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23rd World Congress on Intelligent Transport Systems

Melbourne Convention and Exhibition Centre

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2016. 10. 14

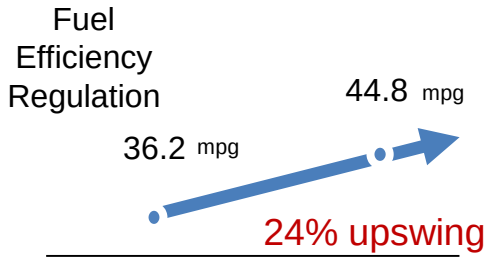
Innovative EV and EV Charging Technologies in Korea

Strengthen the regulation of fuel efficiency to solve environmental problems in each region

'20 : USA 44.8mpg, Europe CO_2 95g/km, China 5ℓ/100km

USA

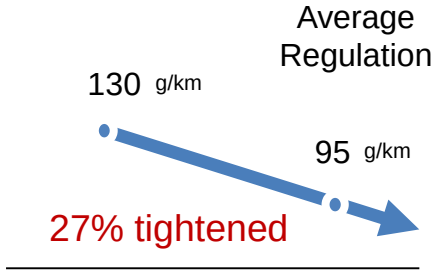
CAFE
(Corporate Average Fuel Economy)



-Penalty : $5.5 per 0.1mpg X Total Sales
ex) 1Million Sales, $55M under 1mpg

Europe

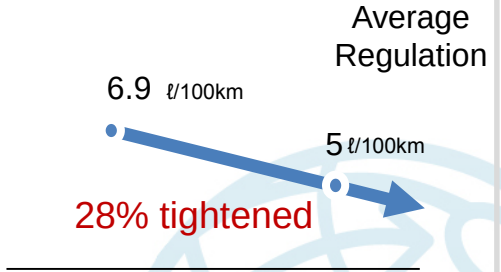
CO_2 Emission



- Penalty : €5~95 X Total Sales (Gradually progressive, €95 after '19)
ex) 1Million Sales, 95M exceeding 1g/km (after '19)

