

# Toward Green Mobility : Visualizing Solar Power Simulations with Zabbix

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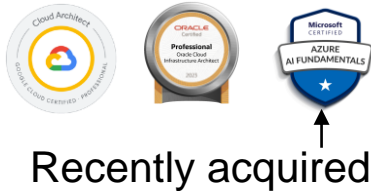
SRA OSS K.K.

# Who are we?

TOYOTA

## ■ Mitsuhiro ONO

- 20 years of experience as a system engineer



## ■ Toshihiro AKAMATSU

- 10 years of experience as a system & technical support engineer for OSS including Zabbix
- Zabbix certified professional



## ■ TOYOTA MOTOR CORPORATION

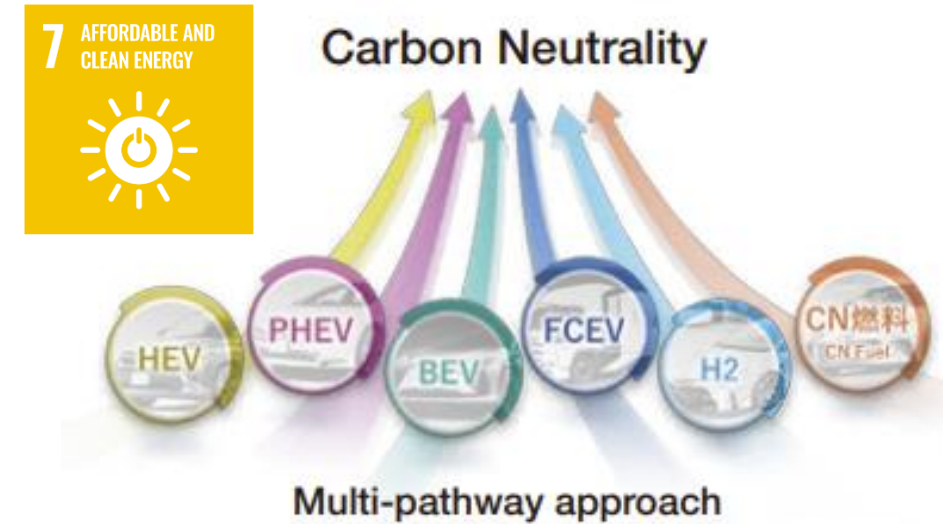
- E2E Computing group, InfoTech-IS;  
From Vehicle to Cloud Center
- Recent projects
  - Advanced development of connected infrastructure for green mobility
  - Advanced development of system monitoring with anomaly detection

## ■ SRA OSS K.K.

- OSS related services
  - Technical support
  - Consulting
  - Product Development
  - Training
- Zabbix premium partner in Japan



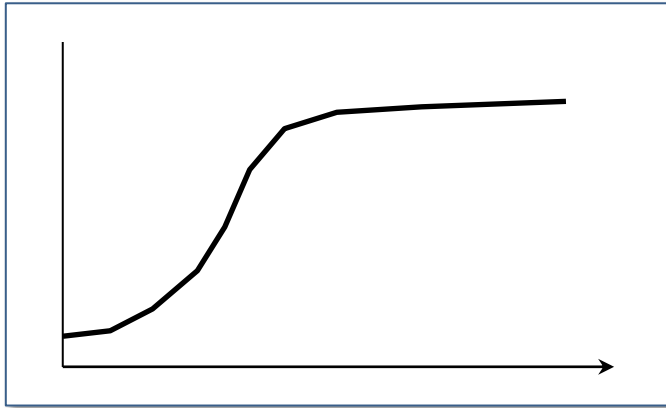
- Carbon Neutrality and Expanding the Value of Mobility
- In-Car : Multi Pathway
  - Providing diverse options (BEV,PHEV,HEV,FCEV,H2,CN fuels)
- Out-Car : Connected Service
  - Collecting and analyzing car condition and situations from the cars connected the internet.
  - Ex) Energy saving route guidance



