Energy Efficiency with IoT & AI

Future of Cities – how does Digital Technology navigate to enhance value to “Smart City”

Tacci Noguchi, President and Chief Executive Officer, ABB Bailey Japan
ABB Facts & Figures

>130 years in Utilities, Industry and Transport & Infrastructure

Pioneering technology Leader in industrial digitalization

~$34 bn revenue*

147,000 employees in ~100 countries

>10,000 digital control systems

>70 MM connected devices

Global Strategic Partnerships

*SOURCE: Q4 2017 published financial results; ABB analysis
ABB will focus in digital transformation of industries and divest Power Grids

Divesting Power Grids to Hitachi

The new ABB

- Electrification
- Industrial Automation
- Motion
- Robotics & Discrete Automation
ABB Bailey Japan Facts & Figures

Since 1971
Started with JV with Bailey Control

Part of ABB group since 1999

One of 5 ABB companies in Japan

> 50% Market Share in Boiler Control for Utilities

> 30% Market Share in LNG Receiving Terminal

250 employees

Head-quartered in Izunouni, Shizuoka

7 locations in Japan

*SOURCE: Q4 2017 published financial results; ABB analysis
The future of cities
ABB perspectives and solutions
Challenge for Cities
Urbanization of Mega Cities and Suburban Challenges

Cities
- 90% urban area at coastline
- 3% of total land mass
- 60% GDP generated
- 2/3 energy consumed
- 60 – 80% Green house gas emission

Suburban / Developed countries
- Aging society
- Aging infrastructure
- Business shift
- People departure
- Risk of public services

Urbanization
- 2.9 billion people move to cities
- 70% population in Cities
- 90% at Developing Economy

Challenges
- Growth Challenge – population, economies
- Competing Challenges - investment and talented workforce, expecting high quality of life
- Sustainability Challenges - local pollution, carbon emission, limitation of natural resources
- Aging infrastructure - often beyond its intended life span

Meet citizen’s expectation
- Initiative for GHG reduction
- Education and medical services
- Quality of life
- Better public services.....

Attract Business
- Energy and utilities cost
- Transportation and other infrastructure
- Public services
- Skilled workforce

Cities in every facet will require address by government, communities and industries for sustainable future
Smart cities – the vision

how can cities attract business and people in a sustainable way

A holistic view of smart city projects with clear ambitions

Meeting city and citizen expectations and demands

Facilitated through digital connectivity and infrastructure

Met by fully connected and sustainable systems and services

- Sustainability
- Comfort
- Education
- Tourism
- Government
- Health and Social Services
- Public Safety

- IT/OT infrastructure
- 5G Network services
- Data analysis and optimization
- End-to-end connectivity
- City communications platforms

- Smart utilities
- Smart buildings
- Smart industry
- Smart transportation and infrastructure
- Smart city services
Smart cities – the vision

Smart cities are defined by the needs & expectations of the citizens.

- District heating & cooling
- Public services
- Health services
- Public safety
- Water
- Smart Buildings
- Education
- Renewable power & Storage
- EV infrastructure
- Network Power Generation
- Utilities
- City assets, Roads, Lights
- Emergency operation
- Digital infrastructure
Smart City Solution Area

ABB Technologies help developing various smart city
ABB Ability provides digital solutions and products for utility providers:
- Power generation, transmission and distribution
- Water supply and management
- Districts heating & cooling

from advanced diagnostics that prevent unplanned downtime, improve maintenance and safety to quality and asset management.
OPTIMAX® for Virtual Power Pools

Aggregates and integrates decentralized generation, flexible loads and storage systems to enable cost-effective operation of your assets to meet the load demand at any time:

- **Coordinate** networked generation by creating “virtual power plant”
- **Balance production and consumption** for multi-source systems (CHP, Water, HVAC) with day-ahead and intra-day planning
- ** Seamlessly integrate**, optimize & trade production from 1000s of small-scale generators across large areas
- **Plan** and **adjust** production dynamically thanks to forecasting
- **Implement** unique business models with flexible architecture
- **Couple** electricity, gas, heating & cooling, water and e-mobility
ABB partners with one of Sweden’s largest cities – Västerås
Smart City Ability solutions to increase sustainability, resiliency and efficiency

ABB collaborate with Mälarenergi, city’s public service company of Västerås to develop smart city solutions with ABB Ability for efficient and sustainable city attractive to business and citizens.

Gains for Mälarenergi

- **Water**
  - Close water with great taste
  - Reduce water leakage rate from today’s 20% with increased understanding of big-data visualization.

- **District heating**
  - Secure sufficient comfort with reduced production and advanced asset management of equipment owned and used by others in the distribution grid.

- **Asset management**
  - Best practices and processes helping to manage assets from day to day and throughout their lifecycle.

- **Utility**
  - Predictive production to minimize environmental impact.
  - Secure sufficient comfort with reduced production and advanced asset management of equipment owned and used by others in the distribution grid.

- **Network / Grids**

- **Hydro power**
  - Optimization of power
  - Optimize power sources for optimal benefit of the environment and cost perspective.

