

TENERGY

(Company profile)

Contents

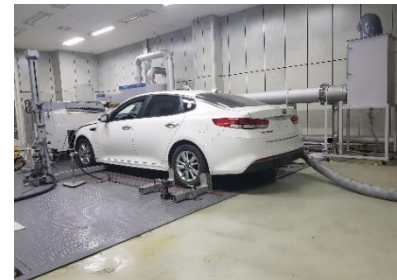
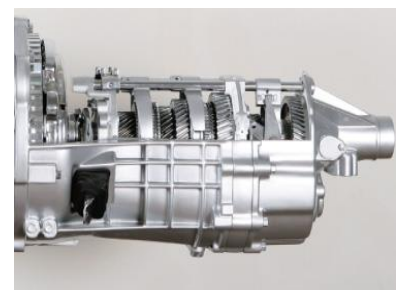
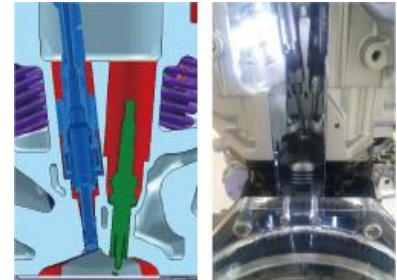
Site

Facility

Organization

References

Major clients



Dongtan R&D center



TENERGY Engineering Center (in PANGYO 2nd Techno Valley)



Expected for completion toward the end of 2024

Engine & T/M dyno.

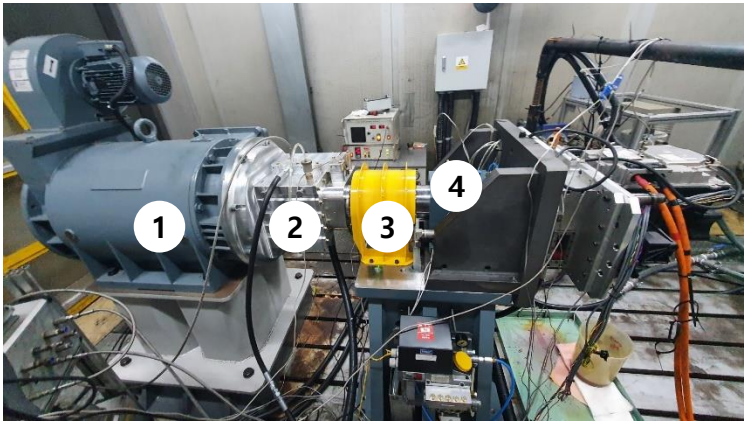
Test cell	Type	kW
T-01	AC	390
T-02	AC	390
T-03	AC	390
T-04	AC	390
T-05	AC	220

Test cell	Type	kW
T-06	AC	390
T-07	AC	390
T-08	AC	390
T-09	AC	350
T-10	Hydraulic	2,500
T-11(P/T)	AC	700

Chassis dyno.

Type	Front (kW)	Rear (kW)	Emission analyzer
4WD HORIBA	150	150	HORIBA MEXA-ONE <ul style="list-style-type: none"> • 3ch analyzer, FTIR • Direct sampling • Europe 14°C ATCT and 25°C emission / CO2

E-dyno.

