



2023.11.15

**French-Japanese workshop on
blockchain technologies and
applications to digital trust Day2**

**Considerations about
Data & Device Trust for
Energy Resources**

Yoshikazu Azuma

- **introduction – myself & company / business**
- **necessity of energy resources IoT, that means ERA(Energy Resources Aggregation) for renewable energy**
- **VPP(Virtual Power Plant) services with ERA of DER(Distributed Energy Resources)**
- **Trust in the electric power system**

Introduction

Introduction of myself and the company

Yoshikazu AZUMA

NR-Power Lab's CTO, Seconded from Ricoh Company Co., Ltd.

- Main Areas of Expertise

Wi-Fi (wireless LAN), Ethernet, SDN(Software-Defined Networking), etc.
Network and interface technologies, Security related to them,
Standardization activities related to them, etc.

- Examples of Development Achievements:

[High-speed Wireless LAN Technology | Global | Ricoh](#)



- Recent Work

Data trust & Device trust for Energy Resources

“Traceability of renewable energy with blockchain” PoC in Electric Power field.

[Applying Blockchain Technology to Renewable Energy | Global | Ricoh](#)

Working Group launch work in Green*Digital Consortium

[Green x Digital コンソーシアム \(gxdc.jp\)](#) (Sponsored by JEITA)

Green x Digital
Consortium



- Award

- TCG Key Contributor Award 2020 [Contribution-Award | Of | Trusted Computing Group | \(TCG\)](#)

- Interop Tokyo 2022 Best of Show Award “Special Prize” [External LAN Ports expansion option box Type M37](#)

Company name	NR-Power Lab Co., Ltd.
Location	< Head Office > NALIC #312&#313, 2-22-8 Chikusa, Chikusa-ku, Nagoya, Aichi < Shin-Yokohama Office > I's building #402, 3-18-5 Shin-Yokohama, Kohoku-ku, Yokohama, Kanagawa
Business commencement date	February 1, 2023
Capital / Investment ratio	40 million yen / NGK Insulators 51%, Ricoh 49%
Business details	Business development related to VPP(Virtual Power Plant) and Energy resources data services
Number of employees	14(Current)



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NAS[®] Energy Storage & Operational Technologies for its

IoT/network technologies through the development of office equipment, etc.

VPP (: Virtual Power Plant) Services

It is the IoT for energy resources. Energy storage is important part.

By the IoT of energy resources.

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Energy Resources Data Services

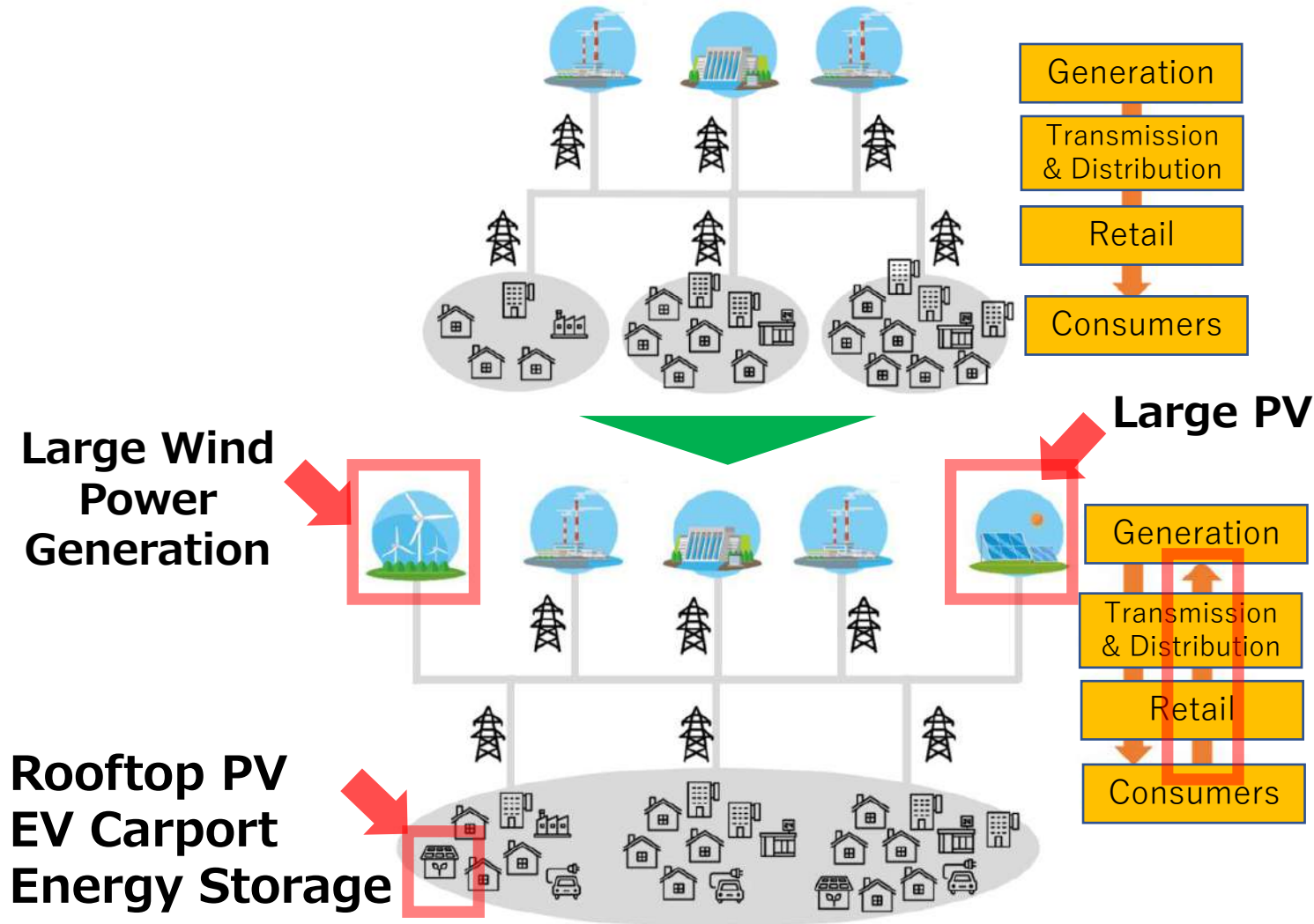
Providing services for carbon neutral based on energy resource data.

