

13th UIC Sustainability Conference



Korean Real-Time Energy Metering Device for Electric Railway Vehicles


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Korea Railroad Research Institute (KRRRI)



12, 13, 14 October 2016

History of KRRI

- 
1996. 3 ————— Established as research institute of Korea National Railway
2000. 8 ————— Certified as an authorized testing agency (KOLAS)
2004. 12 ————— HSR-350 reached records 352.4km/h on test run
2010. 3 ————— KTX-Sancheon(KTX-II) started revenue service
2011. 3 ————— K-AGT started revenue service in Busan
2011. 12 ————— Awarded the Top research institute in Korea
2012. 11 ————— Awarded the Top technology commercialization institute
2013. 3 ————— HSR (HEMU 430-X) renewed top speed (421.4 km/h)
2014. 12 ————— Two UIC 2014 Innovation Awards out of six categories (wireless trans system; and wireless power supply system)
2015. 4 ————— Korea HST awarded as one of 70th top technologies in Korea

Workforce & Budget

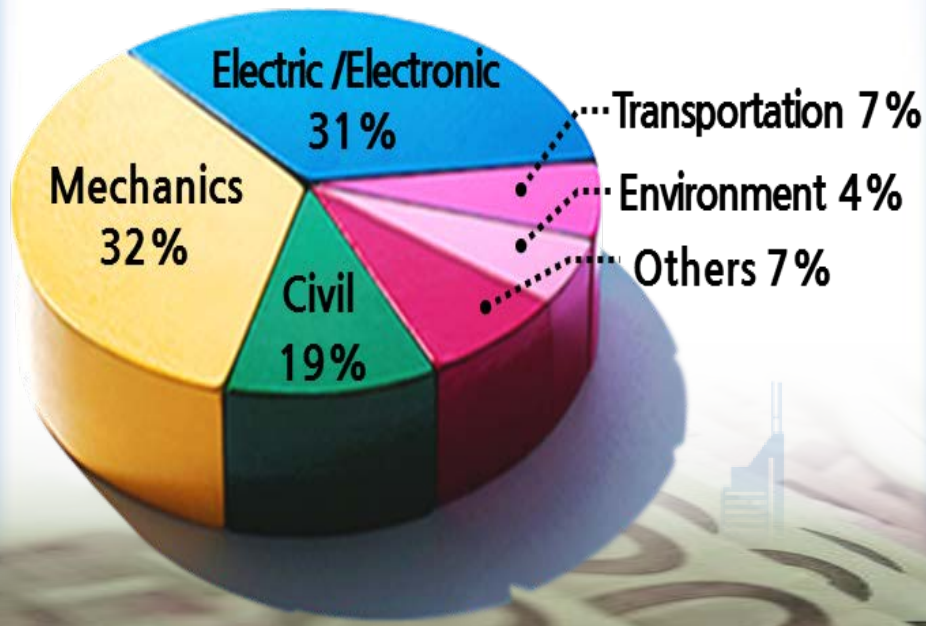
Workforce



• Total : 407



• Researchers : 364



Budget

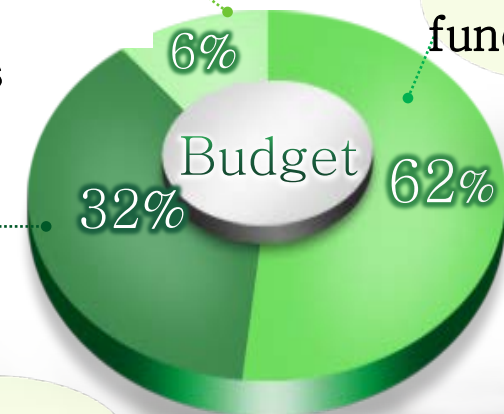


130 mil. US\$ for 2016

Private
R&D
funds

R&D project
funds

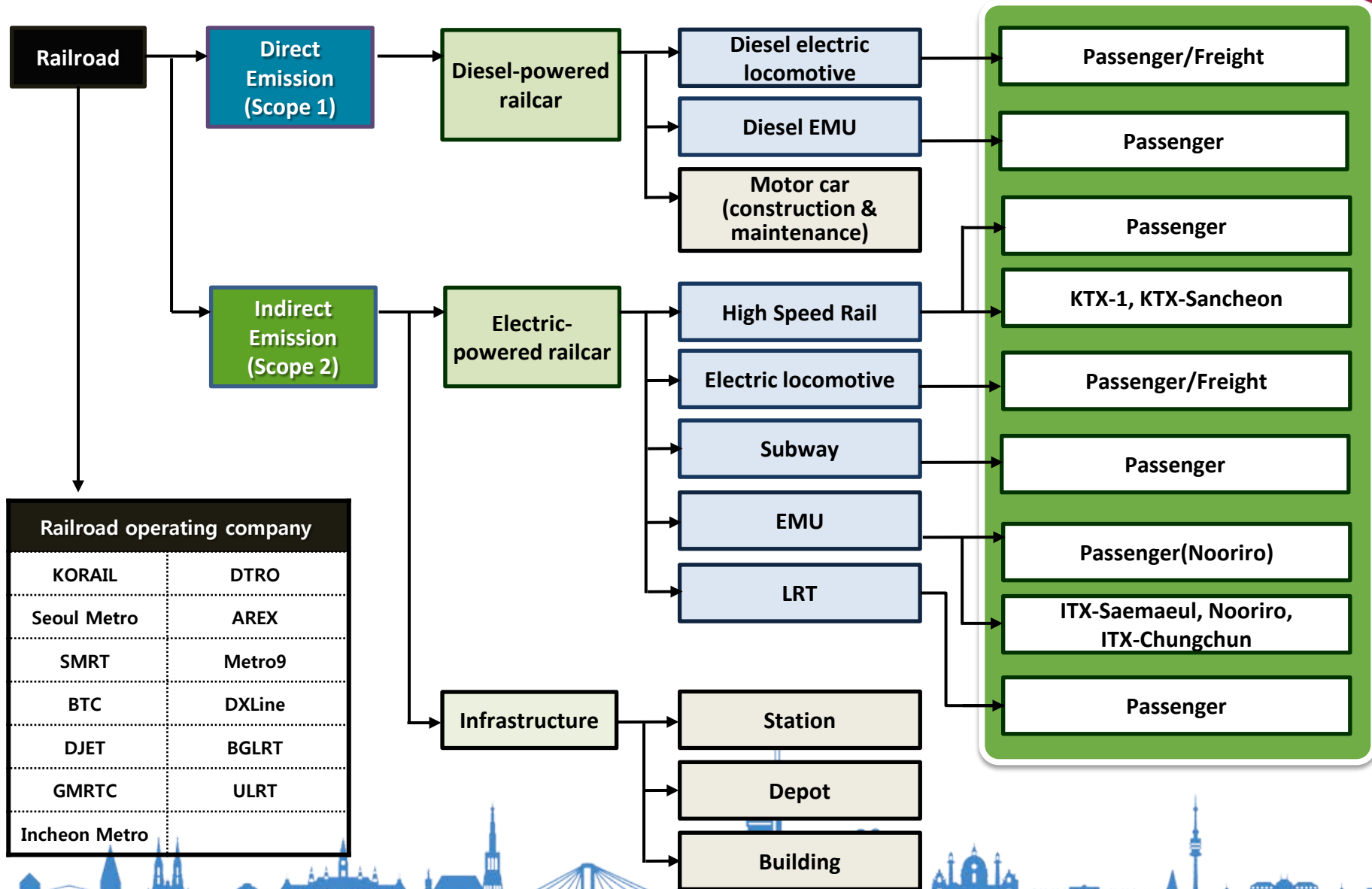
Government
R&D grants



As of Feb. 2016

12, 13, 14 October 2016

Classification of GHG emission source in Railroad



Backgrounds

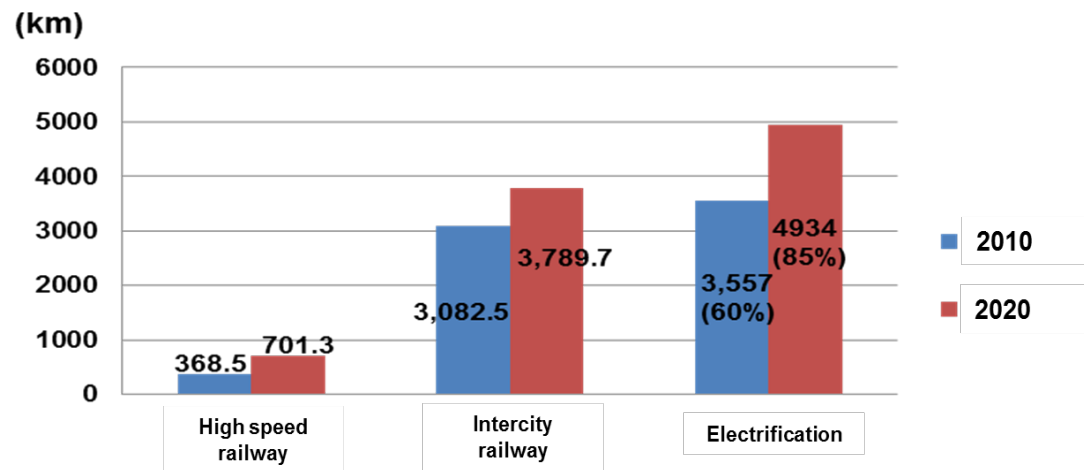
Electrification



Korean railroad network links the shortest distance with **X type + □ type** combination.

