Issues on Smart Grid

이 진 _LS산전 이사
Issues on Smart Grid

1. Overview
2. System
3. Interoperability
4. Challenges/Issues
1-3. Smart Green City

- The Green City will be realized in the intelligent power infrastructure called 'Smart Grid', based on green energy technologies such as renewable energies, eco-friendly power sources, hyper conductivity, energy storages, eco-friendly power devices, green car, and LEDs.

2-1. Systems on Smart Grid

<table>
<thead>
<tr>
<th>Generation</th>
<th>Transmission</th>
<th>Distribution</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection</td>
<td>Protection</td>
<td>Protection</td>
<td>Protection</td>
</tr>
<tr>
<td>Power Grid Control</td>
<td>Substation Control</td>
<td>Remote Terminal Unit</td>
<td>Lead Point Unit</td>
</tr>
</tbody>
</table>

- EMS
- GCS
- SCADA
- SAS
- AMI/AMR
- DMS/DAS
- Smart Customer
- Micro-Grid
- EV Infra.
2-2. Micro-Grid

- Conventional Distribution System
  - Uni-Directional Power Flow
  - Load Forecasting & Generation Planning
  - Bulk Generation
  - Electric Power

- Micro-Grid
  - Bi-Directional Power Flow
  - Unpredictable Generation
  - Small Scale DERs
  - Combined Heat and Power

2-3. AMI System - Configuration

- Integration Framework
- Billing
- DR Manager
- GIS
- Back office Service
- Collector
- WAN
- Smart Energy Platform
- Smart Energy Network
- Smart Home
2-4. AMI System – Residential house

2-5. AMI System – Residential house

**Home Automation**

**Home automation**
1) Remote control
2) Sequential control
3) ...

**Security**
1) Video phone
2) Door lock
3) Gas valve
4) ...

**Energy Usage Awareness**
- Killer Application of Home network
3-1. Standards for Interoperability

- Smart Meter
  - KS C 1214
  - Not enough for Smart Meter
- Appliance
  - No capability for remote control
  - No definition/No standard for smart appliance
- Utility Network
  - Utility(KEPCO) specification
  - Based on KS X 4600 (BPL) – (Co-existence)
- Telecommunication Network
  - Many IP based standards – (Guideline for SG)
- Home Area Network
  - No dominant standard
  - Every vendor uses their own proprietary solution

3-2. Standards for Interoperability (Cont.)

- EV Charging
  - Compatibility to various EV vendors
  - Functionality depends on Pricing policy
- Customer EMS Systems (B-EMS, H-EMS, ...)
  - Definition, Minimum functionality, System Guideline, ...
- Information Modeling/Representation for interoperability
  - Price information/DR signal, Time sync., ...
- Information Security
  - No experience → Begin with Risk assessment
  - “Light” security solution for small devices
- Future Service
  - Upgradeability is new issue
3-3. Example of Priority Standards – Appliance

- HAN Connectivity
  - Remote control functionality for Load Controller
  - HAN Connectivity
- “Smart” functionalities
  - Energy functions
  - Demand responsive
  - Other Service

4-1. Challenges/Issues

- Too many standardization bodies/projects
  - Many projects to deal with similar/same issue
  - Focusing into individual technology
  - Few system-wide projects dealing with interoperability
- Lack of time
  - Implementation is far ahead of standardization
- Variety of stakeholders
  - Utility, Heavy Industries, Constructions, Appliances, ...
  - Lack of communication between stakeholders
- No proven system configuration
  - Every possibility should be considered
4-2. Issues on Deployment

- Variety of Customer Requirements
  - Various Environment / Various Services / Various System

- Benefit < Cost
  - Customers (End User) are not willing to pay for System
  - Low Energy Cost / High System Cost

- Government Driven Deployment
  - Lack of Biz. Model
  - Profit Leads Market

- No standard system configuration
  - Risk on deployment

Q & A
에너지저장기술 비즈니스 모델

오 전근 _ SK에너지 수석연구원
Introduction

1996
- Launched lithium-Ion battery ("LIB") project

2002
- Started manufacturing LIB for electronic devices

2005
- Launched LIB project for HEV application
- Full automation of large format LIB production and awarded i10 EV project