Energy saving route guidance

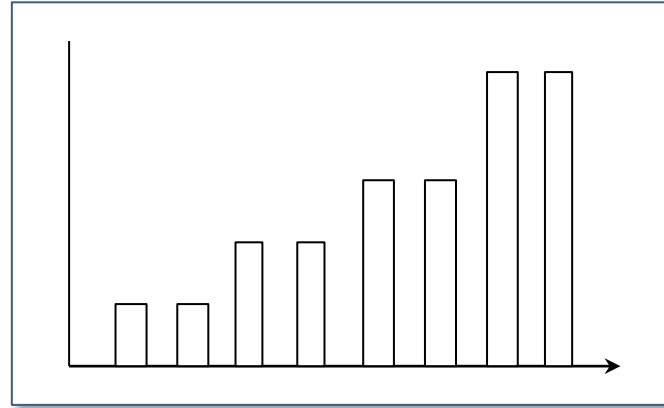


# Green energy is key as connected cars demand rises **TOYOTA**

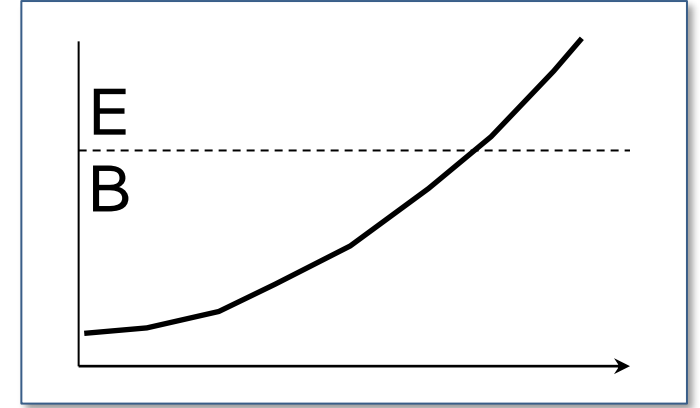


Changes in the total  
Number of connected cars

×



Transition of data transfer  
amount per unit



Connected car total data  
transfer volume

If the amount of transfer and processing increases  
use a lot of electricity

- The use of green energy is essential,  
as is the conservation of energy.

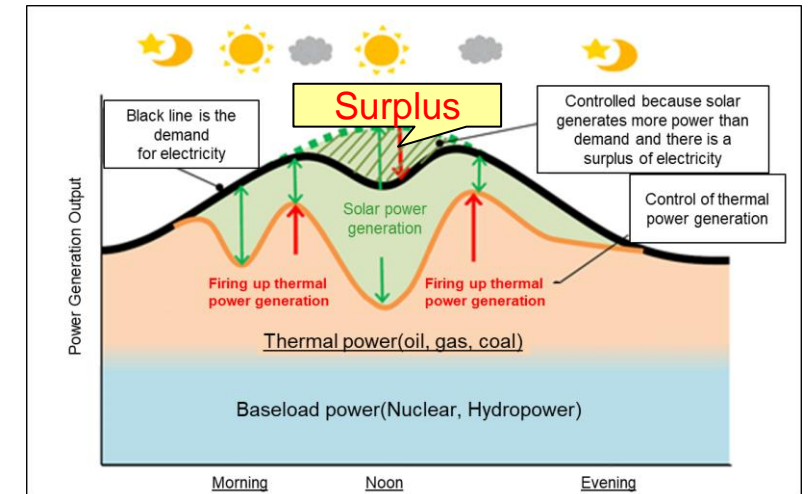
# Issues in utilizing green energy

- Solar power is the most widely adopted
  - Power generation potential for anywhere
  - Cost reductions lead to cheaper electricity

- Solar power generation fluctuates seasonally

- Weather affects electricity generation. Surplus occurs if production exceeds demand.
- Balancing power supply is hard for power companies.

Image of Electricity demand



[https://www.enecho.meti.go.jp/category/saving\\_and\\_new/saiene/grid/08\\_syuturyokuseigyo.html](https://www.enecho.meti.go.jp/category/saving_and_new/saiene/grid/08_syuturyokuseigyo.html)

- To reduce waste, we are working on control power usage dynamically when surplus is expected.

# Developing a solar power simulator for surplus use **TOYOTA**

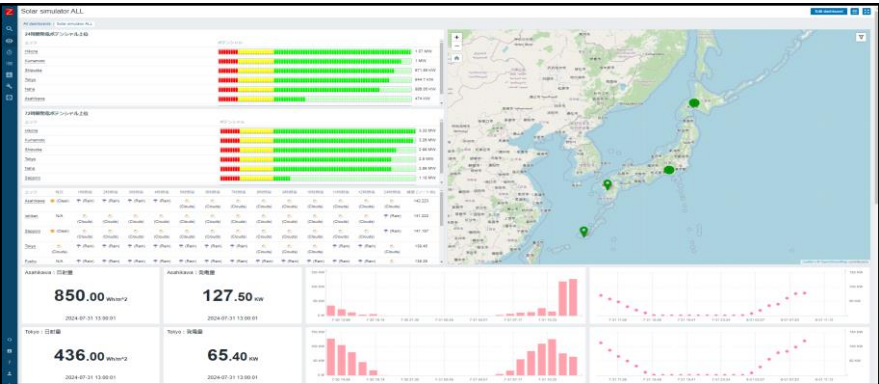
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- Simulation-based visualization of power generation potential : when, where, and how much
  - When : several hours before
  - Where : best place on our sites
  - How much : potential varies with weather
- OSS; quick and small start
  - Essential dashboard widget
  - Extensive monitoring functions and examples
  - Active support and community