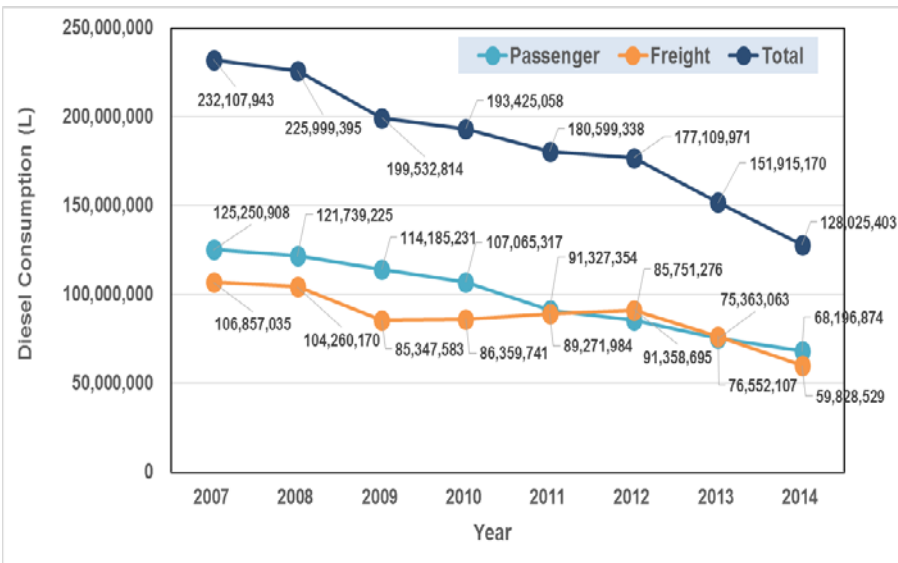
KTX service will be performed through the whole nation.