2009
- Launched project for EV & Awarded Daimler GHC project

2010
Vision and Roadmap

Global Leader of Large Format Battery in Automotive & ESS application

Electric Drive Vehicle
Industry & Customer Leading

Energy Storage
- UPS, ESS (Smart Grid)

Competitive Advantages – Value chain integration

- Lithium Mining
- Cathode Material
- Graphite Mining
- Anode Material
- Poly Ethylene
  SK Energy
- Separator
  SK Energy
- Electrode
  SK Energy
- BMS
- Cell
  SK Energy
- Pack

* BMS: Battery Management System
Competitive Advantages – Proprietary Separator

- Separators for others
- SK Energy’s Separator
- CCS: Coated by ceramic layer

Competitive Advantages – Compact and Powerful

- Volume, Weight, and Cost advantages

![Graph showing power density vs. energy density for different vehicles (HEV, PHEV, EV, Li-ion, NiMH)]

Energy Density, Wh/kg

Power Density, W/kg
Seoul Metropolitan EV Program

City EV

Capacity: 2.15kWh
Weight: 20 kg

10kWh

Electric Bus

100kWh

EV Bus (HMC)

- Energy 95kWh
- 380V High Current
- Forced Air-Cooling
- 1,350Kg (incl. frame)
- Pack 10P Sub-modules
- Sub-module 5S modules
- Module Gen 1 25Ah 20S
**EV Bus (HHI)**

Energy 102kWh  
Voltage 608 V  
Weight 960 Kg (module)  
Module 8S 6P

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**i10 EV**

<table>
<thead>
<tr>
<th>Capacity, Ah</th>
<th>140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy, kWh</td>
<td>16</td>
</tr>
<tr>
<td>Motor, kW</td>
<td>50</td>
</tr>
</tbody>
</table>
| Charge       | 100%@220V, 5hr  
               | 85%@430V, 15min |

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**EV Modules**

<table>
<thead>
<tr>
<th>Model</th>
<th>50Ah Module</th>
<th>25Ah Module</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimension</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>217.8</td>
<td>284.2</td>
<td>236.4</td>
</tr>
<tr>
<td>167.6</td>
<td></td>
<td>211.5</td>
</tr>
<tr>
<td><strong>Config.</strong></td>
<td>50Ah Cell x 10S (10.4 L)</td>
<td>25Ah Cell x 20S (16.8 L)</td>
</tr>
<tr>
<td><strong>Energy Density</strong></td>
<td>183.1kWh/m³ (162%)</td>
<td>113.1kWh/m³ (100%)</td>
</tr>
</tbody>
</table>

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**EDV Applications Summary**

**HEV**
- 340V 2.4kWh
- 270V 2.0kWh
- 340V 5.2kWh

**PHEV**
- PHEV 10
- PHEV 20
- 4kWh
- 8kWh

**EV**
- Morning (V2G)
- E-Zone (V2G)
- i10
- Electric Bus
- Electric Bus

**Military HEV**
- DH/Kia
- CT&T
- HMC
- 16kWh
- 10kWh
- 16kWh
- 100 kWh
- 95 kWh
- 20kWh
- HYundai
- Heavy Industry
- HMC
- Kia
Leading Smart Grid Demonstration Program

- SK Energy is leading one of the smart transportation program
- SK Telecom is leading one of the smart place program
- SK Energy is participating with 1MWh battery for smart renewable

  (1st stage: '09~'11.6, 2nd stage: '11~'13)

- Biz. Field: 
  Smart Transportation
    - Renault Samsung, CT&T, etc.
    - Smart Renewable
    - Hyundai heavy industry
  Smart Place
    - SK Telecom
  Smart Power Grid
  Smart Elec. Service

- Budget of 1st stage:
  (Government) 32 million USD
  (Private) 130 million USD

Advanced EV Services with Smart Grid

- Quick charge and wireless communication is essential for EV to address its range limitation issue. Smart grid is the backbone of EV infrastructure
- Battery quick & smart chargers, rental and maintenance program
- GPS based charging spot & emergency information/services

LIB Rent & Service Provider

Battery Rent Car Sharing

EV/PHEV Service Membership Program
SK can provide a single and unique solution with both battery and infra & service to support EV distribution

Car (EV/PHEV) → EV S/P* → Battery Rental, Smart & Quick Charging, Telematics, Maintenance & Other Services → Customer

* EV Service Provider

End of Document