Role of Digitalization in Energy and Industrial Revolutions?

IIC IIoT Energy & Efficiency Forum

Espoo May 25th, 2018
Energy and Industrial Revolutions

World as we know it is being disrupted – at unprecedented rate of change

**Utilities**
- Renewable electrification
- Smart distribution

**Industry**
- Industry 4.0
- Collaborative, Flexible Manufacturing
- Real-time energy optimization

**Transport & Infrastructure**
- Smart Cities
- E-Mobility
- Mobility-as-a-Service
- Data centers

Electric energy and digitalization are the common denominators
Renewables and energy storage driving unprecedented change

Consider these developments

**Renewables growth**

![Solar icon]

+27%

Already over 27% of all energy generation in Europe comes from renewables, while in the US 15%

**Energy storage price reductions**

$36/Month

Average American consumes 903 kWh/month →≈ 30 kWh/day
By 2020 it will cost $36.8/month ($1.2/day) for a full day of electricity storage

**New regulations & incentives**

8-10%

Global renewables capacity has increased by 8-10% y-o-y since 2010 and the trend is to continue, with over 150GW added annually (2/3 of all capacity addition)

**Renewables penetration**

85%

At certain times of year in Germany the Max hourly variable renewable generation rate already above 85% of hourly demand. Result: NEGATIVE ENERGY PRICES

**Disruption through new business models**

$0

SV Startup Volta offering FREE EV charging in exchange for media rights at prime high-value properties. If this business model succeeds, the EV MARGINAL COST of energy will be ZERO

**The Green agenda**

$350 billion

China recently said it would shut 85 coal plants and instead invest $350 billion in renewable sources of energy
Resulting in increasing complexity in Energy System

New challenges for traditional paradigms for control and commerce

- Distributed energy resources at customer sites
- System in which EV sell demand response services to the grid
- Control in-home appliances to switch off high-load components (load disaggregation)
- Collect, store and report residential energy use information
- Underlying communication to support Smart technology
- Health Monitor network parameters & control devices remotely
- Managing voltage levels & reactive power (VAR) with assets owned by the utility and otherwise
- Distribution connected renewables generation and storage
- Aggregation of DERs for wide-area grid support and market trading
- Load management at customer sites through e.g. dynamic pricing
- Regulatory requirements for more granular pricing schemes and markets
- Prosumers locally sell excess energy from their distributed energy
- Decentralized market platform for charging EVs
- Frequency Regulation
Smart Manufacturing offers tremendous business potential

Tapping into benefits requires much greater agility than typical today

“Smart factories have the potential to add $500 - $1,500 billion annually to the global economy in the next five years.”
Source: Capgemini 2017

“Smart factories are revolutionizing manufacturing by enabling a 7x increase in overall productivity by 2022.”
Source: Capgemini 2017

Industrie 4.0 - DEU
Launched in 2011 at the “Hannover Messe” by the German government. Industrie 4.0 combines production methods with state-of-the-art information and communication technology.

National Network for Manufacturing Innovation - USA
Launched in 2011 by the US government. Network of research institutes focusing on developing and commercializing manufacturing technologies.

Innovation in Manufacturing 3.0 - KOR
Launched in 2015, it aims to invest KRW200 billion ($172 million) annually from 2015 to 2020 to facilitate the building of 1,500 smart factories by 2020.

Made in China 2025 - CHN
Launched in 2015 by the Chinese government, the initiative aims to comprehensively upgrade Chinese industry.

“Smart factories have the potential to add $500 - $1,500 billion annually to the global economy in the next five years.”
Source: Capgemini 2017

“Smart factories are revolutionizing manufacturing by enabling a 7x increase in overall productivity by 2022.”
Source: Capgemini 2017
Multiple deployment models required
Secure digital solutions on-premise, in the cloud, and in an ecosystem
Resulting in new way of working: Collaborative Operations

Collaborative Operations links ecosystem players together for value
# Things are coming together with IIC

## ABB contributions to the Industrial Internet Consortium

### Technology and Liaison

<table>
<thead>
<tr>
<th>Architecture</th>
<th>- Co-authored IIRA Analytics and Advanced Data Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytics and Artificial Intelligence</td>
<td>- Co-authored Industrial Analytics WP and IIAF</td>
</tr>
<tr>
<td>Edge Computing</td>
<td>- Co-authored Edge Computing WP</td>
</tr>
<tr>
<td>Liaison</td>
<td>- Liaison Officer for NEMA</td>
</tr>
</tbody>
</table>

### Testbeds and External Events

<table>
<thead>
<tr>
<th>TSN – Flexible Manufacturing for Robotics and Automation Cells</th>
<th>- Testbed contributor (B&amp;R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IoT Solutions World Congress</td>
<td>- Co-authored TSN WP (ABB and B&amp;R)</td>
</tr>
<tr>
<td>- Program Committee member</td>
<td>- Diamond Sponsor 2017</td>
</tr>
<tr>
<td>Global Forum</td>
<td>- IIC Keynote in Helsinki</td>
</tr>
</tbody>
</table>

### Governance and Support

<table>
<thead>
<tr>
<th>Policies</th>
<th>- Strengthened member agreement to cover anti-trust principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>- Contributed to Group procedures</td>
</tr>
<tr>
<td>- Co-founded the Industrial Analytics TG</td>
<td>- Technology WG co-chair</td>
</tr>
<tr>
<td>- Elected to SteCo representing Large Industry members</td>
<td>- Member dinner in Helsinki</td>
</tr>
</tbody>
</table>

## ABB is committed to the success of the IIC with digitalization and IIoT best practices