Aim to contribute to renewable energy spread and sustainable society.

Background

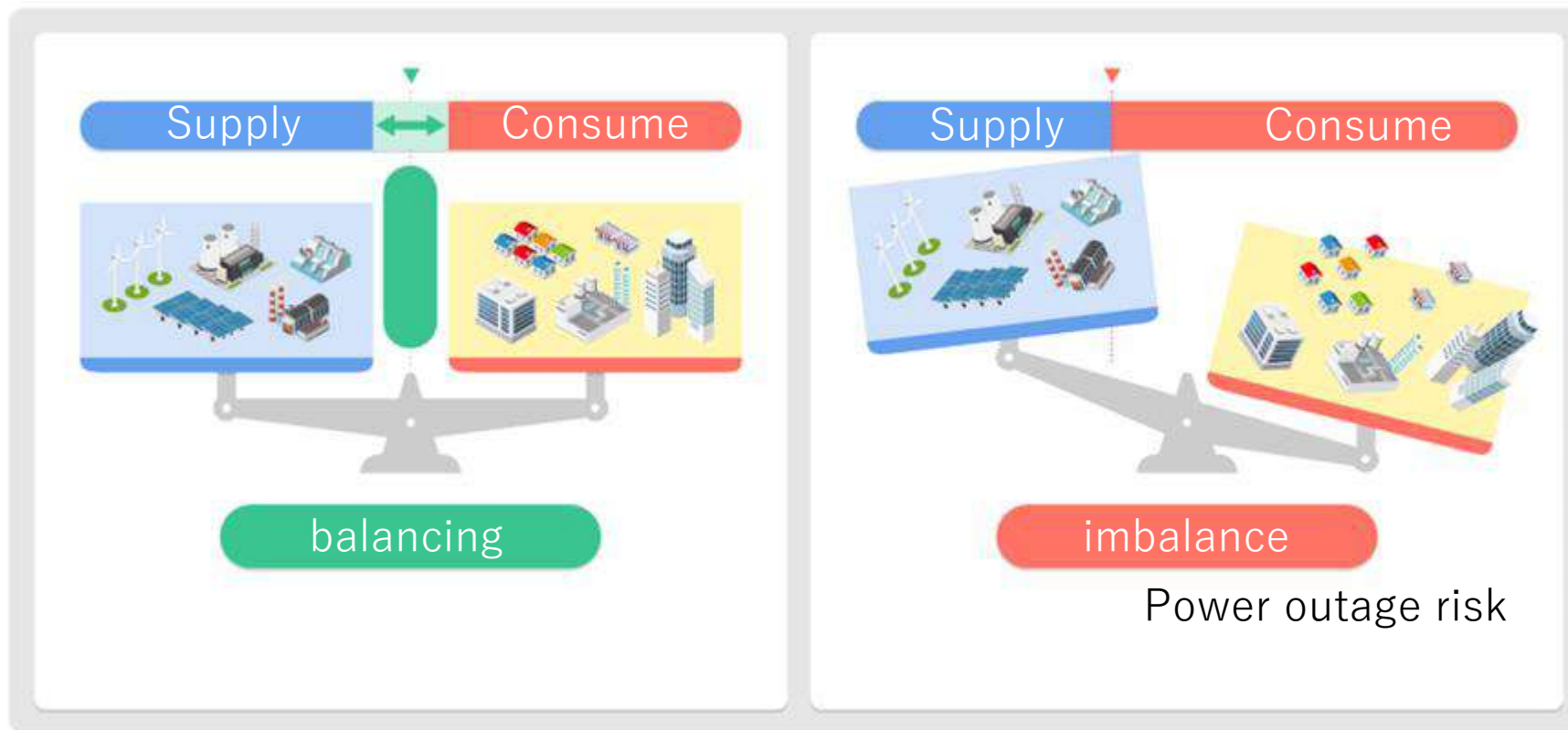
**Why is IoT of energy resources
necessary for the spread of
renewable energy?**