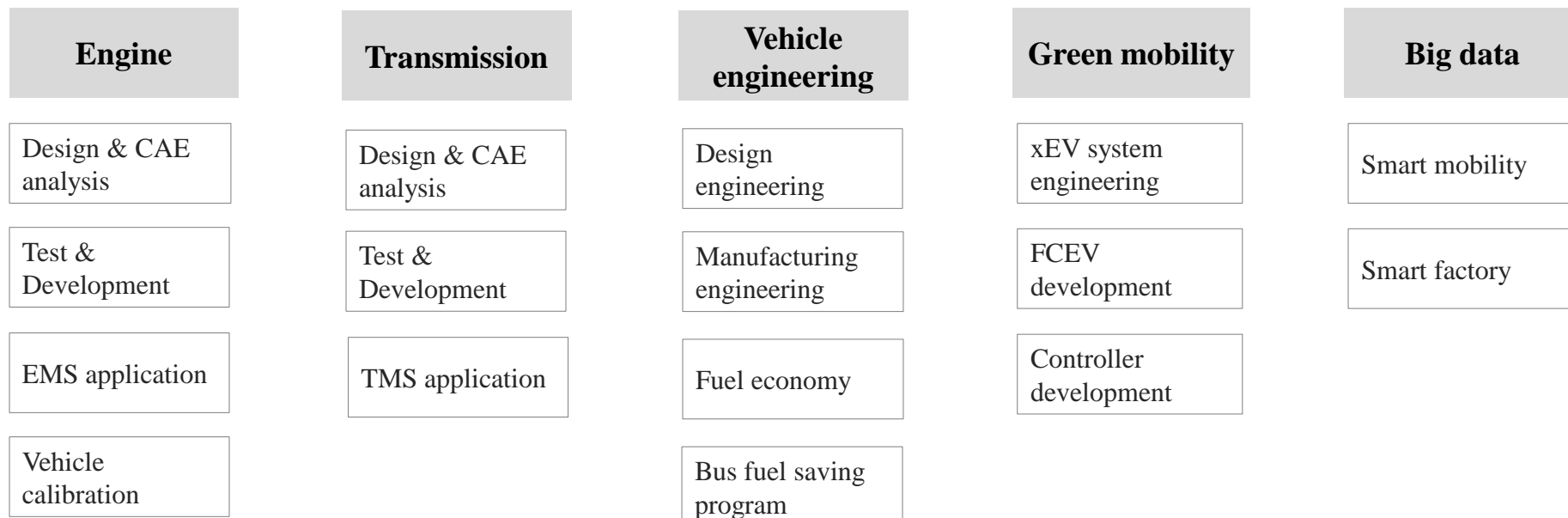


No.	Item
①	AC dynamometer - 10,000rpm/390kW
②	High-speed gearbox (specifically developed) - Accelerated up to Max. speed 22,800rpm - Max. torque 368Nm
③	Torque sensor
④	Block bearing

Battery simulator



Item	Specification
Power	360kW
Voltage range	100~1,000 VDC
Current range	± 800A
Mode	CC, CV
Constant voltage	Load and discharge
Constant current	Bi-directional current flow
Battery test mode	Additional system
Voltage accuracy	≤ 0.1% F.S
Current accuracy	≤ 0.1% F.S
Voltage response (Rise time 0 to 90%)	≥ 100ms
Current response (Rise time 0 to 90%)	≥ 50ms
Current & voltage ripple	1%



Gasoline engine develop.

2.0L & 2.4L Euro-5	<ul style="list-style-type: none"> • Design & CAE • Combustion / Function & mechanical / Durability development
1.25L Euro-5	<ul style="list-style-type: none"> • Design & CAE • Combustion / Function & mechanical development
1.3L Euro-4	<ul style="list-style-type: none"> • Design & CAE • Combustion / Function & mechanical / Durability development
2.0L GDI Euro-5	<ul style="list-style-type: none"> • Design & CAE (Center injector) • Combustion development
2.0L T-GDI Euro-5	<ul style="list-style-type: none"> • Design & CAE (Stratified center injector) • Combustion / Mechanical development • Engine calibration
2.0L T-GDI Euro-5	<ul style="list-style-type: none"> • 10% power-up • Engine calibration
1.8L T-MPI Euro-5	<ul style="list-style-type: none"> • Design & CAE • Combustion / Function & mechanical / Durability development • Engine calibration
2.7L Euro-5	<ul style="list-style-type: none"> • Design & CAE • Combustion / Function & mechanical / Durability development • Engine calibration

Gasoline engine develop.

125cc & 150cc	<ul style="list-style-type: none">• Design & CAE• Combustion / Function & mechanical / Durability development
149cc (LNG)	<ul style="list-style-type: none">• Design & CAE• Combustion / Function & mechanical / Durability development
1.5L Euro-5	<ul style="list-style-type: none">• Design & CAE• Combustion / Function & mechanical / Durability development
2.4L Euro-5	<ul style="list-style-type: none">• Design & CAE• Combustion / Function & mechanical / Durability development• Engine & vehicle calibration
1.2L & 1.6L T-GDI Euro-5	<ul style="list-style-type: none">• Design & CAE• Combustion development
177cc 2-Cycle (Hybrid Power System for Drone)	<ul style="list-style-type: none">• Design & CAE• Combustion / Function & mechanical / Durability development
330cc Wankel Rotary	<ul style="list-style-type: none">• Design & CAE• Combustion / Function & mechanical / Durability development

Diesel engine develop.