- **Solar power**

City opportunities

- **Smart City**
  - Connected equipment
  - Shared information creates new service opportunities.

- **City assets, Roads, Lights**
  - Optimization and coordination of road maintenance
  - Predictive asset management for new equipment.

- **Public services**
  - New ways of communication, case management system, crisis management
  - Increased speed and synchronization with reduced administration.

- **EV infrastructure**
  - Connected services, systems for billing

- **Emergency operation**
  - Visualization of current status reduces response time
  - Info from water, roads, property owners, citizen’s video streams etc., creates a better overview of available resources and situational awareness.

- **Real estate owners**
  - New ways of purchasing comfort for tenants with reduced costs.
Stadtwerke Trier

Proving the model

Customer requirement

- Connection / Integration power production, consume and energy storage in a own balancing group
- Connection to Day-Ahead-, & Intra-Day

ABB solution

- Expansion of automation system
- Energy management with energy forecast
- 3 stage optimization of balancing group:
  Day-Ahead-, Intra-Day & Intra-Period optimization
- Balancing of fluctuating renewable energy generation at the group level
- Reduction of balancing power expenses
- Integrating seamlessly battery storage and charging station for e-vehicles

Customer benefit
Smart Water
As Vietnam’s Ho Chi Minh City grows the need for a sustainable fix for water leakage increases

City of Ho Chi Minh lost nearly 30 percent of its clean water in 2016 through leaking and damaged aging infrastructure.

Solution
ABB Ability™ Symphony® Plus SCADA integrates a leakage detection and management system from water network management company TaKaDu. Data collection points, such as sensors and meters for flow and pressure monitoring, to the water network and allow SAWACO to digitally monitor the network conditions in nearly real time.

SAWACO undertook a major renovation of the city’s water distribution network.

Sustainable Development
Expansion of the current network capacity, integration of more isolated sections, reduction of water leakage, and real-time control and monitoring of the network conditions to prevent major disruptions are all part of the project scope.
Transforming transportation in globally sustainable ways.

ABB’s product portfolio includes:
- charging technologies for electric cars, buses and trucks,
- solutions for the electrification of ships, railways and cable cars,
- More than 7,000 DC fast charging stations installed in 60 countries

ABB is the global leader in connected DC fast charging technology.
### eBus and Heavy Duty Vehicle Charging

<table>
<thead>
<tr>
<th>Opportunity charging – On street</th>
<th>Overnight charging – Depot charging</th>
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</thead>
<tbody>
<tr>
<td>150 kW: HVC 150P</td>
<td></td>
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<tr>
<td>300 kW: HVC 300P</td>
<td>50-150 kW</td>
</tr>
<tr>
<td>450 kW: HVC 450P</td>
<td>Compact charge box with cable close to bus parking area</td>
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<tr>
<td>Quickest charge, on-demand, longer routes</td>
<td>Off-peak, load-friendly, wake-up/warm up</td>
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<tr>
<td><strong>Connected Services:</strong> Online 24/7/365, remote NOC monitoring, software upgrades; statistics, remote diagnostics and 1st line support</td>
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E-Mobility and Virtual Power Pools

Load and Energy Management for E-Bus Depots (ABB Ability Optimax EVFleet)
Forecast, Analysis and Optimization of Energy Cost in a Bus Depot
Power and Charging Management System for E-Buses

**Load and Energy Management for E-Bus Depots**

- PowerFit EVFleet
  - optimizes the load demand and the charging schedules of buses and Charging Stations
  - accounts for the technical restrictions, route schedules, energy prices and renewable generation forecasts in an optimal way

**Benefits – Reduce CAPEX and OPEX**

- Reduce the required grid connection (CAPEX)
- Maximize the consumption from your own renewable assets
- Charge your bus fleet in the most cost effective way
- Get reimbursed for your flexibility from your energy supplier
Integration of E-Mobility into Virtual Power Pools
3Connect Germany HUB Allgäu – Fleet Management System for E-Vehicles

Installed Capacity
121 kW

Maximum Required Capacity
35 kW
Integration of E-Mobility into Virtual Power Pools
Energy and Load Management System for E-buses - TOSA Project in Geneva

TOSA Key Figures

TOSA 15 Seconds Charging

TOSA - A breakthrough e-bus charging innovation from ABB for sustainable urban transport in Geneva – 1:18
https://youtu.be/fm3_N4Js3Nw

Charging a bus in 15 seconds: Geneva's new CO2-free public transport solution – 2:27
https://youtu.be/NLNQcEzLrY4

ABB enables the integration of power generation, consumption and storages for an efficient usage of energy
ABB eBus charging – reference projects