Electrification will increase **by 85%** in 2020

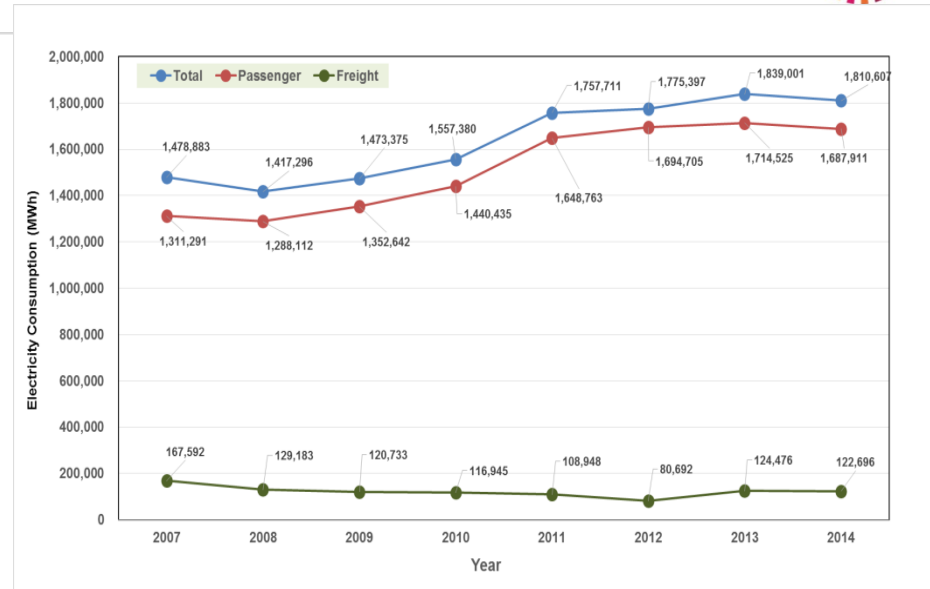


Backgrounds

A shift from diesel to electric vehicles



< Diesel consumption by the railcar operation (2007-2014) >

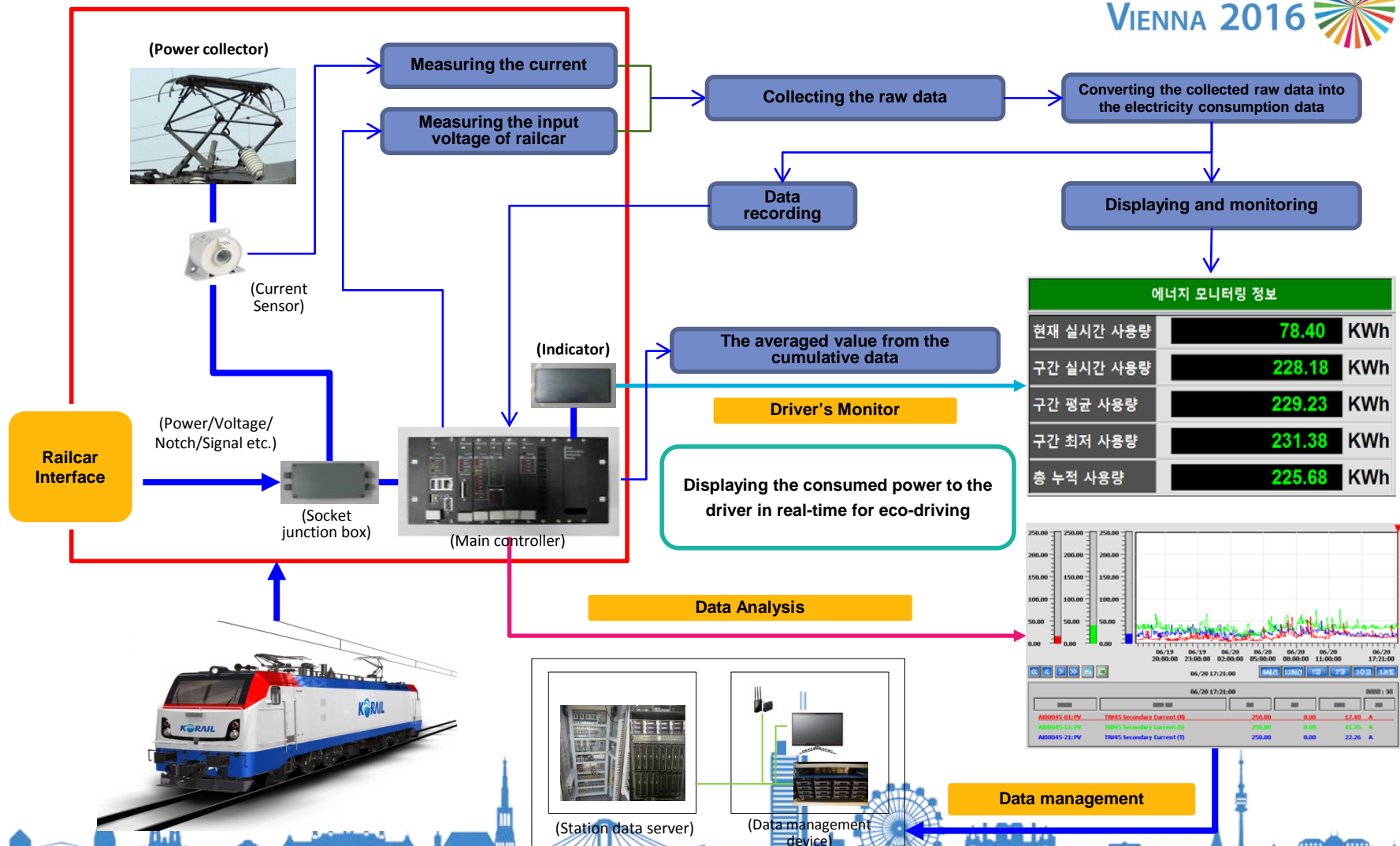


< Electricity consumption by the railcar operation (2007-2014) >

- ❖ Rail vehicles powered by electricity have been steadily increasing.
- ❖ Growing challenges among operators to reduce energy consumption from their operations and improve energy efficiency in terms of GHG emissions.
- ❖ Energy metering and billing systems are prerequisite.



Concept of Korean Smart Energy Metering System



Action Plan for Smart Energy Metering System



Target

Tasks

1st year

Designing smart energy metering device & manufacturing major modules for the device

- Requirement and compatibility analysis of the energy metering device
- Requirement identification for the vehicle and user interfaces
- Specification development of the device and system interfaces
- Design of system interfaces for the energy metering device
- Design and manufacture of major modules
- Test standard document development for the metering device
- Functional test for major modules of the metering device



2nd year

Manufacturing and prototyping the device & testing interfaces

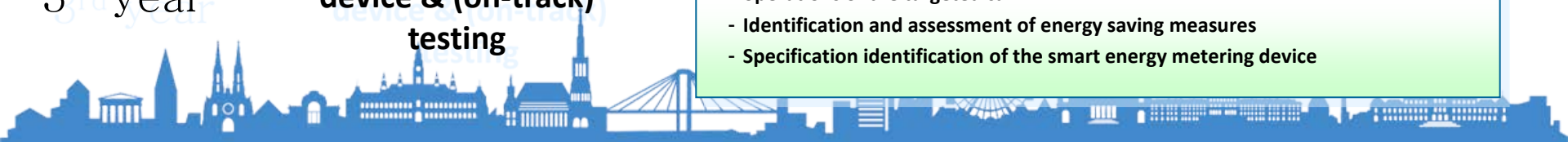
- Detailed design and prototyping of the metering device
- Performance test procedure identification for the metering device
- Performance test for prototyped major modules of the metering device
- Data collecting and recording system establishment for the device
- System programming and development
- Target railcar selection and interface testing (Sep.-Dec.,2016)



