Thinktank Roundtable C (IEEJ)

Digitalisation, an Enabler of the Energy Transformation

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Pre-Introduction

Digitization, Digitalization or Digitalisation

- I am no expert, I am farrrrrrrrrrrrr from an expert
- I will talk about what I think I know about digitalization
- My apologies fo my panelists who will have to correct me in the coming hour

Source: IEEJ

Introduction

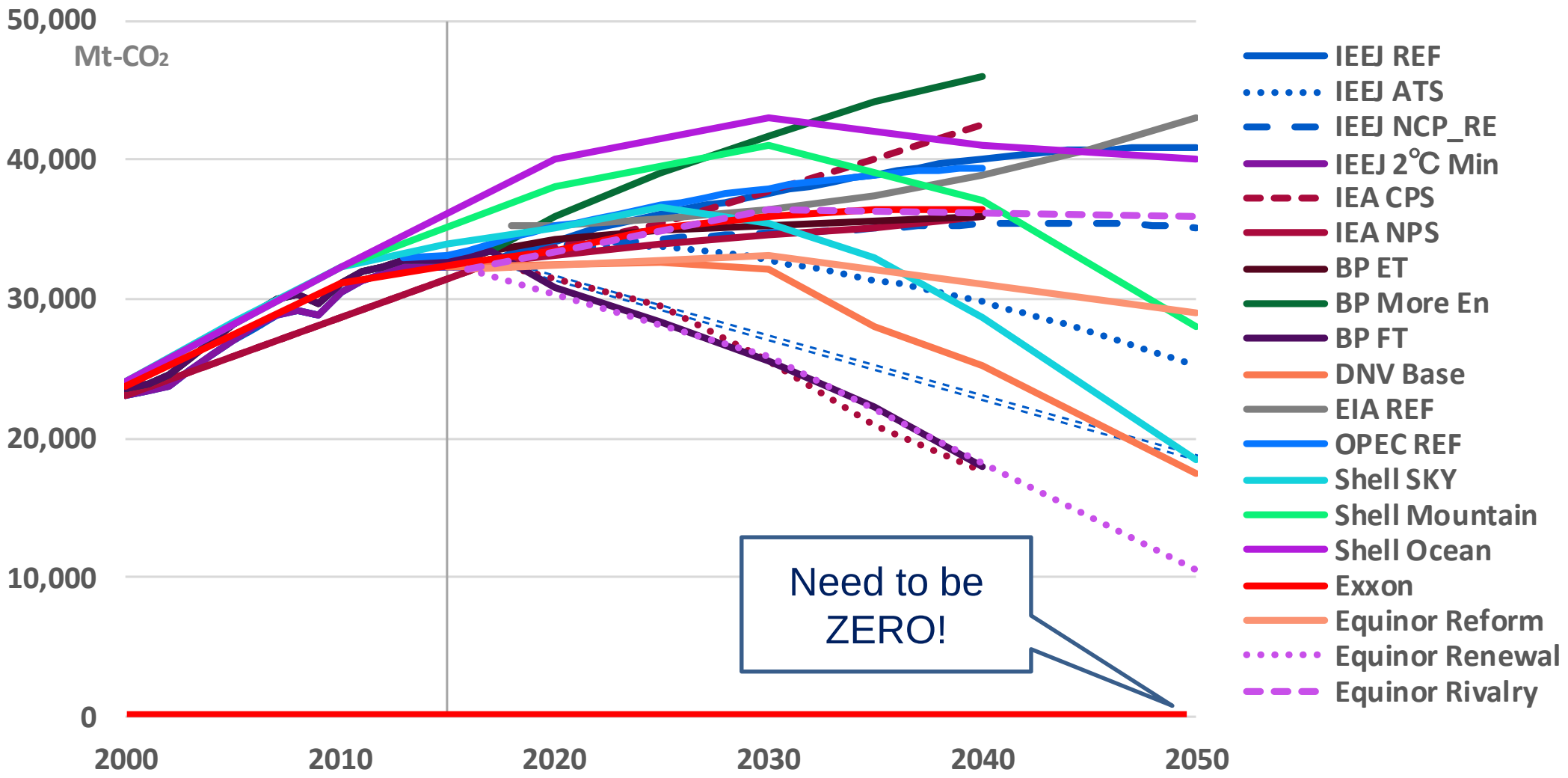
How to Accelerate Energy Transformation?