■ The power grid becomes unstable.



• Both the supply on the generating side and the reverse power flow on the consumer side affect the grid.

08 | Electric Power grid needs "balancing".

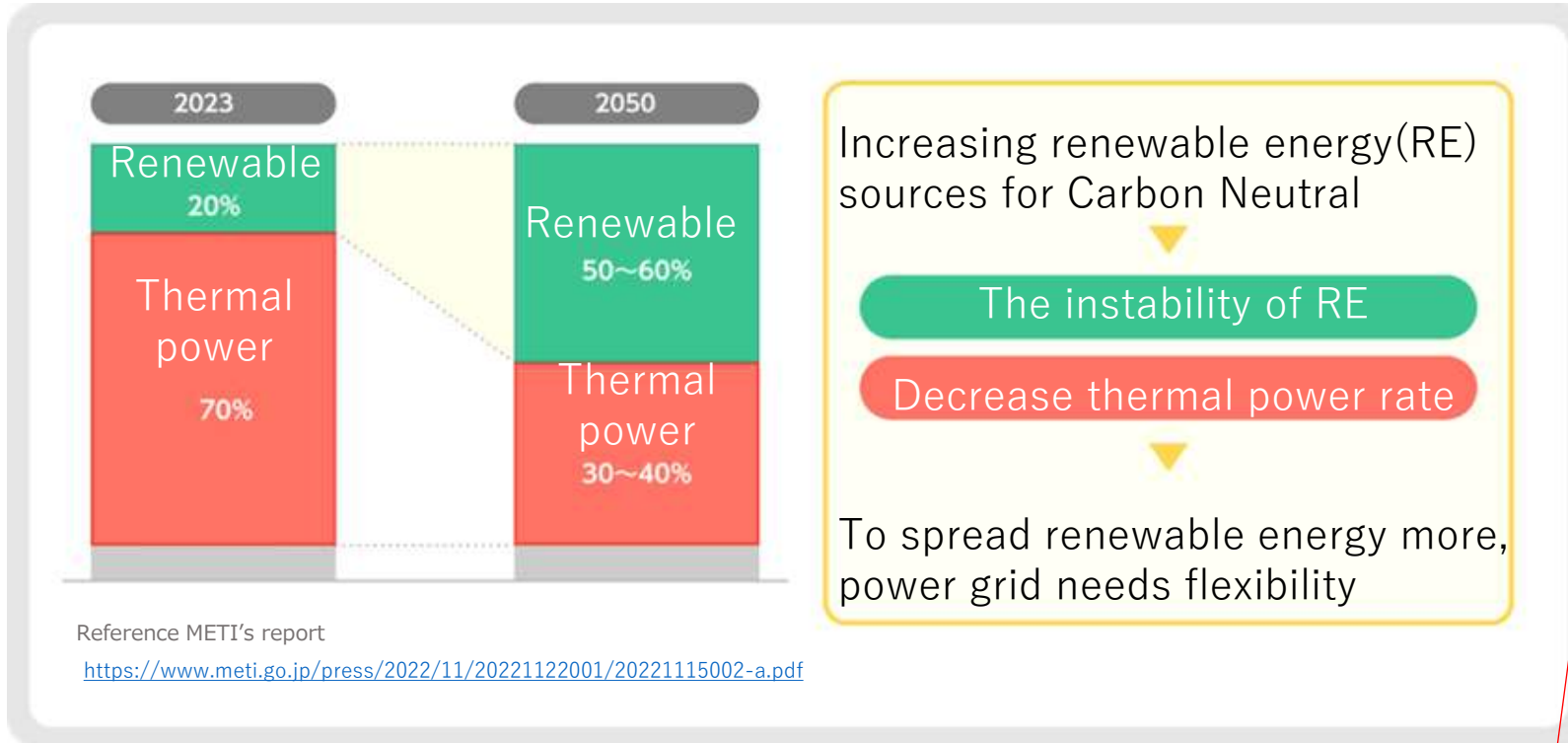


- The power grid is the OT system for control "balancing"

□ And currently, the amount of power generation is adjusted mainly by thermal power plants

09 | Because of change in power supply ratio, DER, ERA is required

- Instead of declining thermal power plants, other resources will be needed to adjust electric power.