China

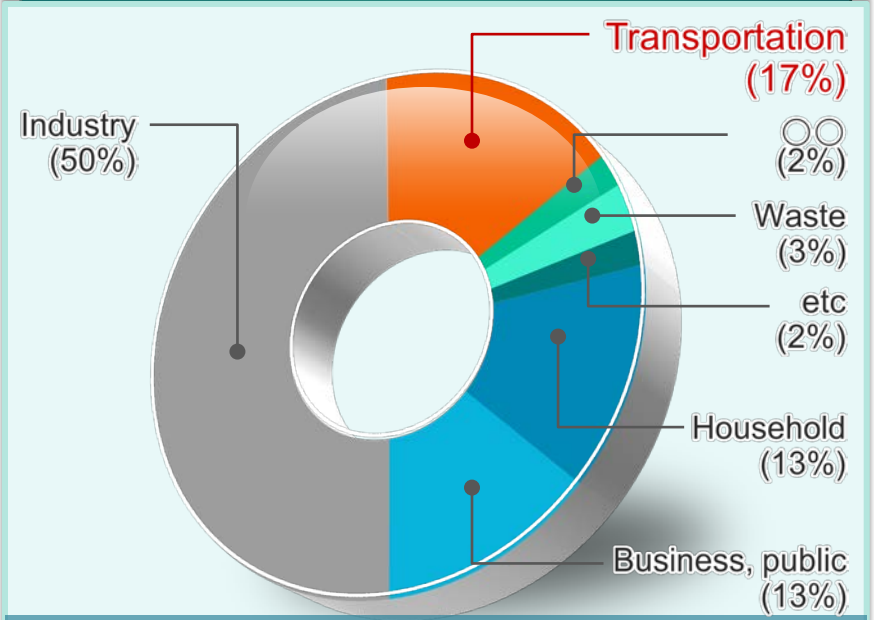
Fuel Efficiency



- Penalty : in the Review

Korean Government is Tightening the National Target of CO2 Emission Reduction

Greenhouse gas emission by sector



17% of greenhouse gas emission from road transportation

Presidential Commission on Green Growth Announced Target

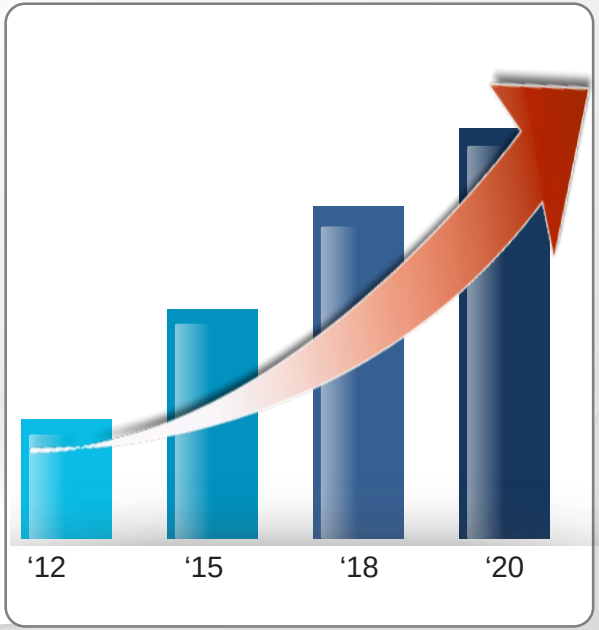
- 1990 — CO_2 emission 298 million tons
- 2005 — CO_2 emission 594 million tons
- 2020 Forecast — CO_2 emission 813 million tons
- 2020 Target — CO_2 emission 569 million tons

To achieve target, need new green technologies to emit less CO_2 for the road transportations

Optional Regulation for Fuel Efficiency & Greenhouse Gas Emission

Upswing target

- Fuel efficiency :18.6 km/ℓ (’16) → 24.3 km/ℓ (‘20)
- CO_2 emission :127 g/km(’16) → 97 g/km(’20)
- Gradual upswing from 2012
- Corporation could optionally meet a regulation either fuel efficiency or gas emission
- Impose penalty on corporations that cannot fulfill either regulation



Domestic EV Dissemination Status

- Expanded to three models from the second half of 2013, added 2 models in 2014

  * Mainly spread in Seoul (688), Jeju Island (360)

- Plan for disseminating EVs : ('16) 0.487 million → ('20) 2 million

< Ray EV > KIA
- Max. Speed : 130km/h
- Battery : Li-Polymer (16.4kWh)
- Driving range per charge : 91km

< SM3 EV > Renault-samsung
- Max. Speed : 135km/h
- Battery : Li-Polymer (26.6kWh)
- Driving range per charge : 135km

< Spark EV > GM Korea
- Max. Speed : 145km/h
- Battery : Li-Polymer (18.3kWh)
- Driving range per charge : 128km

< i3 EV > BMW Korea
- Max. Speed : 150km/h
- Battery : Li-Polymer (21.3kWh)
- Driving range per charge : 132km

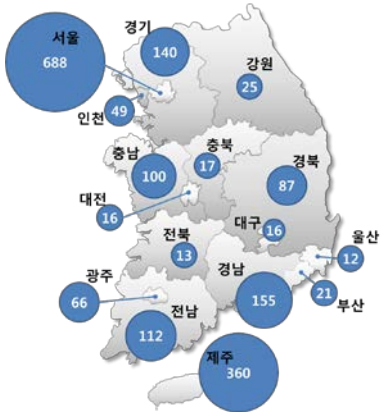
< Soul EV > KIA
- Max. Speed : 145km/h
- Battery : Li-Polymer (27kWh)
- Driving range per charge : 148km

< Leaf EV> Nissan
- Max. Speed : 140km/h
- Battery : Li-Polymer (24kWh)
- Driving range per charge : 132km

< ionic EV> Hyundai
- Max. Speed : 165km/h
- Battery : Li-Polymer (28kWh)
- Driving range per charge : 191km

< OLEV EV(WPT)> Dongwon
- Max. Speed : 80km/h
- Battery : Li-Polymer (98.2kWh)
- Driving range per charge : 175.5km

< E-Primus EV> Hankuk Fiber
- Max. Speed : 100km/h
- Battery : Li-Polymer (85.8kWh)
- Driving range per charge : 69.8km



Domestic charging station dissemination status

- ('16) Charging station dissemination status : Normal 5,405, Fast 337
- Plan for disseminating fast charging system : ('16) 487ea → ('20)1,400ea

Normal Charging Station

KODI-S
- Input Voltage : AC 220V
- Output Voltage : AC 220V/32A
- Rated Power : 7.7kWh

Signet System
- Input Voltage : AC 220V
- Output Voltage : AC 220V/35A
- Rated Power : 7.7kWh

LG CNS
- Input Voltage : AC 220V
- Output Voltage : AC 220V/30A
- Rated Power : 7kWh

ChungAng Control
- Input Voltage : AC 220V
- Output Voltage : AC 220V/32A
- Rated Power : 7kWh