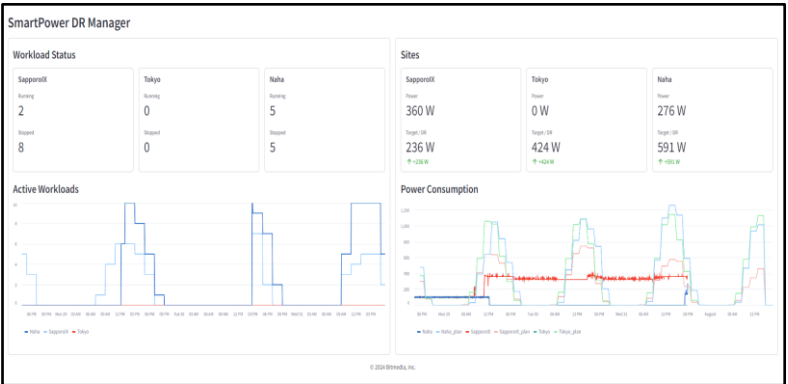
⇒ Zabbix is well-suited

# Experiment to manage resources using solar predictions **TOYOTA**

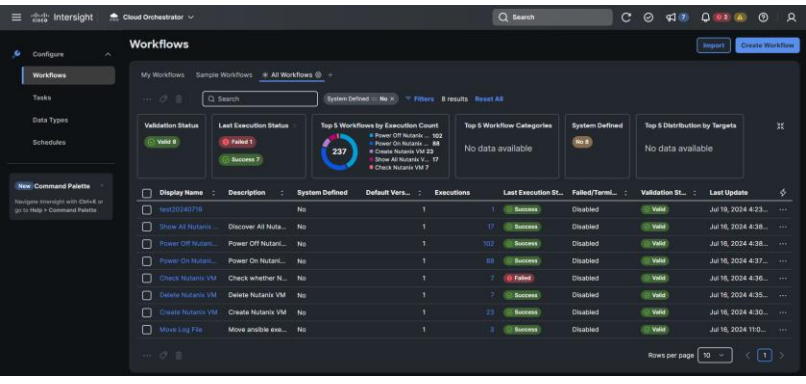
- Utilizing computer resources during periods and at locations with surplus energy