How to balance the supply and demand instead of large “adjustable” power plants?

Small-scale energy resources on the consumers side are expected for this.

It is called DER (Distributed Energy Resources)

“IoT of DER” is called ERA(Energy Resources Aggregation).

...and the services enabled by ERA is VPP (Virtual Power Plant).

Rooftop PV
EV Carport
Energy Storage



Consumers

Services through the ERA: Energy Resource Aggregation

VPP (Virtual Power Plant) & Secondary effects of it

VPP are services that aggregate DER facilities to perform **functions "like" electric power plants**

Focus on facilities distributed over a wide area in consumer side (= DER)
Aggregation of DER by IoT = ERA



The thing "like" electric power created by VPP is called "Electric Power Reserve".

Especially, energy storage is key facility for VPP.

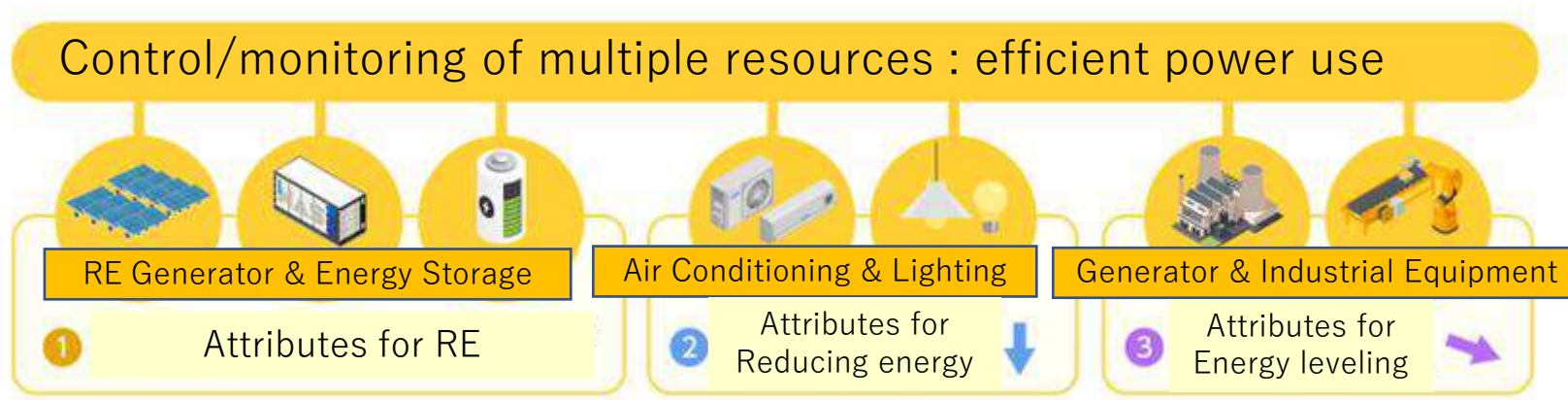
Examples of facilities :
Energy storage, Air Conditioning & Lighting, PV/EV, Generator, Electric Water Heater, Co-generator, Hydrogen generator, Industrial Equipment, etc.

Examples of VPP operation :

- Insufficient power generation: Discharging from energy storage, Reducing power consumption for air conditioning & lighting, etc.
- Surplus power generation: Charging to energy storage, etc.

11 | ERA can measure “Green” attributes.

- Facilities data can be obtained in ERA.
- That is, Green attributes.
- They create additional services.



Provision of secondary services:

Solutions related Carbon Neutral by ERA such as...

carbon footprint(CFP) calculation, renewable energy credit issuance, etc.

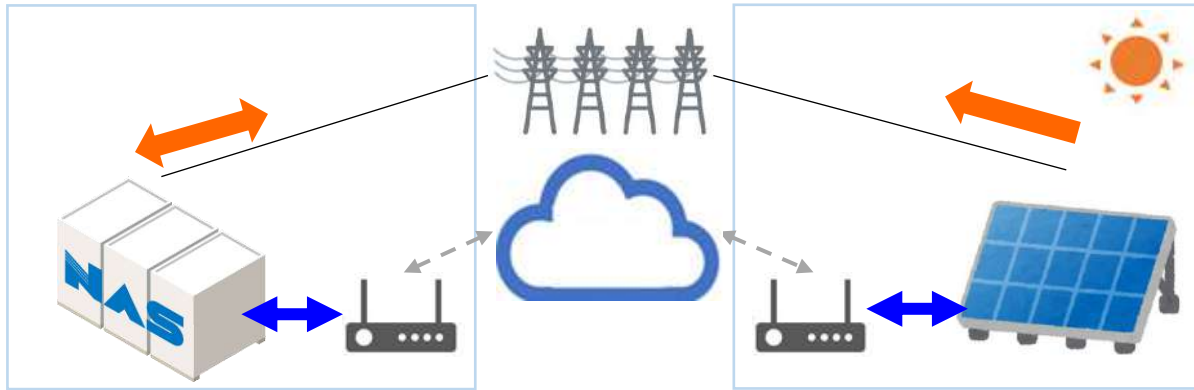
VPP/ERA Users can increase ROI in the investment to facilities,