- Need Bulk Introduction of Clean Energy (renewables)
- Need New Players (ESG, TCFD)
- Need a New Way of Thinking (IT, IoT, AI)
- Need Lots of Data (Big Data)

Need **Digitalisation, maybe?**

Source: IEEJ

Global CO2 Emissions



Dash for Renewable Comes with New Challenges

- Currently towards electricity… Challenges remain in transport and industrial use
- Decarbonization with carbon- free electricity (i.e. nuclear, renewable, fossil fuels with CCS/CCU).

- VRE brings challenges to the power sector (generation, system operators, transmission, distribution…)

- Uncertainty and Intermittency

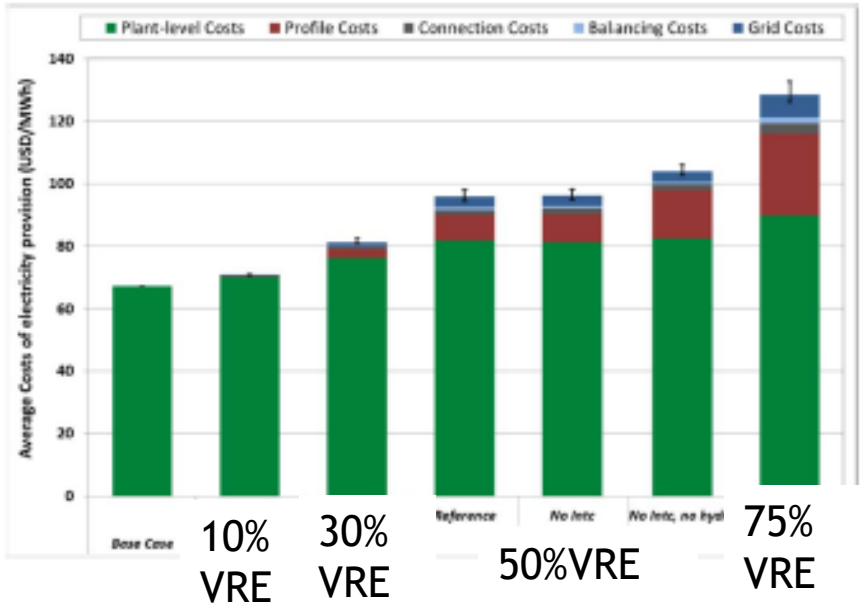
- Low average utilization ratio (PV:13%, Onshore Wind:20%, Offshore Wind:30%)
  ➔ More capacity (and space!) required than thermal plants

- Central grid access may be limited **in peak generation hour** (curtailment)
  ➔ Flexibility is required in demand-supply balancing

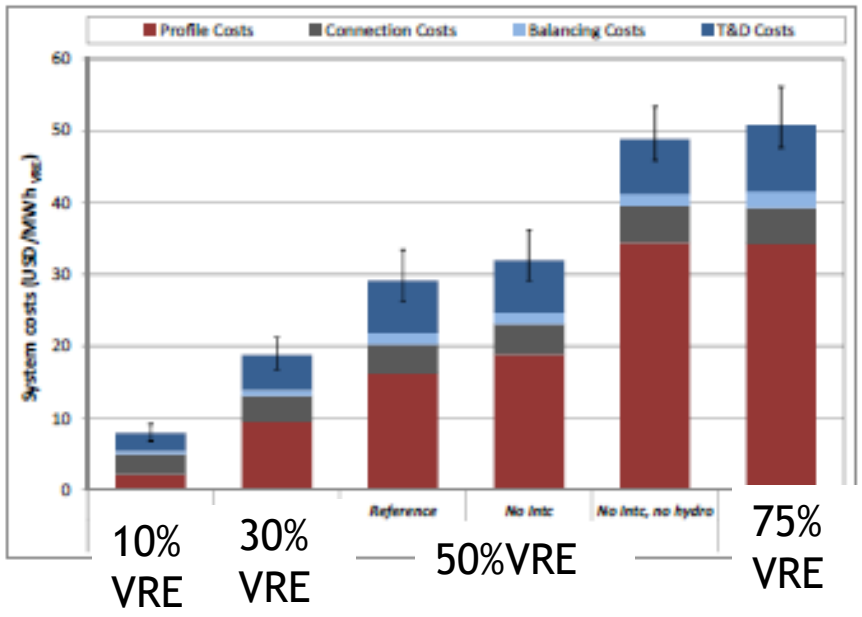
☐ All “cons” above mean additional “costs”