3rd year

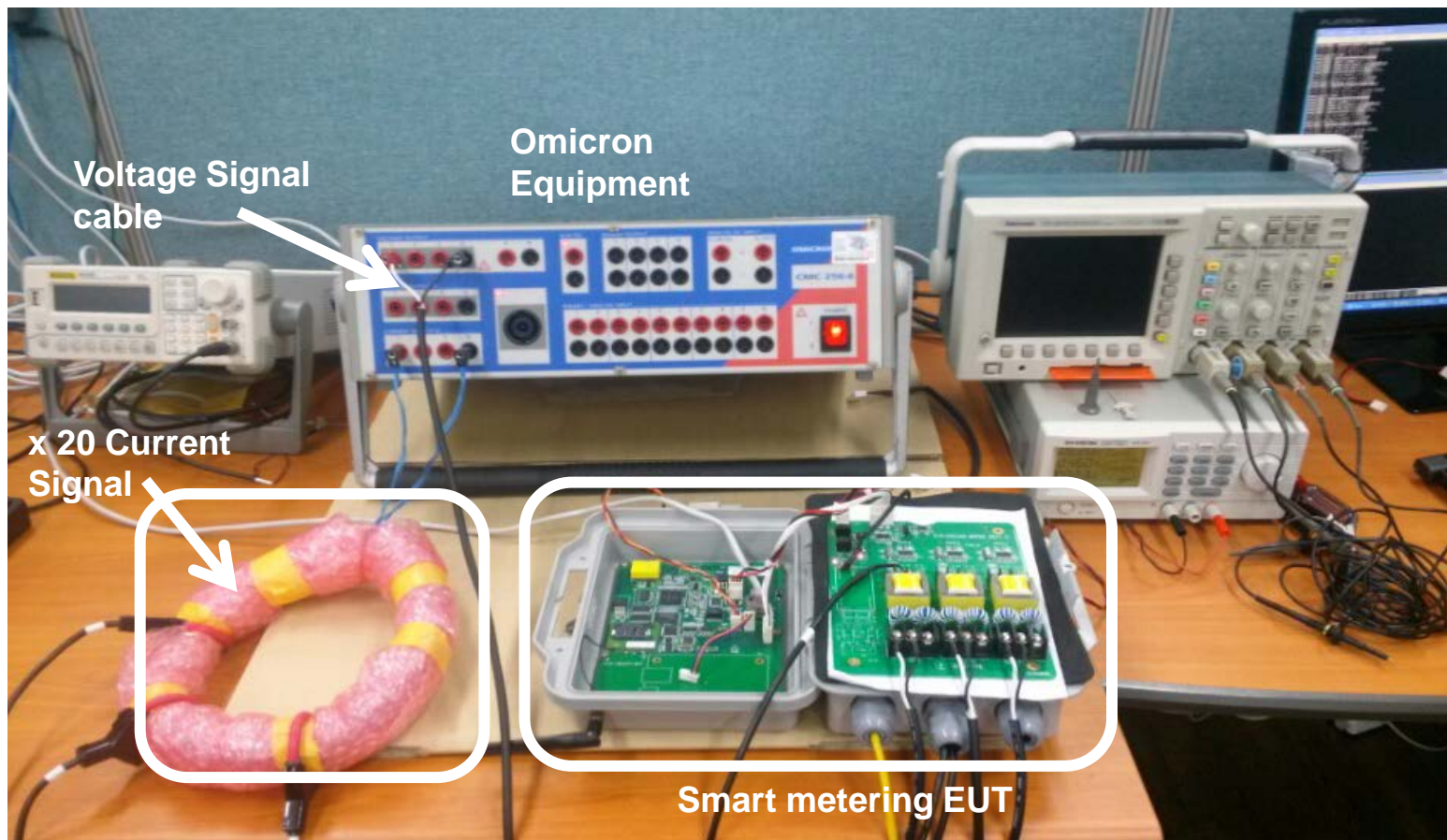
Installing the metering device & (on-track) testing

- On-track testing of the metering device installed(Jan.-Sep.,2017)`
- Environmental and economic performance analysis of energy consumption from operations of the targeted car
- Identification and assessment of energy saving measures
- Specification identification of the smart energy metering device



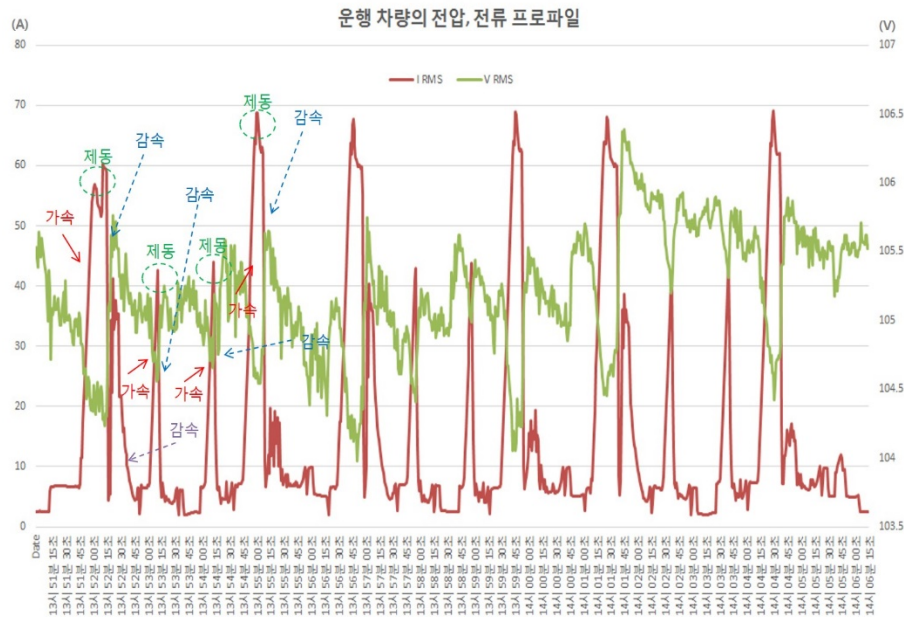
Examples

Functional testing of the prototyped major modules for the energy metering device