due to the economic value generated by the Green attributes and the reducing electricity power charges through the efficient electricity power use.

Challenges in connecting a large number of energy resources

Trust in the Electric Power System

ERA requires OT/IT convergence



Energy resources are part of the "power grid," an OT system that controls physical phenomena such as power generation, charging, and discharging. Trust data is required.

Large amount & Distributed over a wide area



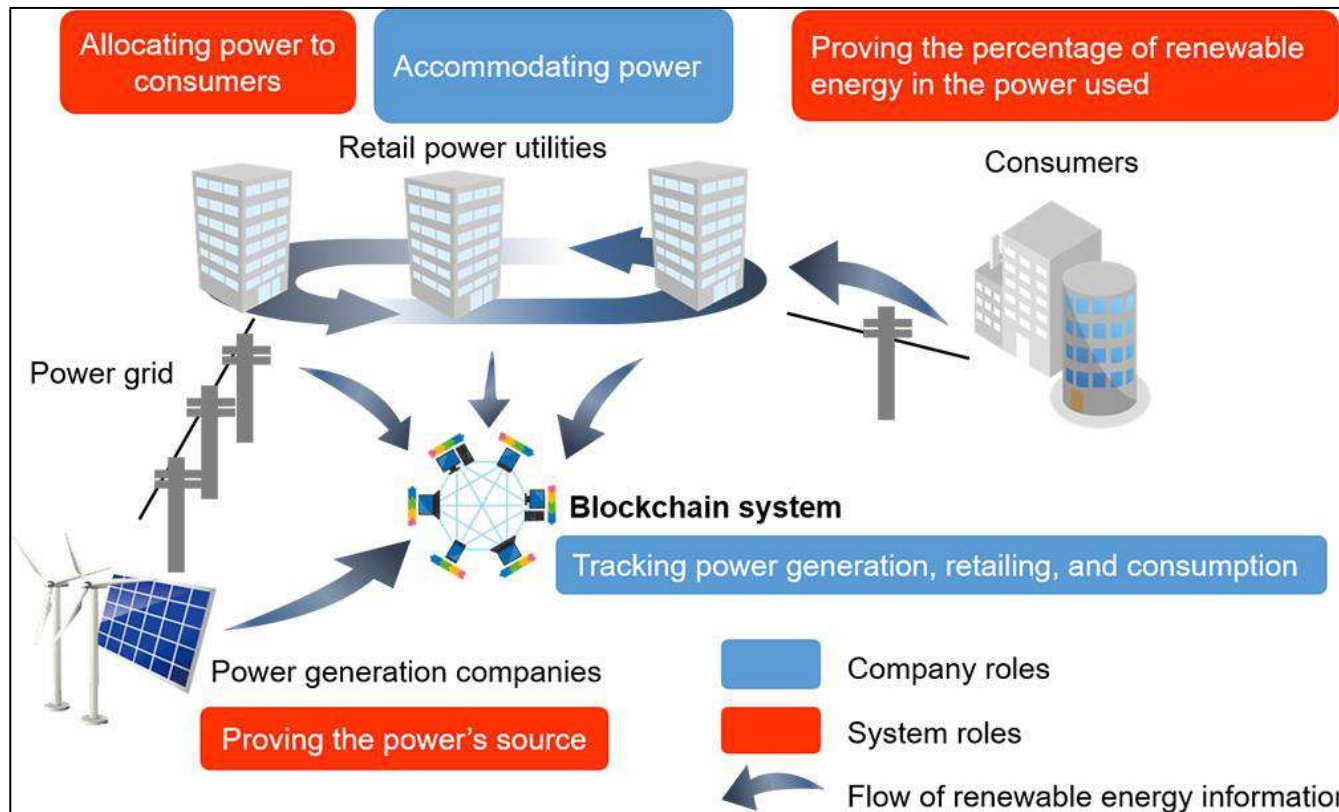
How does the ERA system verify the identity of many energy resources that are far away?

Of course, network quality is important. In addition, trusted data exchange and trusted identity with bi-directional verification is important.

13 | Challenges #1: "Data trust" for Green attributes

This is a concept of "infrastructure" in the electric power industry share verifiable Green attributes.