As VRE Share Increases, System Costs Increase

Total Costs



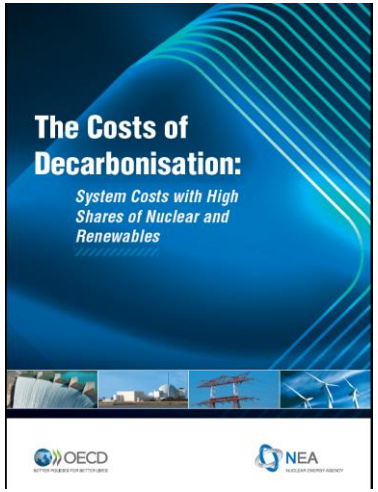
Breakdown of System Costs



Characteristics of Wind & PV

- Variable
- Uncertain
- Location-constrained
- Non-synchronous
- Modular
- With low variable costs

- ☐ Profile Costs
- ☐ Balancing Costs
- ☐ Grid Costs
- ☐ Connection Costs



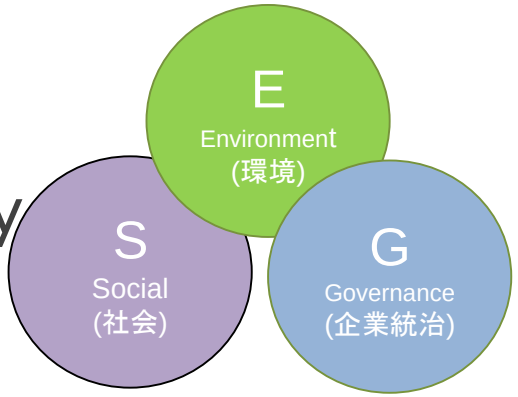
Source: OECD/NEA,The Costs of Decarbonisation (March 2019)

New Players in Town after Paris!

- Principle of Responsible Investment, TCFD and ESG
  - "Coal divestment" and de-carbonization trend
  - Rapid shift towards EV → peak oil demand?
  - Aggressive plan to introduce renewables → 100% renewables?

    ⇒ No more investment in fossil fuels?

TCFD TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES



- Decentralized (Distributed) :small-scale regional energy network in addition to existing central network.

  e.g. Smart cities with BCPs (business continuity plan)

- Demand-side players such as prosumers and VPPs. New business requirement such as CASE(*) and MaaS.

  *CASE: Connected, Autonomous, Shared and Electric

- Resilience and adaptation in addition to mitigation

New Way of Thinking after Paris!

- Growing expectations towards digitalization (AI, Big Data, IT, ICT, IoT, robotics...)
  - Autonomous driving, shared economy…, Tesla, Uber, Platformers (GAFA, …
  - Market liberalization, prosumers, blockchain, VPP, smart grid, smart city/ compact city…

