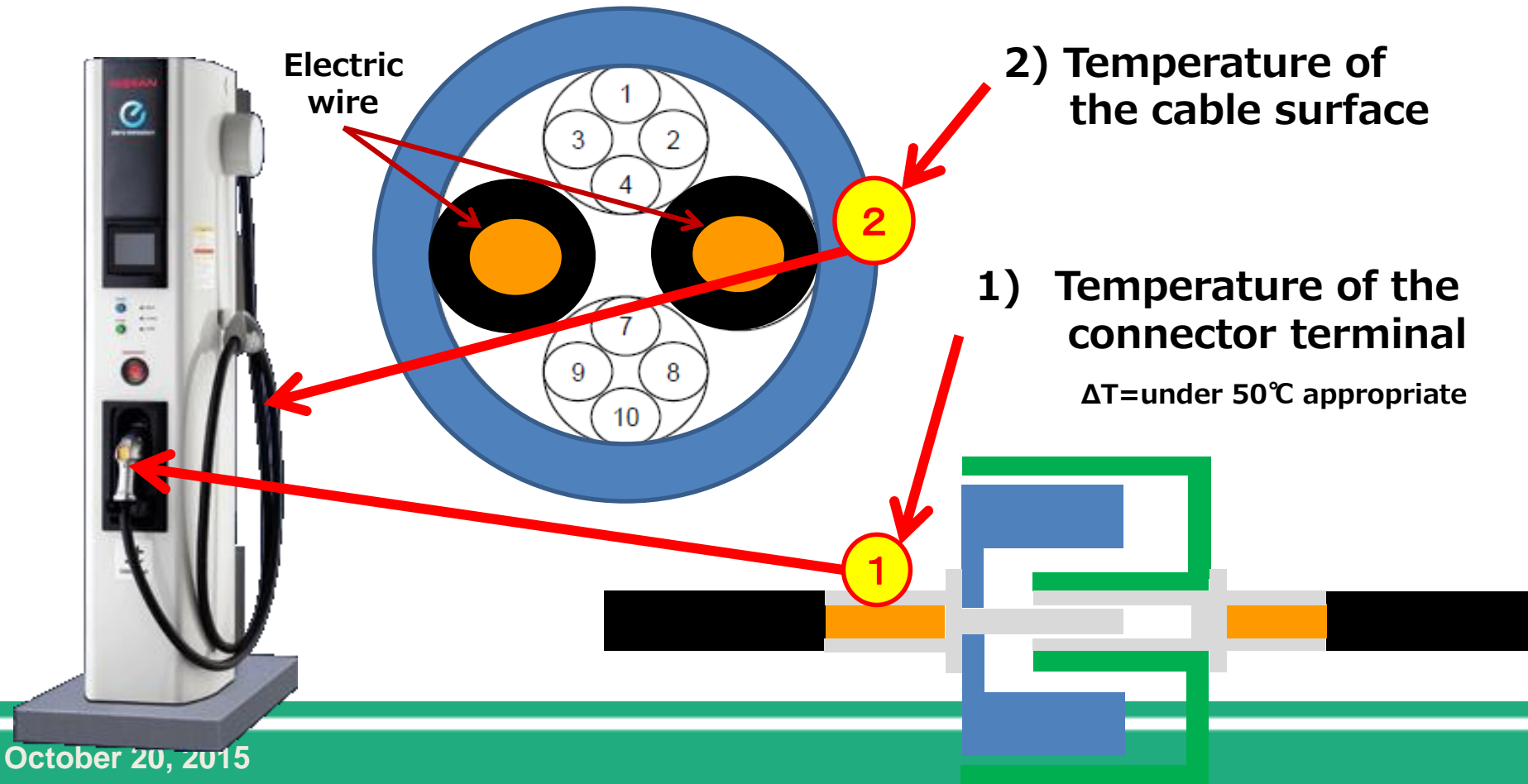
- ✓ High Output Power Specification (accordingly)

Tasks for 100kW

■ Thermal Damage

Temperature rising by large current

- 1) Connector Terminal (Internal Damage by a Fire)
- 2) Cable Surface (burn)



Tasks for 100kW



- **EMC** (Electronic Magnetic Compatibility)
 - ✓ EMC turns worse double theoretically.
 - ✓ Keep EMC influence* as current specification level



- Inspecting a difficulty
- Possible Solution

*) Influence of EMC (Pacemaker, Radio noise etc.)

Tasks for 100kW

- CHAdeMO Standard to be Modified as follows

1. Output range

DC 0~125A⇒0~250A* (*; tentative)

2. Temperature Standard of the cable outer

Can be added as "cable periphery temperature management is needed so that harm (burn) does not extend to the users."

3. EMC

No Change, Need Keep Existing Standard



Conclusion



- **High Power Output is Possible and Feasible**
- **Need to Solve Technical Challenges**
- **Points to be Considered**
 - ✓ **Output Power; 100kW or more**
 - ✓ **Compatibility; EV and QC Compatibility**
 - ✓ **Cable; Handlings / Thermal measure**
 - ✓ **EMC; Keep Current Level**
 - ✓ **Cost; Minimum Increase**
 - ✓ **Usage; Optimum Location to install**
 - ✓ **Volume; Global Market Volume**



Thank you for your attention!!!