- **Luxembourg, Lux**
  - Ville de Luxembourg
  - 4 x HVC 150P

- **Namur & Charleroi, BE**
  - 15 x HVC 150P

- **Gothenborg, SE**
  - Volvo Busar
  - 1 x HVC 150P
  - 1 x HVC 300P
  - R&D

- **Namur & Charleroi, BE**
  - TEC
  - 1 x HVC 300P

- **Namur & Charleroi, BE**
  - 1 x HVC 150P

- **Ostersund, SE**
  - 2 x HVC 300P

- **Varnamo, SE**
  - Varnamo Energi
  - 1 x HVC 150P

- **Luxembourg, Lux**
  - MDDI & Sales Lentz
  - 4 x HVC 150P

- **Luxembourg, Lux**
  - Ville de Luxembourg
  - 4 x HVC 150P

- **Harrogate, UK**
  - Transdev
  - 3 x HVC 300P

- **Offenbach, DE**
  - Cobus
  - 50kW Connector based

- **Geneva, CH**
  - Hess
  - TOSA

- **Södertälje, SE**
  - Scania Buses
  - 1 x HVC 300P
  - R&D test track

- **Plattsburgh, USA**
  - Novabus
  - 1 x HVC 300P

- **Munich, DE**
  - MAN Truck & Bus
  - 4 x HVC 150C
  - R&D
ABB Ability provides digital solutions and products for utility providers:
- power generation, transmission and distribution
- Water supply and management
- Districts heating & cooling

from advanced diagnostics that prevent unplanned downtime, improve maintenance and safety to quality and asset management.
ABB Ability™ Optimax Virtual Power Pools for Site (Energy Management System for Sites)

Site EMS
Connects local assets
Optimizes & controls to maximize value at site level

1. Solar
   - Reduces energy costs
   - Reduces CO₂ emissions

2. Storage (BESS)
   - Allows peak shaving and other optimization benefits
   - Provides power quality services
   - Offers back-up power

3. EV charging
   - Providing fast or standard charging speeds
   - Allows smart charging solutions to reduce peaks
   - May provide link to charge point operators

4. Backup Diesel
   - Allows peak shaving
   - Provides power quality services
   - Offers back-up power

5. Recogizer
   - Links to building automation to optimize heating, cooling, ventilation
   - Where available links to CHP and/or back-up generator to create more value
Integration of Renewables and Charging
Solar and EV Integration in commercial buildings and spaces

ABB supports COOP with innovative technology

In addition to robotics solutions that increase energy efficiency, COOP installed solar converters from ABB to achieve CO2 neutrality by 2023

Solution: Increase of own solar capacity with 20,000 sqm of PV installations on the rooftop of 17 sites

Benefits: own consumption is managed, control over energy and costs is achieved, OPEX-costs are decreased

Automation factory in a process of carbon neutral

- ABB Bailey Japan installed 1,000 PV panel to generate 257kw and PV inverter - 2012
- Newly installed are; fast EV charger and
- ABB Ability Optimax for Virtual Power Pools for Site being managed in itself at its Collaborative Operation Center
ABB – Mission to Zero
The future of electrification is safe, smart and Carbon neutral - through OPTIMAX optimization

- 1.3MWp solar production (86% self-consumption, 14% to grid)
- 1.1 GWh production / year
- CO2 reduction of > 629 t / year (> 15k tons over 25 year life)
- Fully self-sufficient during peak solar production
- Onsite generation of 50% of total energy needs (CHP + PV)
ABB Ability™ digital solutions make your buildings smarter:
- intelligent and automatic lighting,
- air-conditioning
- heating
- movement detection
We make greater energy efficiency and increased security easier than ever - controlled remotely, giving you complete control.
ABB Ability™ OPTIMAX® Virtual Power Pools for Site

PoC – Demand Response for Building HVAC system

Target PoC

- HVAC 13 floors 52 units with multiple tenants
- Connectivity with existing building automation (BACnet)
- Connectivity with existing EV Charger
- Receive instruction of DR and control

Requirements

- Proper control of HVAC along with instructions of DR volume
- Absorb energy consumption at EV charging

ABB Solutions

- Optimization of logic, Event management
- Preparation of batch messaging
- Managing objects (detailed conditions)
- Follow up control during event
- Monitoring HVAC conditions and recovery
- Identification of EV charging

PoC for enhancing building load for Energy Optimization
Innovation in action: ABB-free@home® in a sustainable development

First energy self-sufficient multifamily house in the world

ABB-free@home and ABB solar equipment provide off-grid living with superior comfort
ABB Ability™ Collaborative Operations connects assets and operations and engineering and business management through IOT applications, delivering real-time 24/7 information to identify, categorize and prioritize actions. Integrated digitalization helps improve asset availability, operational efficiency and safety and business profitability.
Leading solutions for collaborative operations
Enabling customer to remotely collaborate with ABB domain experts 24/7

Customer Operations Center / HQ

Analytics
- Analytics and Visualization
- Simulation

Ops support
- Operations and Technical Support

Optimization
- Emission Monitoring
- Energy Optimization
- Performance Optimization
- Alarm Management

Predictive maintenance
- Condition Monitoring
- Asset Health
- Predictive Maintenance

Cyber and Safety
- Cyber Security
- Safety Management

Control
- Control Centers
Let’s write the future, together

Smart cities – the vision

District heating & cooling
Health services
Water
Education
Public services
Public safety
Smart Buildings

Renewable power & Storage
Utilities
Emergency operation
City assets, Roads, Lights
Digital infrastructure

Transportation

Ability™ and partner solutions