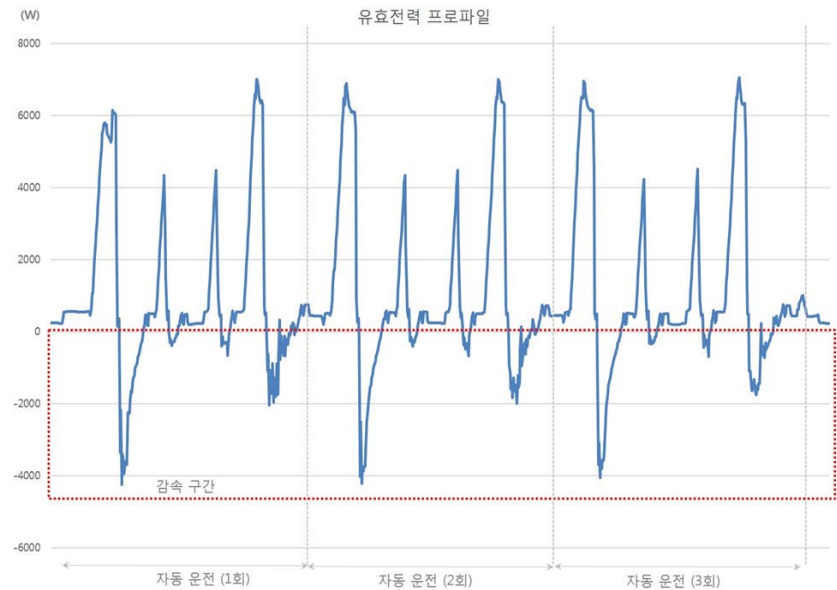


Examples

Functional testing of the prototyped major modules for the energy metering device



<Profile chart of the line voltage and current RMS during the vehicle's operation>



<Profile chart of the active power for the vehicle's operation during its testing (automatic) driving >



Examples

Data recording and management system



(Smart Energy Metering Device)