2.4L & 3.4L TC	<ul style="list-style-type: none"> • Design & CAE • Combustion / Function & mechanical / Durability development • SOP supports
2.4L CRDI Tier-4 TCI/TC/NA	<ul style="list-style-type: none"> • Combustion / Function & mechanical / Durability development • Engine & DPF calibration
3.4L CRDI Tier-4 TCI	<ul style="list-style-type: none"> • Mechanical / Durability development
1.8L & 2.4L CRDI Tier-4 TC/NA	<ul style="list-style-type: none"> • Combustion / Function & mechanical / Durability development • Engine & DPF calibration
1.9L & 2.5L CRDI Tier-4 TCI	<ul style="list-style-type: none"> • Combustion / Function & mechanical / Durability development • Engine & vehicle calibration
27L V12 CRDI TCI	<ul style="list-style-type: none"> • Optimization of crank-train system • Improvement of bearing reliability
30L V12 CRDI TCI	<ul style="list-style-type: none"> • Design & CAE (PFP 220bar)
22L V12 CRDI TCI	<ul style="list-style-type: none"> • Design & CAE • Combustion / Function & mechanical / Durability development • Engine calibration & SOP supports

Gasoline EMS calibration

1.5L T-GDI Euro 6d	<ul style="list-style-type: none">• X150 vehicle calibration (RDE/GPF)
2.0L MPI Euro 6b	<ul style="list-style-type: none">• C300 Vehicle calibration
1.5L T-GDI SULEV30	<ul style="list-style-type: none">• C300/X150 Vehicle calibration
1.8L T-MPI	<ul style="list-style-type: none">• Euro 5 Engine calibration
3.3L Gasoline	<ul style="list-style-type: none">• OBD2 Validation
11L CNG Euro 6	<ul style="list-style-type: none">• CNG lean-burn engine OBD Logic / Calibration
125cc / 250cc Gasoline (Single cylinder)	<ul style="list-style-type: none">• Engine calibration• Emission / OBD / Drivability calibration

Diesel EMS calibration

2.0L CRDI Euro 4 / Euro 5	<ul style="list-style-type: none">• A150 Vehicle calibration with/without CDPF• Euro 5 with CDPF / Euro 4
2.0L CRDI Euro 4 / Euro 5	<ul style="list-style-type: none">• C150 Vehicle calibration with/without CDPF• Euro 5 with CDPF / Euro 4
2.0L CRDI Euro 3 / Euro 5	<ul style="list-style-type: none">• C211 Vehicle calibration with/without CDPF• Euro 5 with CDPF / Euro 3
2.2L CRDI Euro 6b	<ul style="list-style-type: none">• Y295 Vehicle calibration with CDPF & LNT
2.2L CRDI Euro 6b	<ul style="list-style-type: none">• Y400 Vehicle calibration with CDPF & LNT
2.2L CRDI Euro 6b	<ul style="list-style-type: none">• Q200 Vehicle calibration with CDPF & LNT
2.2L CRDI Euro 6b	<ul style="list-style-type: none">• Q201 Vehicle calibration with CDPF & LNT
1.9L / 2.5L CRDI Tier4	<ul style="list-style-type: none">• Industry engine calibration• Vehicle OBD / Drivability / DPF calibration

T/M design & develop.

T-MAT Development	<ul style="list-style-type: none"> • T-MAT: Torque interruption free (Manual-based Automatic Transmission) • Concept & Layout design, Installation & Calibration
EV A/T Development (w/o Torque Converter)	<ul style="list-style-type: none"> • Turn-key project for Electric Vehicle • Concept & Layout design, Test & Development, SOP support • All Control Logic development & Verification
4WD transfer case	<ul style="list-style-type: none"> • Turn-key project • Concept & detail design, Test & development, SOP support • Full time transfer case • High-Low gear ratio & Center differential locking mode
HDT(Hydro-Dynamic Transmission) (w/ Torque Converter)	<ul style="list-style-type: none"> • Turn-key project • Concept & detail design, CAE, Test & development • TCU S/W development & Calibration
Manual transmission	<ul style="list-style-type: none"> • Design, CAE • Gear ratio optimization • Compact shift control mechanism
Benchmarking	<ul style="list-style-type: none"> • FF 6-speed A/T of 'H' (Sedan & SUV) • FF 6-speed DCT of 'F' (Sedan) • FF & FR 6-speed A/T of 'T' (SUV) • FF 7-speed DCT of 'V' (Wagon) • FF CVT of 'J' (Sedan)

