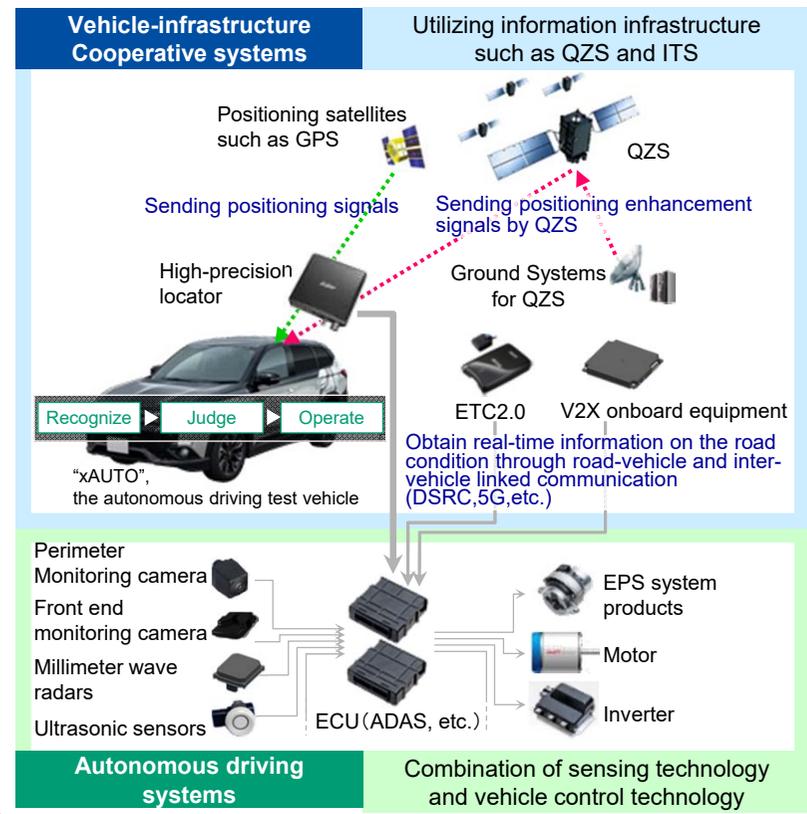# 6. Technology Synergies and Business Synergies
－ Safe, Secure and Comfortable Autonomous driving Society －

Contribute to realizing a safe and comfortable autonomous driving society from both "autonomous driving systems" and "vehicle-infrastructure cooperative systems"

Vehicle-infrastructure Cooperative systems	Utilizing information infrastructure such as QZS and ITS

Positioning satellites such as GPS

QZS

Sending positioning signals

Sending positioning enhancement signals by QZS

High-precision locator

Ground Systems for QZS

Recognize → Judge → Operate

"xAUTO", the autonomous driving test vehicle

ETC2.0   V2X onboard equipment

Obtain real-time information on the road condition through road-vehicle and inter-vehicle linked communication (DSRC,5G,etc.)

Perimeter Monitoring camera
Front end monitoring camera
Millimeter wave radars
Ultrasonic sensors

ECU（ADAS, etc.)

EPS system products
Motor
Inverter

Autonomous driving systems	Combination of sensing technology and vehicle control technology

*ITS：Intelligent Transport Systems, QZS: Quasi-Zenith Satellites, ECU：Electric Control Unit, ADAS：Advanced Driving Assistant System, DSRC：Dedicated Short Range Communication, V2X：Vehicle to X, 5GAA：5G Automotive Association, Sapcorda Services: joint venture established with Bosch,Geo++, and u-blox (Aug.2017)

Progress（Examples）
Implementing various road tests in Japan and overseas to establish safe autonomous driving technology

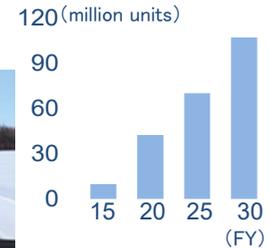Road test on the metropolitan highway ("Shutoko")(2H 2017-)

Test drive in cold climates (Jan.2018~)
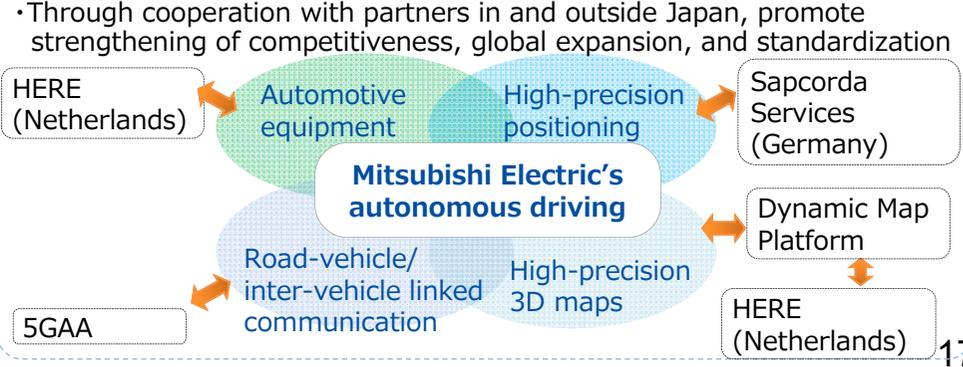
Road test in Detroit, US (2H 2017-)