Of course, the system does not necessarily have to use blockchain. However, there are many stakeholders in this use case, so it may work reasonably.



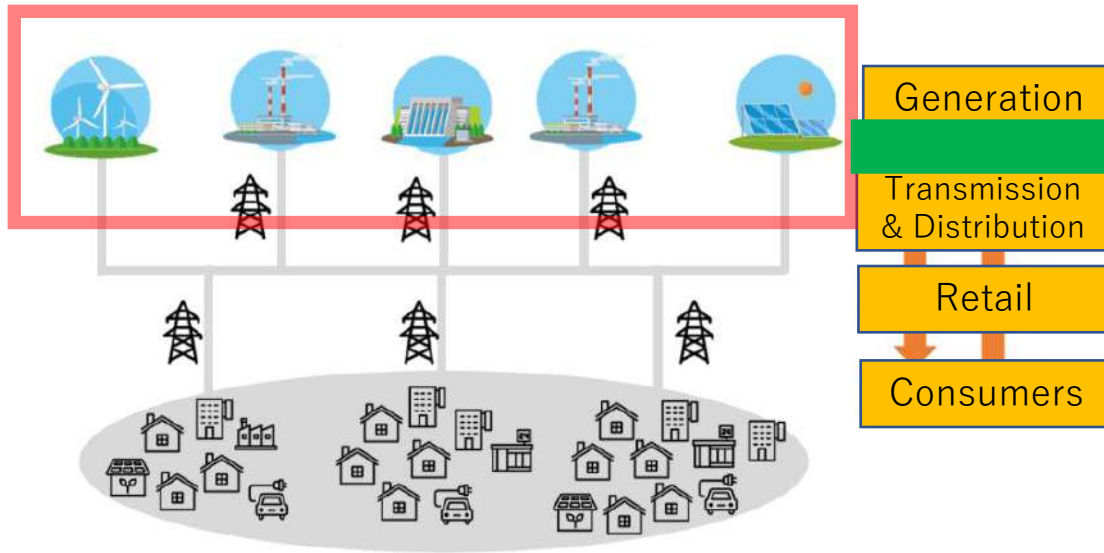
Awareness through this PoC:

This industry has been put "the Internet connection" on the back burner...

How to create a framework for "trust" in the industry field?

14 | Legacy electric power system "Trust"

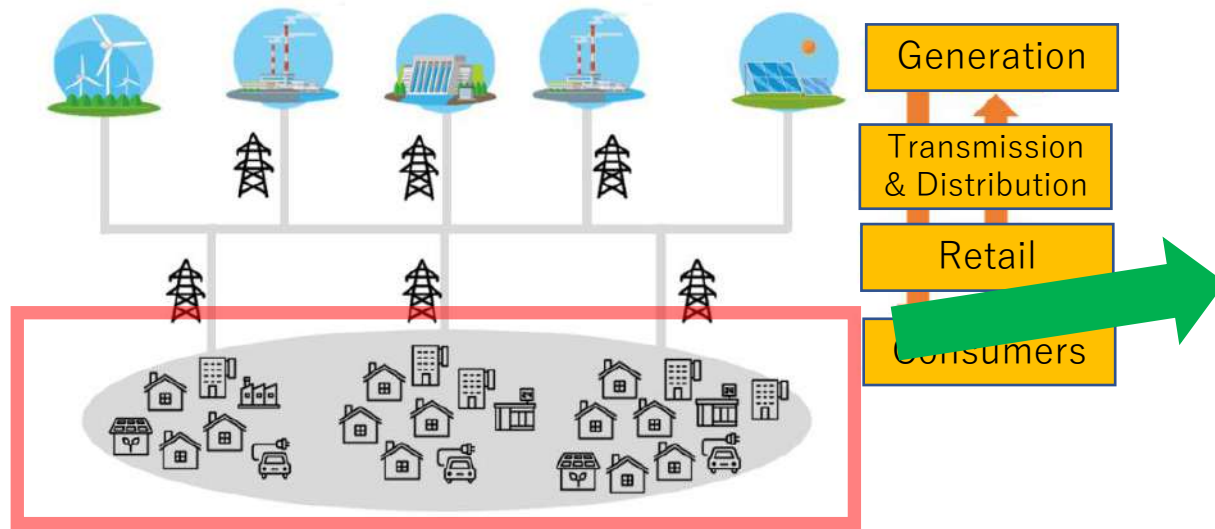
System architecture by networking with leased lines