TMS Calibration

A/T 6 TH TMS for 2.0L Diesel Euro 5	<ul style="list-style-type: none">• Shift Function Verification & Validation• Shift Feeling Calibration• Damper Clutch Control• Shift Pattern Validation
A/T 4 TH TMS for 1.3L Gasoline	<ul style="list-style-type: none">• Shift Feeling Calibration• Damper Clutch Control
AMT 2 ND TMS for Electric Vehicle	<ul style="list-style-type: none">• All Shift Control Parameter Set & Validation• All new function verification & Calibration• Auto Parking Verification & Calibration• Diagnostic & Fail Safety Verification & Calibration
A/T 6 TH TMS for 2.0 Diesel Euro 6	<ul style="list-style-type: none">• Drivability & Fuel Economy Development• Durability & Protection mode verification• Cold/Hot/High Altitude Test & Calibration• Shift Feeling Calibration
AMT 6 TH TMS for 1.6 Gasoline	<ul style="list-style-type: none">• All Shift Control Parameter Set & Validation• All new function Verification & Calibration• Shift Feeling Calibration

Fuel economy

Practical tools confirmed through more than 20 projects.

D-segment (“H” company) : 24.90mpg → 26.50mpg (6.4% ▲)

A segment (“G” company) : 16.95 km/L → 21.00 km/L (23.9% ▲)

SUV (“S” company) : 13.40 km/L → 15.00 km/L (11.7% ▲)

“H” company	<ul style="list-style-type: none"> • Passenger : 1.1L, 1.5L, 1.6L, 2.0L, 2.0 T-GDI, 2.4L, 3.3L, 3.8L • Diesel SUV : 2.0L, 2.2L • Commercial : 24 ton Truck
“G” company	<ul style="list-style-type: none"> • Diesel SUV : 2.0L
“S” company	<ul style="list-style-type: none"> • Diesel SUV & Van : 2.5L, 2.7L • Diesel SUV : 2.0L
“R” company	<ul style="list-style-type: none"> • Passenger : 3.5L
“T” company	<ul style="list-style-type: none"> • Passenger : 1.2L Turbo
“D” company	<ul style="list-style-type: none"> • Passenger : 1.6L
Toyota, Honda, Renault, Volvo, Audi, etc.	<ul style="list-style-type: none"> • More than 25 reference vehicles were analyzed for benchmarking

Vehicle engineering

Integrated engineering
(Vehicle development)



Proton



Saga-R



Persona-R



Iriz



Preve



Exora



New Saga



Savvy

Integrated engineering
(Body manufacturing integration)



GAZ



Next Mini Bus



Next Van



Gaz-on Truck



Next Double















Next Single



Frame Bus

Vehicle engineering

Integrated engineering (Vehicle development)	 <p>AvtoVAZ</p>  <p>LADA S/W</p>  <p>LADA VESTA</p>
Integrated engineering (Vehicle development)	 <p>TATA</p>  <p>HEXA</p>
Tool & equipment development (Body assembly)	 <p>GM</p>  <p>Essentia</p>  <p>Aveo</p>  <p>Sail</p>  <p>D-MAX</p>
Tool & equipment development (Body assembly)	 <p>GreatWall</p>  <p>Ling-ao</p>

Bus fuel saving program

Project 1 (Seoul capital city, Korea)	Project 2 (Daegu city, Korea)	Project 3 (Seoul capital city, Korea)
<ul style="list-style-type: none">Target vehicle : 4,000 city buses (M/T bus)Period : Jun. 2014 ~ May, 2019Results : 15% improvement	<ul style="list-style-type: none">Target vehicle : 1,600 city buses (M/T, A/T bus)Period : Aug. 2018 ~ Jul. 2023Results : 12% improvement	<ul style="list-style-type: none">Target vehicle : 3,500 city buses (A/T bus)Period : Sep. 2019 ~ Aug. 2024Results : 12% improvement

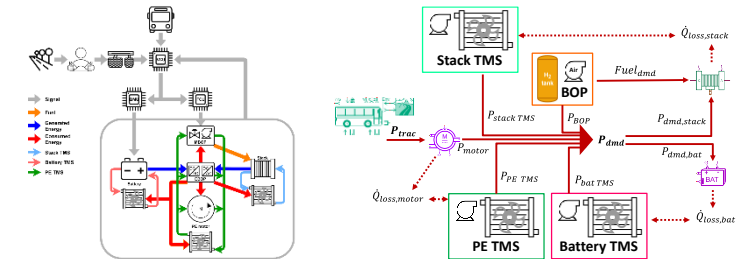
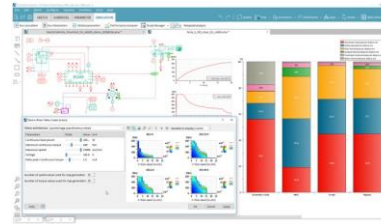
Business model : SOC type