PNE Solution
- Input Voltage : AC 220V
- Output Voltage : AC 220V/32A
- Rated Power : 7.7kWh

Clean inelex
- Input Voltage : AC 220V
- Output Voltage : AC 220V/32A
- Rated Power : 7.7kWh

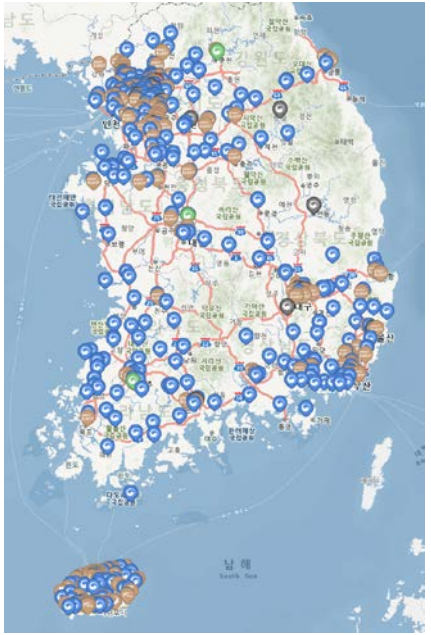
Fast Charging Station

KODI-S
- Input Voltage : AC 380V
- Output Voltage : DC 50~450V/110A
- Rated Power : 50kWh

PNE Solution
- Input Voltage : AC 380V
- Output Voltage : DC 50~450V/110A
- Rated Power : 50kWh

Signet System
- Input Voltage : AC 380V
- Output Voltage : DC 500V/125A
- Rated Power : 50kWh

Signet System
- Input Voltage : AC 380V
- Output Voltage : DC 50~400V/125A
- Rated Power : 50kWh



Change Telephone booth to EV fast charging station (‘16)

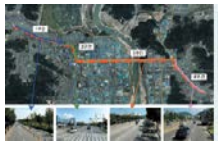
- ✓ Location : Seoul(3ea), Sungnam(1ea), Daegu(3ea), Sunchun(2ea)
- ✓ Unit cost : 313.1 won/kWh
- ✓ Full charging cost : 8 dollars
- ✓ Increasing 20 fast charging station at the telephone booth every year
- ✓ Input voltage : AC 380V
- ✓ Output voltage : DC 500V/125A
- ✓ Rated power : 50kWh

Pilot Project of the WPT system in Korea – OLEV


- Construction of power supply infrastructure in Seoul Grand Park (Since July 2011)
  - ✓ Lunched the commercial OLEV tram service in 2011
  - ✓ Power supply infrastructure : Built on 372.5m, 16% of the 2.2km circular road


- Construction and operation of power supply infrastructure during Yeosu EXPO 2012
  - ✓ Power supply infrastructure : Built on 36m, 6% of the 600m road


- Construction commercial power supply infrastructure and operation of the on-campus OLEV shuttle service (since October 2012)
  - ✓ Power supply infrastructure : Built on 60m, 1.6% of the 3,760m road
  - ✓ Max. output : 240kW(320 hp), Max. efficiency : 80%, air-gap : 20cm, rated
  - ✓ First commercialized model



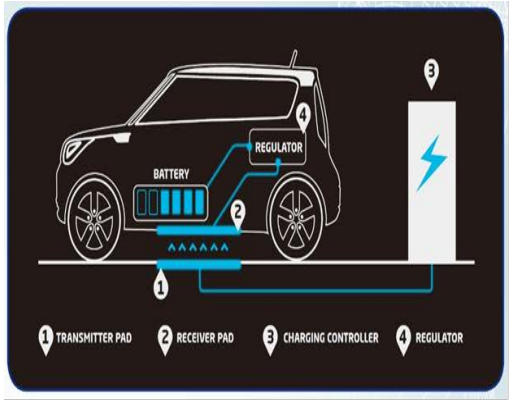

- Construction commercial power supply infrastructure and operation of the public OLEV bus service in Gumi(since October 2014)
  - ✓ Power supply infrastructure : Built on 24km, 0.6% of the 24km road
  - ✓ World 1st commercialized model in public road

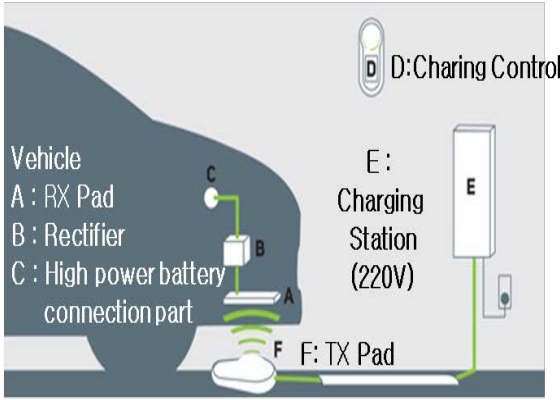

- Construction commercial power supply infrastructure and operation of the public OLEV bus service in Sejong(since October 2014)