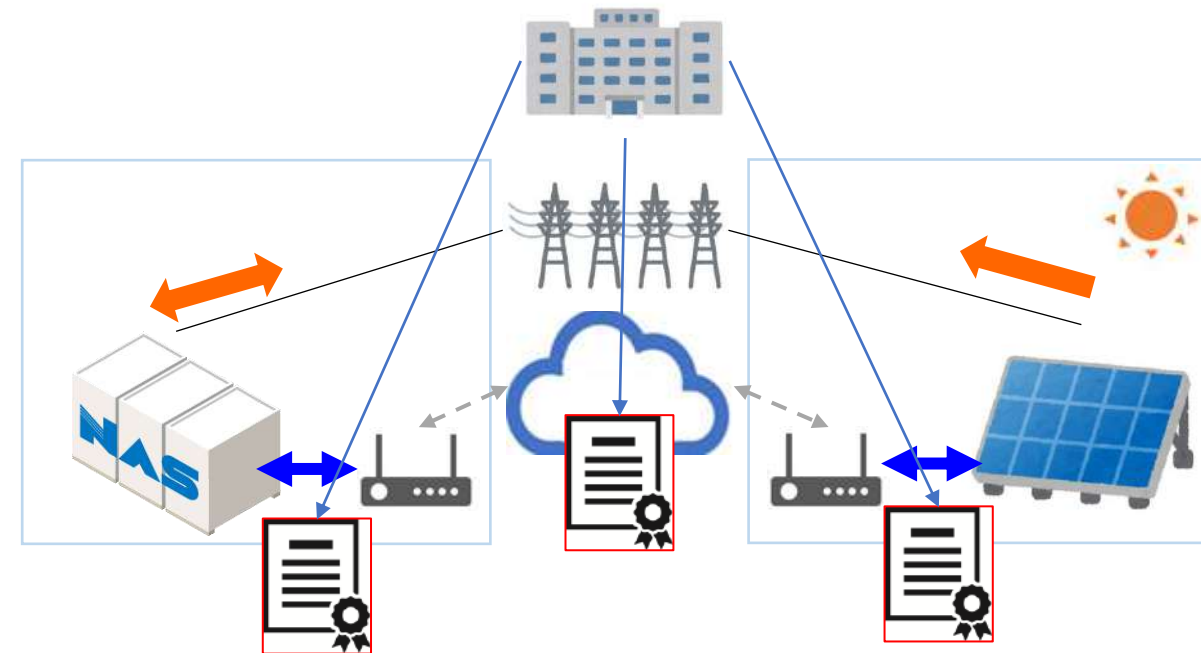
If the energy resources are few, the system works well. Of course, there is no problem with "trust" due to a closed network.

But this method does not have reasonable scalability. **need to use the Internet for many DERs.**

15 | To DER, how about applying the current web trust?



Trust by X.509 certificate



Concernes:

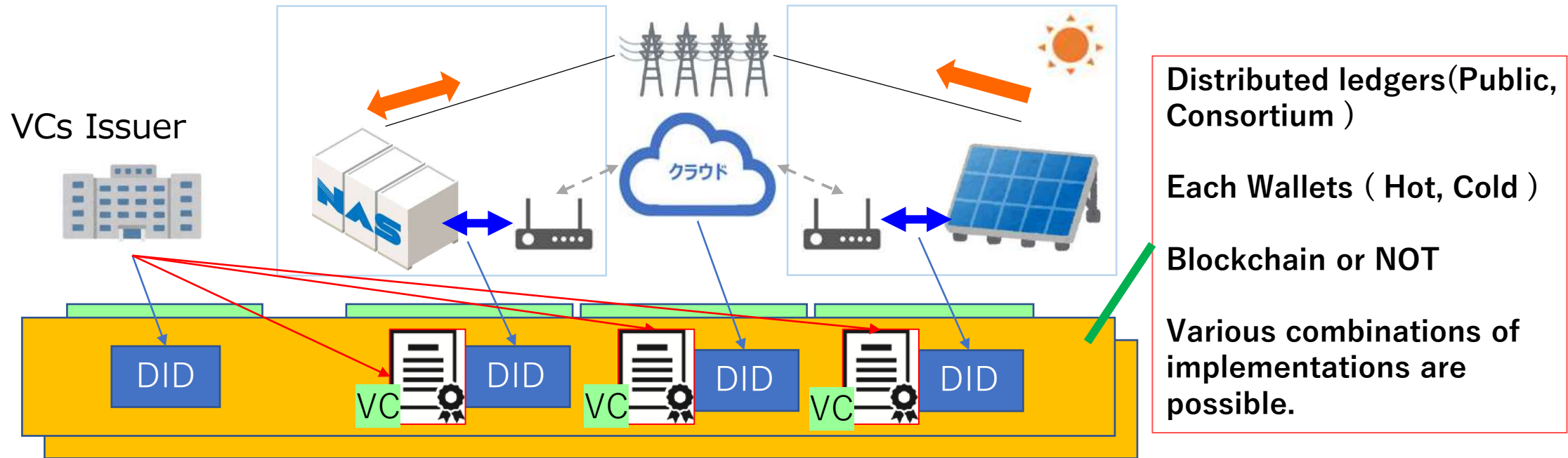
Dependency on Certificate Authorities

Web certificates can only validate string matches (e.g., Comon Name, etc.)