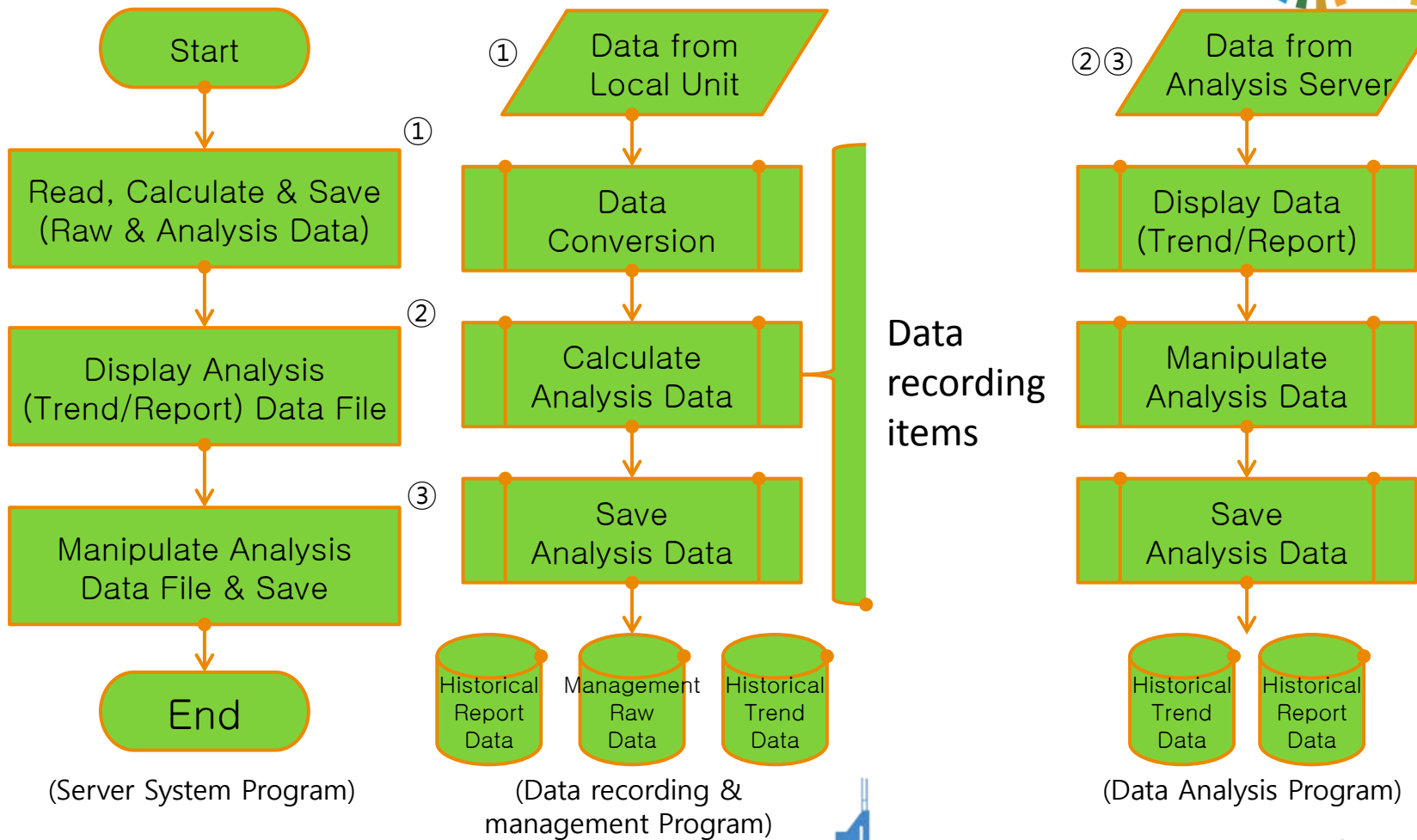


(Memory)

Data recording item	
Vehicle No.	Car No.
Section	Driver ID
Driving date	Storage time
Weight	Driving mode
Notch	Braking notch
Train speed	Wattage
Additional items	Others

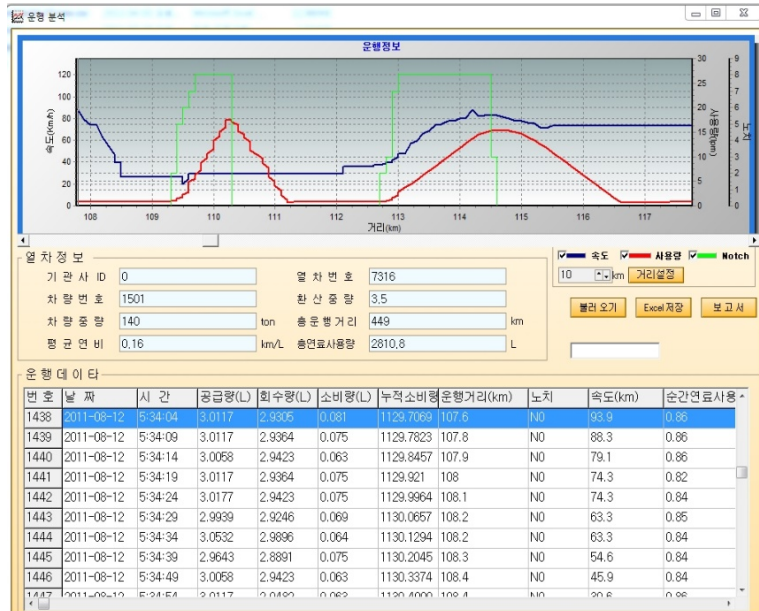
Type	
Fixed item	Vehicle No. Car No. Section
Base	Storage time
Variable	Drive ID Driving date Weight Driving mode Notch Braking notch Train speed Wattage . .

Structure of server system for data recording, management and analysis



Examples

Data recording and management system



에너지 사용량 보고서

보고일시: 2016-06-10 작성자: 작성자

기본사항 (일시는 "2016-05-01" 으로 표현)

일시: 2016-07-01 차량번호: 8501 열차번호: 1274

기관사 ID: b001 열차종량: 10

운행구간: 대전-서울 ('출발역명-도착역명' 으로 표현)