Pilot project of the WPT system in Korea – Jeju Smart Grid Pilot Project in 2011

- ✓ CT&T NEV eZone
- ✓ Power Factor : 0.99, THD : 3%
- ✓ Output Power : 3.3kW, DC 250~350V, 12A, 60kHz
- ✓ Efficiency : 90% @ 100mm Air gap
- ✓ Tolerance : X-Y (> ± 100mm), Z (> ± 5mm)
- ✓ Jeju Lotte Hotel (2set)
- ✓ Period : 2 years

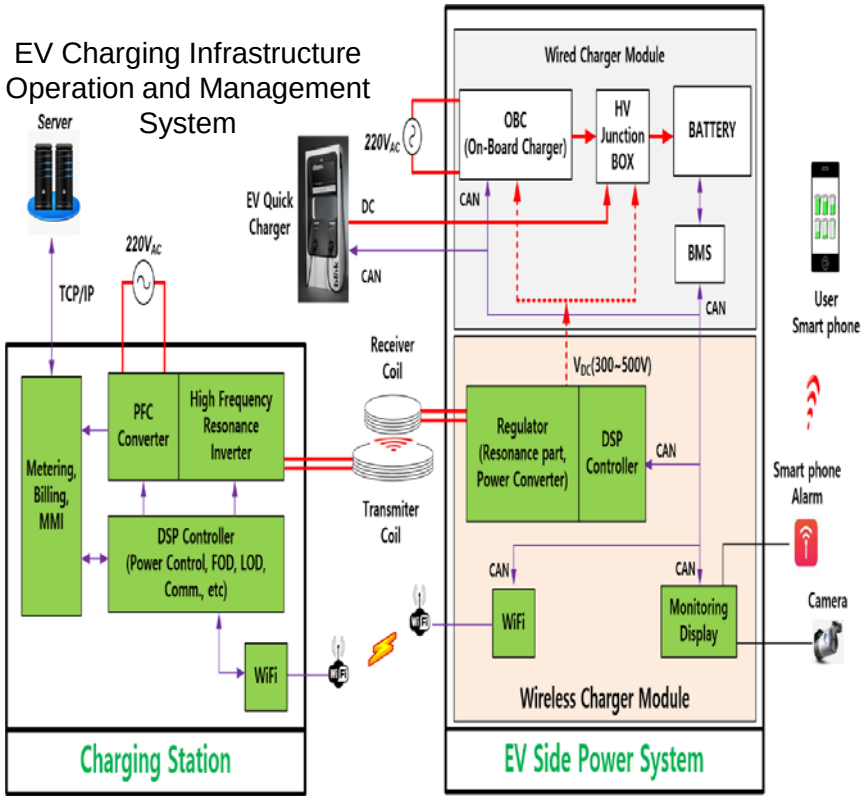
3.3kW WPT system applied on SOUL EV in 2014 (Hyundai/KIA Motors)



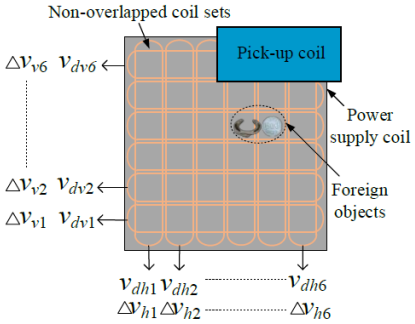


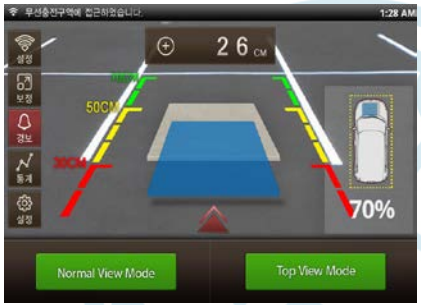
- ✓ Switching Freq. : 60kHz/85kHz
- ✓ Tolerance : X (± 100mm),
  y (± 50mm)
  Z (> ± 120mm)
- ✓ EMF : ICNIRP 1998
- ✓ Efficiency : < 90%

6.6kW WPT system applied on SOUL EV (under developing since 2015 for 3 years)