Outlook on market size for autonomous driving systems

120（million units）
90
60
30
0
15 20 25 30
(FY)

Source: Strategy Analysis Nov.2017

*Includes autonomous driving levels of 1 to 5 (From driving assistance to fully autonomous driving)

<Relationship of Mitsubishi Electric's autonomous driving related technologies and major business development partners>
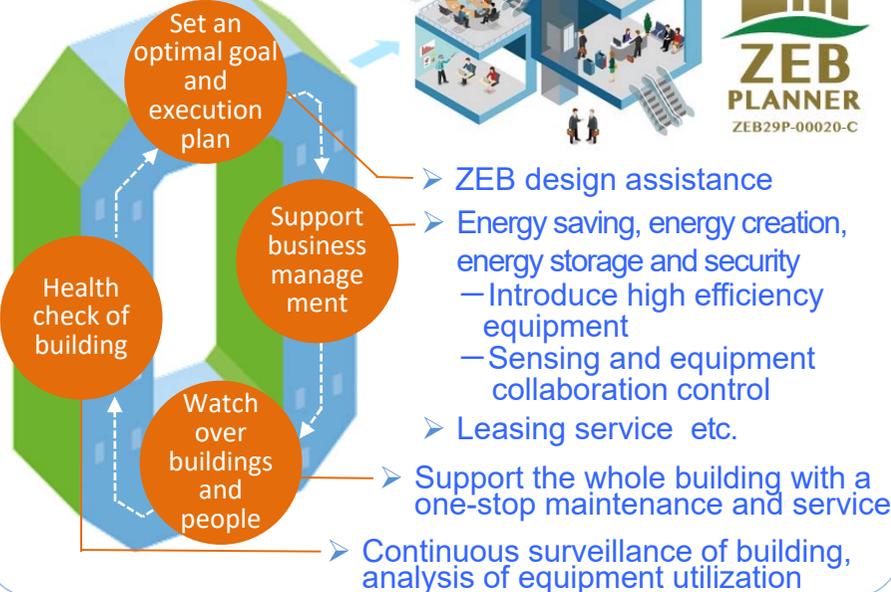・Through cooperation with partners in and outside Japan, promote strengthening of competitiveness, global expansion, and standardization

HERE (Netherlands)

Automotive equipment

High-precision positioning

Sapcorda Services (Germany)

Mitsubishi Electric's autonomous driving

Dynamic Map Platform

5GAA

Road-vehicle/ inter-vehicle linked communication

High-precision 3D maps

HERE (Netherlands)

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6. Technology Synergies and Business Synergies
ー Energy-saving ,Safety, Security and comfort for Buildings ー

ZEB deals Market size projection (Japan)

※Company estimate

Deliver products/ systems/ services across various business domains, and contribute to energy-saving, safety security and comfort, intellectual productivity and raising of asset value of the building

ZEB ONE-STOP SOLUTION

ZEB PLANNER
ZEB29P-00020-C

- Set an optimal goal and execution plan
- Support business management
- Health check of building
- Watch over buildings and people

➢ ZEB design assistance

➢ Energy saving, energy creation, energy storage and security
  ー Introduce high efficiency equipment
  ー Sensing and equipment collaboration control

➢ Leasing service etc.

➢ Support the whole building with a one-stop maintenance and service

➢ Continuous surveillance of building, analysis of equipment utilization

Progress（Examples）

■ Delivered a facility/system to contribute to ZEB **as the first ZEB planner** as an electronics manufacturer

Shirasagi Denki Kogyo Head Office Building
(Completed Jan.2018)

Achieved **74**% reduction against the standard primary energy consumption amount

BEMS Screen (Image)

＜Facility and services delivered＞
ZEB facility consulting, air conditioning, ventilation, lighting, elevators, solar power generation, power conditioner for EV, image monitoring, access control/management, substations (AC/DC),BEMS, operation and maintenance services

■ Promote technological development which contributes to improving comfort of living environments
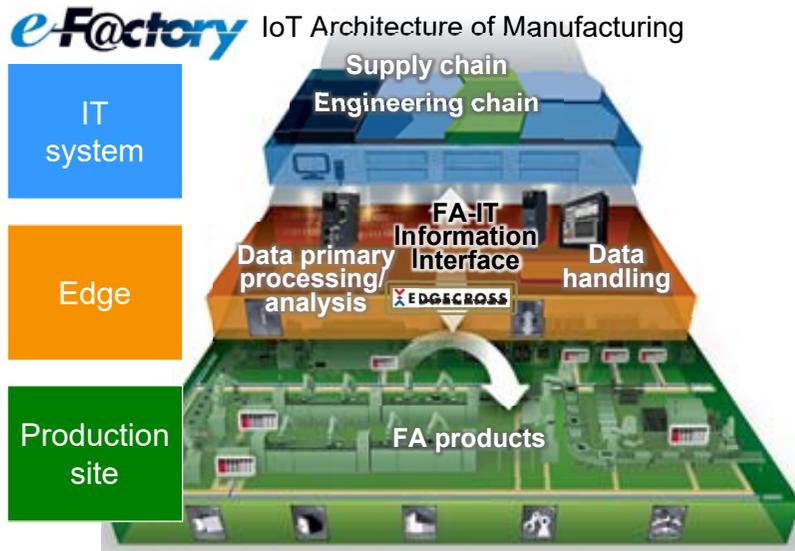

