Strategy for the Future
Delivering high-added values from an equipment supplier

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President & CEO
Tokyo Electron Limited
Why was Pokemon-GO release delayed in its home ground Japan?

Because of the server capacity
User’s frustration is...
Battery runs out soon

Because of AR and GPS which consume high-power
Autonomous driving will transform society

It requires sensor systems and AI enabling advanced semiconductor
New wave of IoT technologies

New disruptive technologies require higher performance, lower power and higher reliability devices
**Semiconductor technology roadmap**

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<td>10nm</td>
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<td>1Xnm</td>
<td>1Ynm</td>
<td>1Znm</td>
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<td>64 layer</td>
<td>96 layer</td>
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<td>STT-MRAM</td>
<td>ReRAM, XPoint</td>
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<td>Fan Out-WLP / 2.5D, 3D</td>
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Source: TEL marketing, as of April 2016

**As technology becomes complex, the role of equipment supplier is getting more critical**
Quest for leading-edge solutions with wide range of products

TEL™ leading-edge technologies
Integrated technology is becoming more essential

SAMP
(self-aligned multiple patterning)

SAMP requires ALD, which can control deposition thickness at the nm scale

SAC
(self-aligned contact)

ALD and ALE are indispensable to SAC, which is now dominant in MOL contact

44nm hp  22nm hp  11nm hp  5.5nm hp

We propose optimized solutions which solve customer’s critical problems by integrating our various technologies
TEL-IMEC partnership since 1998

This collaboration began with lithography area,
Now expanded to other key technology programs
Significant results achieved by open innovation

TEL - Tohoku University partnership for STT-MRAM

2Mb STT-MRAM fabricated with 90nmCMOS/60nm MTJ adapting on-via MTJ cell structure

- 60% cell size reduction (vs. conventional off-via MTJ cell)
- Over 95% average yield

Achieved with TEL’s PVD & RIE

H. Koike et al. @ IMW2016

By courtesy of Professor Endoh, Director of CIES

*CIES: Center for innovative integrated electronic systems in Tohoku University since 2012.
New wave of IoT technologies

Existing technologies just as important as innovative technologies
Semiconductor manufacturing process node for IoT

Wafer Consumption by Node

(Mil. sq. inch)

Source: IHS, Semiconductor Silicon Forecast Tracker Q2, 2016

Leading-edge

Mature Technology

Manufacturing process node going multi-generational
Existing manufacturing lines just as important
Our strategic directions in IoT era

Provide leading-edge equipment

Improve performance of legacy equipment

Respond to customer needs in all generations
Providing solutions for equipment in the field - capacity

TEL’s world-wide installed base: 60,000 units
(Taiwan 12,000 units)

Upgrades to leading-edge technology

TEL-certified used equipment

Fully support customers’ diversified needs driven by IoT
Providing solutions for equipment in the field - productivity

Intelligent Remote Service
TELeMetrics™

- **Customer fab site**
- **TEL real-time Database server**

**Internet**

- **27% reduction** in MTTR
- **35% reduction** in process variability
- **20% reduction** of consumables
- **10% improvement** in throughput

Actual values based on specific situations. Results may vary.

Increase equipment productivity and lower manufacturing costs
Providing further values - smart manufacturing

Intelligent equipment

- Sensing & AI technology
- Optimal process control
- Self-diagnosis
- Predictive fault detection

Smart manufacturing realized by intelligent equipment
Taiwan, the largest spender and the largest wafer capacity holder

Wafer-fab equipment spending in 2015

Taiwan 26%

U.S. 15%

China 12%

Japan 15%

Korea 22%

Europe 6%

Other 4%

Source: VLSI Research

Wafer capacity at Dec-2015

Taiwan 22%

U.S. 14%

China 10%

Japan 17%

Korea 21%

Europe 6%

Other 10%

Source: IC Insights, Monthly installed capacity in 200mm equivalents

Taiwan plays a critical role in the semiconductor industry both in terms of “production” and “technology development”
Summary

- As new and innovative applications emerge, semiconductors are required to evolve further.

- Customers’ needs get diversified. We continue to provide leading-edge technologies that support customer’s further scaling, while providing solutions to customers’ needs by upgrading their existing manufacturing technologies.

- TEL is fully committed to support semiconductor industry in Taiwan which is a critical base both in terms of “production” and “technology development.”