사용량

총 사용량: 2529 KWH 온실가스 환산량: 53

구간 사용량: 1979 KWH 구간 추진사용량: 2147 KWH

구간 회생사용량: 168 KWH

기지내 사용량: 550 KWH 기지내 추진사용량: 597 KWH

기지내 회생사용량: 47 KWH

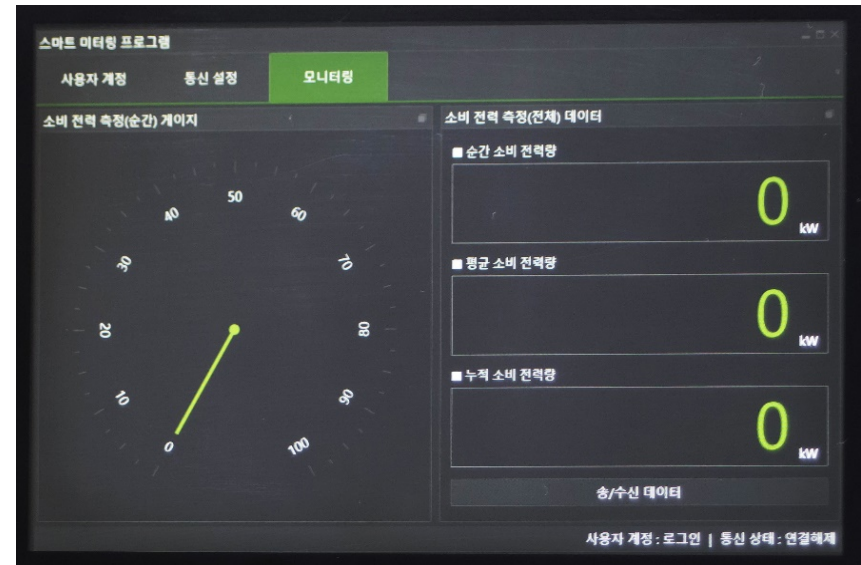
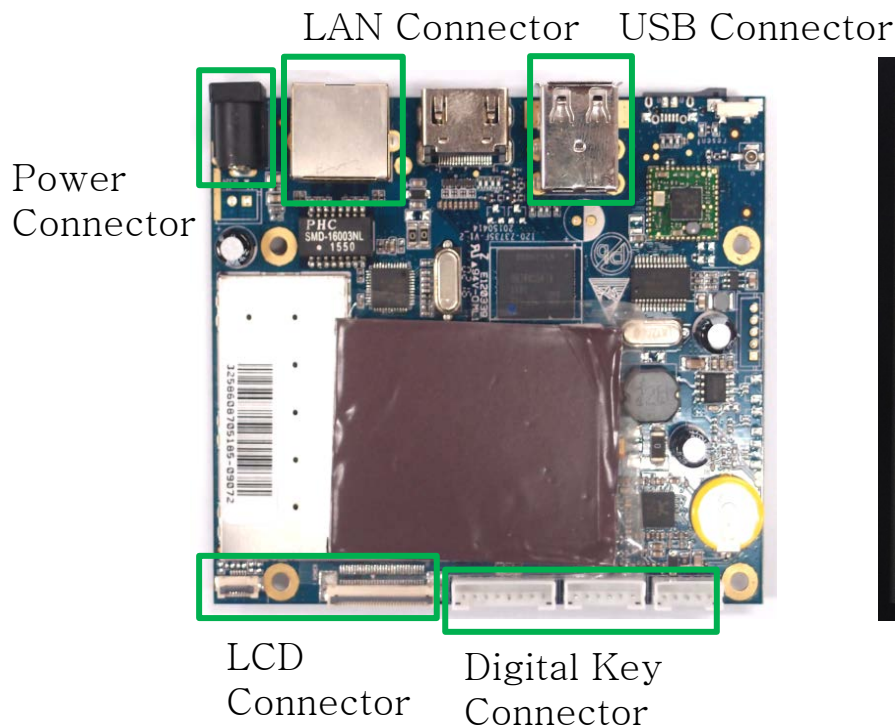
비교: 20160701-001

정보분석화면 이력관리화면 인쇄출력 불러오기 업데이트 원본파일저장 이력저장



Examples

Data display



7" Inch LCD

➤ LCD Display + Touch



Examples

Data display



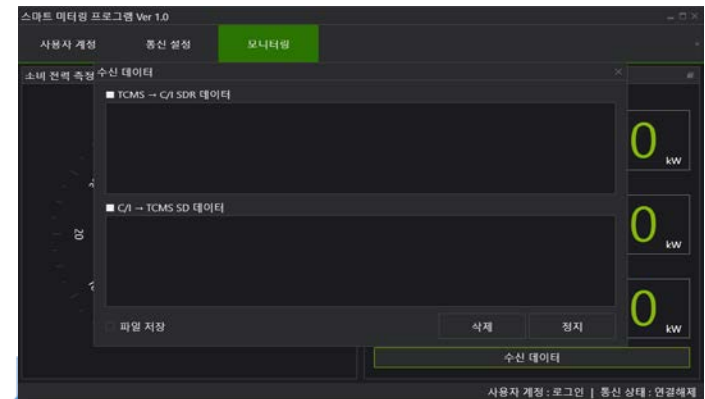
Log-in



Communication port setting



Real-time metering



Data validation (CC-Cl)



Application



- ❖ Conducting field tests on the energy metering & controlling device, evaluating its performance and commercializing the device
- ❖ Improving the economic and environmental aspects of operating vehicles by using the recording system of operating energy for rolling stock
- ❖ Obtaining the technology associated with the high-voltage measurement and the data analysis, thus assessing the energy consumption of driving pattern for rolling stock
- ❖ Advertising technology associated with the smart energy metering device to the stakeholder related to the railway industry
- ❖ Preventing the abuse of operating energy and cost per each type of rolling stock and each route
- ❖ Establishing a mid & long-term strategies associated with energy supply and demand for operating vehicles
- ❖ Expecting the effect of improving the business condition for railway operation company by minimizing the energy cost of operating vehicles
- ❖ Satisfying the national energy saving policy with the action plan on higher operating-energy efficiency for rolling stock





Thank you for your attention!

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