TENERGY share : 40% of saved fuel cost for 5 years

Green mobility

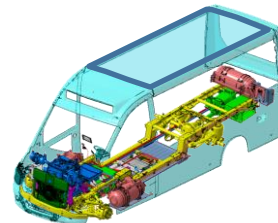
System planning

Research on global market trends
xEV Fuel economy simulation



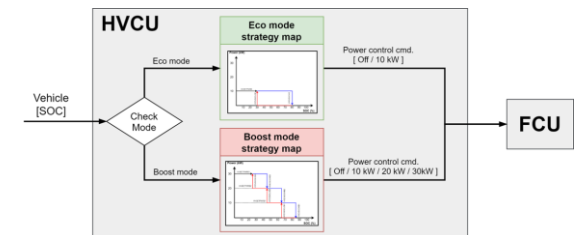
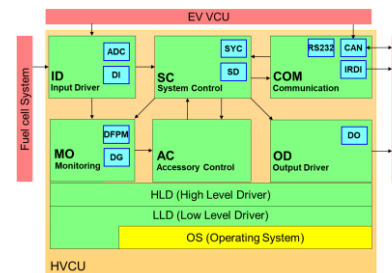
Hydrogen FCEV proto vehicle development

FCEV system concept design
Packaging design
Fuel cell system and Battery system evaluation
Proto vehicle development and test



Controller development

Control logic development and calibration
(VCU, BCM, TMS, FCU, etc.)
Controller H/W, S/W design

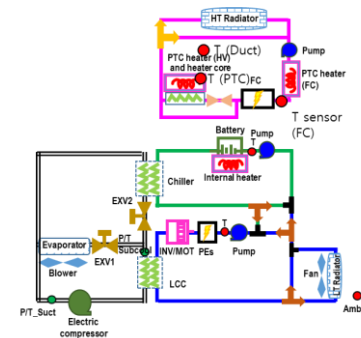


Green mobility

Thermal Management System development

Tenergy TMS development (FCEV, EV)

System rig test and control logic verification



Benchmarking & system analysis

CAN reverse engineering

Sensor installation

Real-road driving test, Chassis-dynamo test

Analysis for thermal management strategy, energy flow

➤ BM completed vehicles (2019~2023)

EV FCEV

➤ BM planed vehicles (2023~)



Big data (Vehicle Data Engineering & Management Solution)

IIoT & Edge Device for Vehicle Data

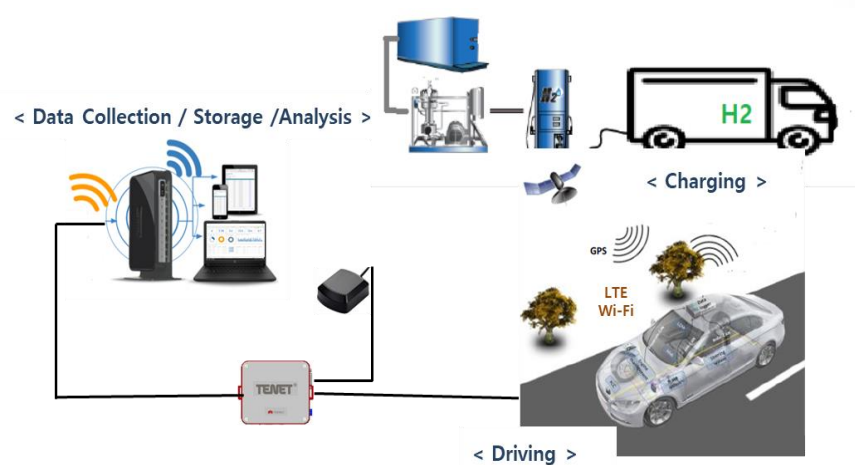
Data Collection CAN / XCP Communication with Vehicle

*.dbc file supporting for hundreds Vehicles, A2L available

Extendable for various sensing

Easy Installation & Usage

Applied to vehicle, vessel, agricultural and non-road machinery, etc.