Generating and installing certificates on IoT devices is not so scalable.

16 | How about applying the next generation trust to DER?

Trust by DID(Decentralized Identifiers) and its related standards, VC(Verifiable Credentials) etc.



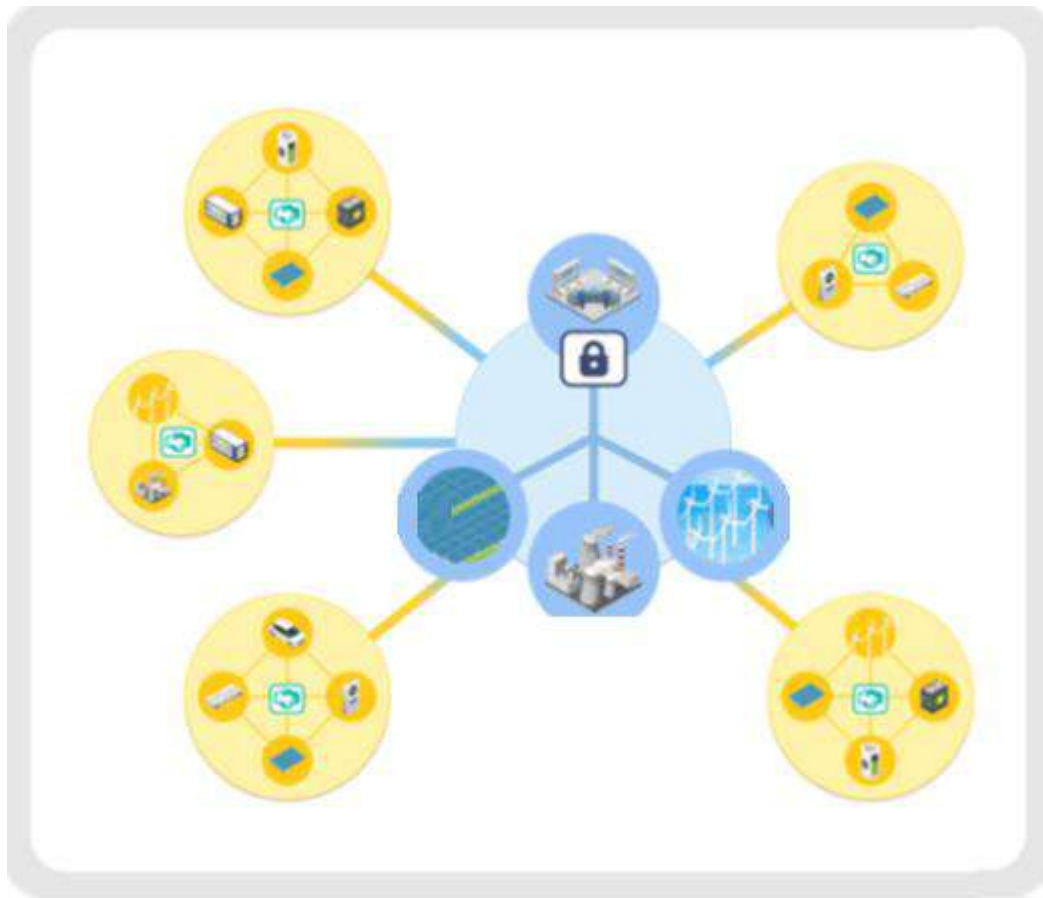
Some of the problems with X.509 may be solved. But there are no silver bullets...

Things to think about:

Who is issuer for VCs? How about his trust & VC's contents? Eventually, rules and standards for data models and trust, etc. are needed in each industry.

15 | Challenges #2: "Device trust" for DER

For expanding the use of DER, the issue of "trust" is unavoidable.
For a while, maybe the legacy and the next generation method will coexist.



By proposing means to achieve trust, NR-Power Lab would like to contribute to the expansion of ERA and VPP services in the industry.

The proposal and implementation of the concept can change the current situation little by little...

NEWS:

The Association for ERA in Japan was established in October.

<https://www.denkishimbun.com/archives/321499> (in Japanese)

- **For the spread of renewable energy, ERA is required to aggregate many DERs with IoT**
- **VPP services are provided by ERA. In addition, ERA can use IoT data to provide other services, such as measuring Green attributes, etc.**
- **Because the power systems handle mission-critical data, ERA aggregating many DERs needs to continuously improve the trust of data and devices.**

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<https://nr-power-lab.jp>