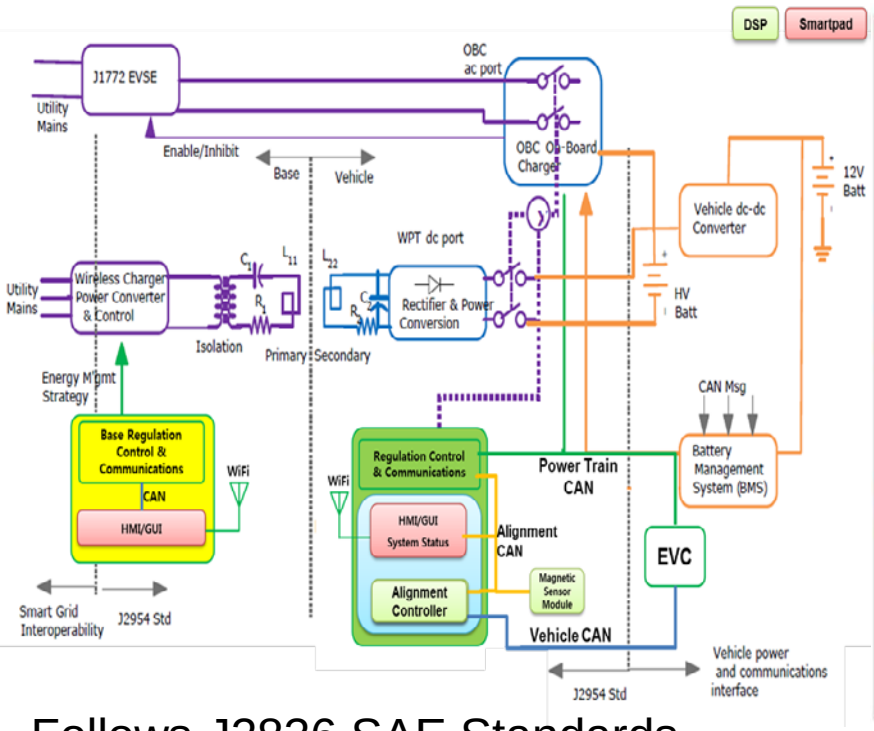


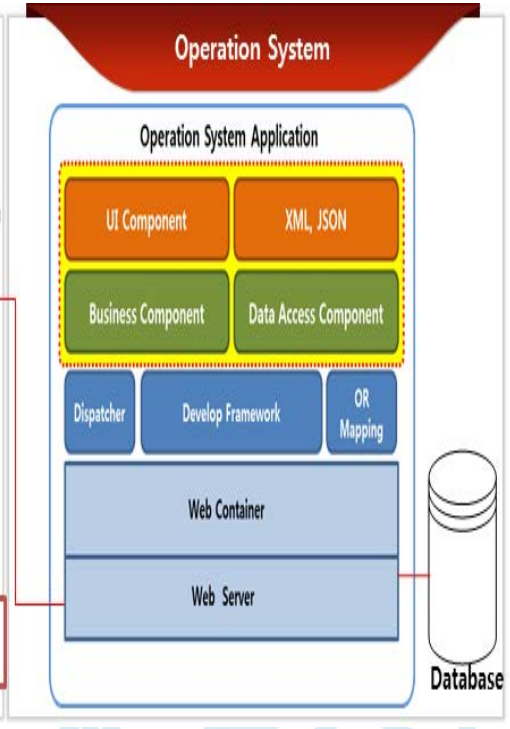
- ✓ Switching Freq. : 85kHz
- ✓ Tolerance : X (± 130mm), y (± 75mm)
  Z (> ± 160~120mm)
- ✓ Auto-tuning
- ✓ FOD(Foreign Object Detection)
- ✓ EMF : ICNIRP 1998
- ✓ Efficiency : > 90%





20kW WPT system applied on SM3 EV (under developing since 2016 for 3 years)





Follows J2836 SAE Standards

Continue to governmental support program for expanding market at early dissemination stage and support for commercialization of private service provider in parallel

Policy	• Necessary to EV and EV infrastructure dissemination related with national strategy such as reducing CO2, metropolitan traffic infrastructure with cooperation of governmental department
Energy	• Necessary to establish detail supporting strategy based on predication of energy market and need with government energy policy
Support	• National Support for Market Expansion of a EV and EV infrastructure (Subsidy , Tax Benefit)
Infrastructure	• Establish and Announce Roadmap for Battery Charging Infrastructure • Promote the Spread of EV and EV infrastructure through a Private Enterprise step by step

Thank you very much!

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