Applications

Telematics

FOT (Field Operational Test)

Performance Test

Description	TeNeT
Purpose	Data Logging Device via Vehicle Networks
Operating System	Linux
Processor / Memory	ARM-A72 CPU 2.5GHz / 8GB
External Memory	32GB SD Card
Interface	UDS, OBD2, TP, GMLAN, BMW(7 Byte) with CAN(FD) / LAN
Measurement	11bit Standard Diagnostic / 29bit Extended CAN Bus monitoring with dbc file / External Trigger input
Wake up	CAN signal / Key On
Sensors	1x GPS
Ports	4x USB / 2x CAN / 1x LAN / HDMI (option, 4x CAN)
Communication	WiFi / 4G LTE
Sub-Device	4 x 8 ch AI

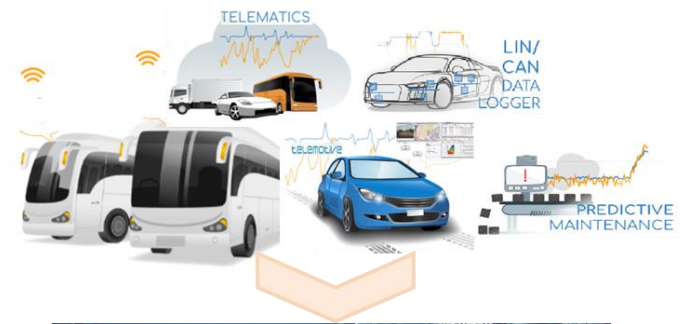
Big data (Vehicle Data Engineering & Management Solution)

Driving Data Platform

Validation & Evaluation for Test & Measurement Data

Predictive Management / Telematics

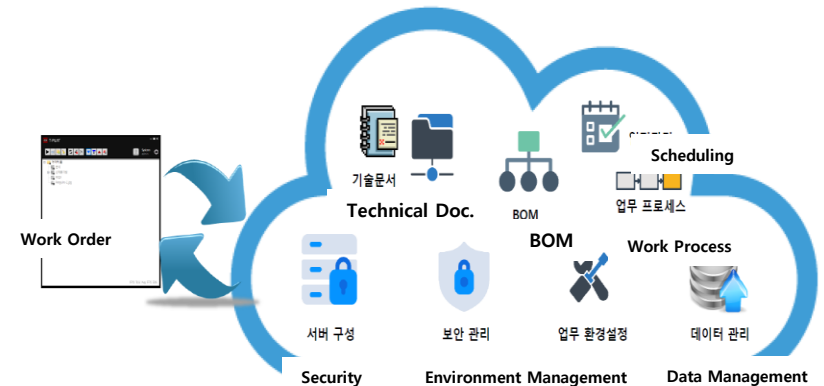
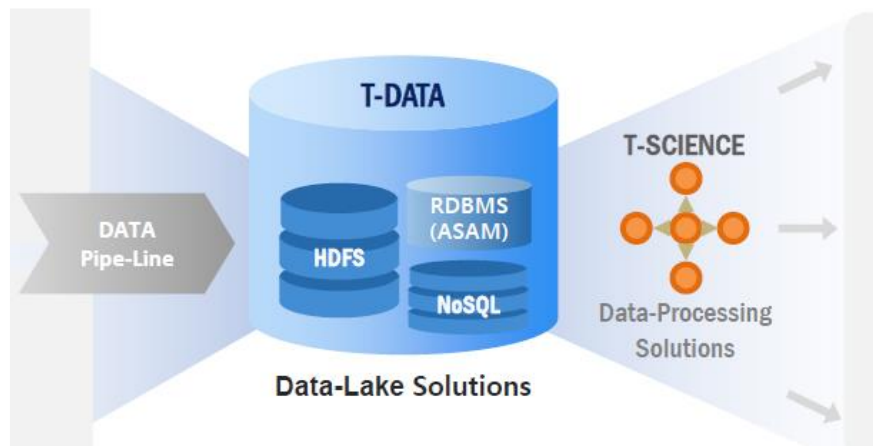
Public & Safety Assurance
















Design & Engineering Collaborating Platform

On-Line ECP (Engineering Collaboration Process)

Cloud Service Templates / Planning / Execution for Engineering



Domestic (Korea)

Automotive OEMs	Agricultural / Industrial	Others
     	   	  

Overseas

Automotive OEMs					
 TATA	 Mega Motor	 DFM	 GM	 HAITEC	 NISSAN
 UAZ	 AvtoVAZ	 GAZ	 GreatWall	 Proton	 VINFAST