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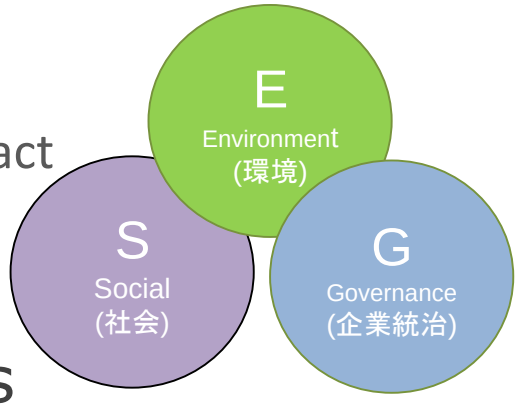
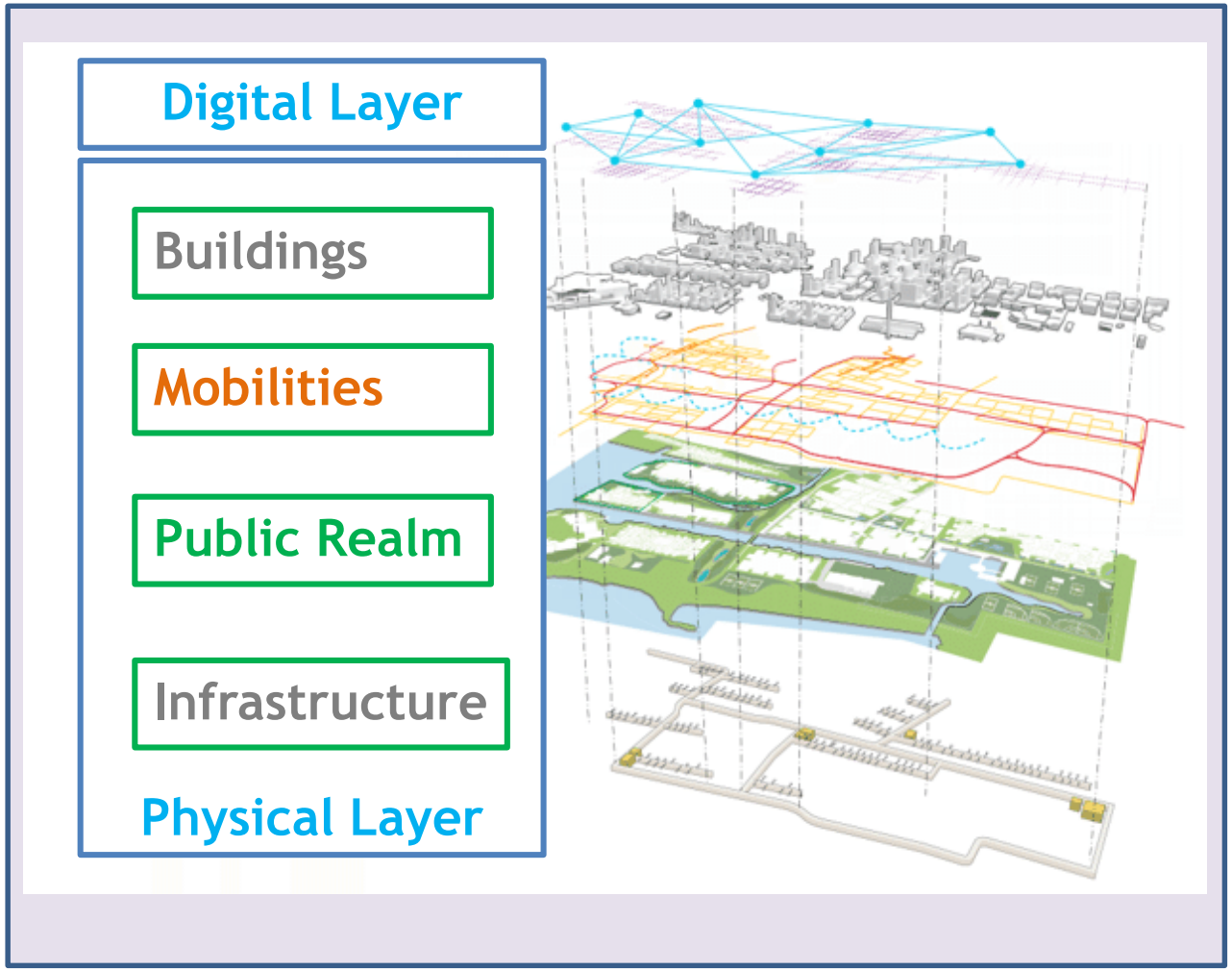


- **Digitalization** assists balancing demand and supply as well as clearing the markets with new players

- Growing concerns
  - Intellectual Property Rights, trade conflicts, cyber attack…

Smart City, Distributed Energy, Mobility, Resilience

- Digital Infrastructure over Physical Infrastructure layers e.g. Toronto Sidewalk
- Energy Management
  e.g. TEMS, BEMS, HEMS
- Mobility (VPP, V2G, car sharing, …)
- CASE, MaaS, Smart Pay, e-Government
- Sustainable infrastructure with resilience with BCP (Business Continuity Plan)



In Summary

Accelerating Energy Transformation:

- Need Bulk Introduction of Clean Energy (renewables)
- Need New Players (ESG, TCFD)
- Need a New Way of Thinking (IT, IoT, AI)
- Need Lots of Data (Big Data)

Of Course, **Digitalisation** can be an enabler.

I am counting on my panelists to de-mystify these concepts.

Questions for the Panel

- Can digital technologies assist variable renewable electricity to become a major power source?
- What are the pros and cons of distributed vs centralized power systems? Can digitalization contribute to the design of a well-balanced combination of the two types of systems? Will society benefit?
- How and Can digital technologies contribute in facilitating the roles of prosumers?
- Are there governance issues? Do we need to protect systems, users and data?

Panelists

(in alphabetical order)

- Dr. Arij van Berkel,
  Research Director,
  Lux Research

- Mr. Matthew Friedman
  Chief Digital Officer
  Sembcorp

- Ms. Miki Sato,
  General Manager,
  Business Planning & Promotion
  Tokyu Power Supply Co., Ltd.

Time for Tea Now

- Enjoy your tea and please think about your questions

General Questions for the Panel

- Can digital technologies assist variable renewable electricity to become a major power source?
- What are the pros and cons of distributed vs centralized power systems? Can digitalization contribute to the design of a well-balanced combination of the two types of systems? Will society benefit?
- How and Can digital technologies contribute in facilitating the roles of prosumers?
- Are there governance issues? Do we need to protect systems, users and data?