(e.g.)**Automatic morning preparation**
③(Curtain opens)
①<DETECT> User starts cooking
④(TV switches on)
②(Ventilator turns on)

Device-linking technology for smart Appliances
・Enable coordination between devices through IoT technology (without having to go through the cloud)
・Possible to equip home appliances in a compact manner. Deliver new value through linking of devices

*Standard Primary Energy Consumption Amount：The total converted calorific value of the energy consumed by facilities and equipment such as air conditioners, whose consumption amount is determined by the 2016 Energy Saving Standard per region, use of building, and use of room. For the Shirasagi Denki Kogyo Head Office Building, while the initial reduction was expected at around 70.1%, as a result of re-evaluation before the final specification confirmation, further reduction was achieved. BEMS：Building Energy Management System

6. Technology Synergies and Business Synergies
－ Strengthening Competitiveness of Manufacturing through IoT －

Market expectation of Intelligent Production

10 （¥Tn.）
8
6
4
2
0

18 20 25 30
（FY）

※Company estimate based on Fuji Keizai Co., Ltd data

Reducing total cost of development, production and maintenance through the utilization of FA and IT technologies

e-F@ctory IoT Architecture of Manufacturing

- IT system
- Edge
- Production site

Supply chain
Engineering chain

FA-IT Information Interface
Data primary processing/analysis
EDGECROSS
Data handling

FA products

<Partner companies> ＊Mar.2018

e-F@ctory Alliance

e-F@ctory: Approx.610 participating companies
- Software Partners (approx.150)
- SI partners (approx.310)
- Equipment partners(approx.150)

CLPA

CC-Link : Approx.3,300 participating companies
Approx.1,800 connectable products

Progress (Examples)
- Joined Edgecross consortium(Nov.2017)
- Launched Edgecross-compatible edge computing products(May.2018)

EDGECROSS
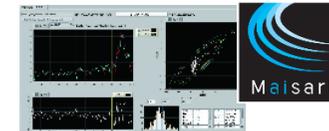
MELIPC   Real-time data analyzer   SCADA(MCWorks64)

- Strengthened global expansion of e-F@ctory

Japan
・East Japan FA Solution Center to be opened(Jul.2018)
・Completed construction of an e-F@ctory concept integrated-automation factory (Power Distribution Systems Center, VI and VCB factory, Feb.2018)

VI and VCB factory

China
・Built ITEI Intelligent Manufacturing model line(Nov.2017)
・Strengthened local organization

ITEI model line
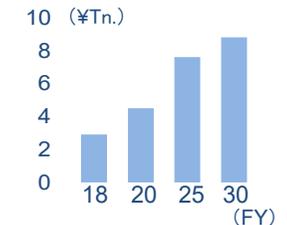
South Korea/ Taiwan
・Started South Korea/ Taiwan e-F@ctory Alliance formed(Mar.2018)

e-F@ctory Alliance formed

*Edgecross：An open software platform in edge computing which realize FA and IT harmonization., SCADA: Supervisory Control And Data Acquisition, VI: Vacuum Interrupters, VCB: Vacuum Circuit Breakers, ITEI: Instrumentation Technology and Economy Institute. Research organization directly under the Chinese government which promotes Intelligent Manufacturing.

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6. Technology Synergies and Business Synergies
― Further expanding Mitsubishi Electric AI technology "Maisart" ―

Compact AI which is our original technology promote the wider applicability of AI in diverse business

Mitsubishi Electric AI technology "Maisart"

Maisart

Deep Learning
Compact algorithm
Implement high level AI for all equipment

Reinforcement Learning
Implement our AI in a short period of time by speedy learning

Big data analysis
Efficiently analyze large volumes of data with limited amount of computation

Maisart：Mitsubishi Electric's AI creates the State-of-the-ART in technology

*FPGA：Field Programmable Gate Array

Object-recognition camera technology for electronic mirrors

Recognize objects which are about 100m away from rear side of car through real-time processing

☐ Truck
☐ Passenger Car

<Application fields/Use>
・Electronic mirrors, Autonomous driving
・Monitoring、Crime prevention

Intelligent wireless system utilizing AI

Improve a amplifier gain and movement efficiency by optimal tuning and reduce power consumption of communication equipment

<Application fields/Use>
・5G mobile base stations, terminal unit
・IoT-related equipment in homes, factories, etc.

Compact hardware AI

Realize implementation of AI into small FPGA. Expand applicable areas for AI by reducing computational time and lowering cost

<Application fields/Use>
・Home appliances, Elevators, High precision maps, etc.

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