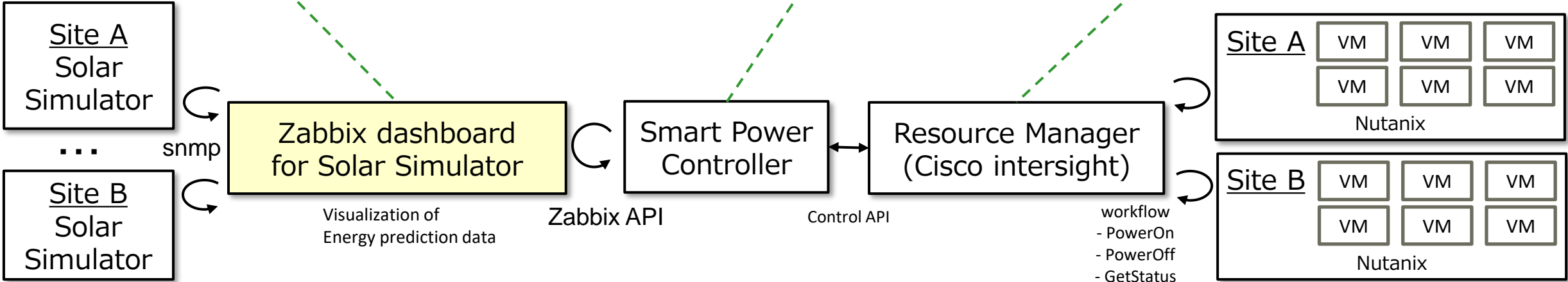
Collect & Visualize



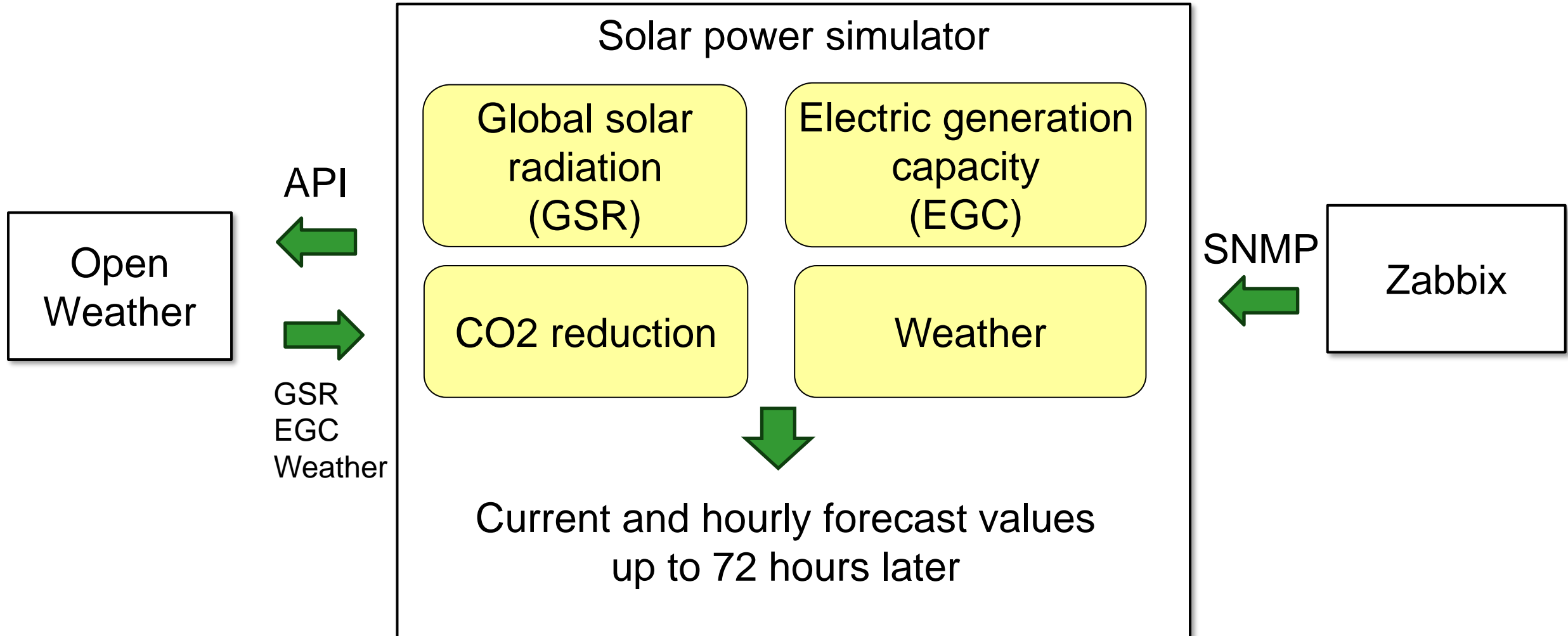
Decide to control



Manage resources on each site



# Integration of Zabbix with solar power simulator

































# Display of power generation potential

- Ranking of future power generation potential using top hosts widget

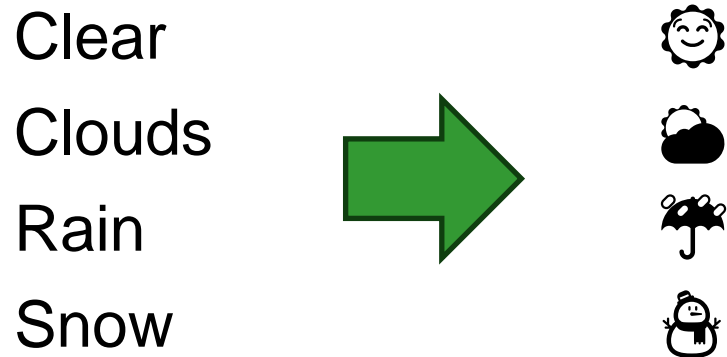


# Weather forecast

- Hourly weather forecast for each site using top hosts widget

Weather														
Site	Now	1h later	2h later	3h later	4h later	5h later	6h later	7h later	8h later	9h later	10h later	11h later	12h later	Longitude (for sort)
<u>Riga</u>	 (Clouds)	 (Clouds)	 (Clouds)	 (Clouds)	 (Clouds)	 (Clouds)	 (Clouds)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	24.22
<u>Naha</u>	 (Clouds)	 (Rain)	 (Clouds)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	 (Clear)	127.69

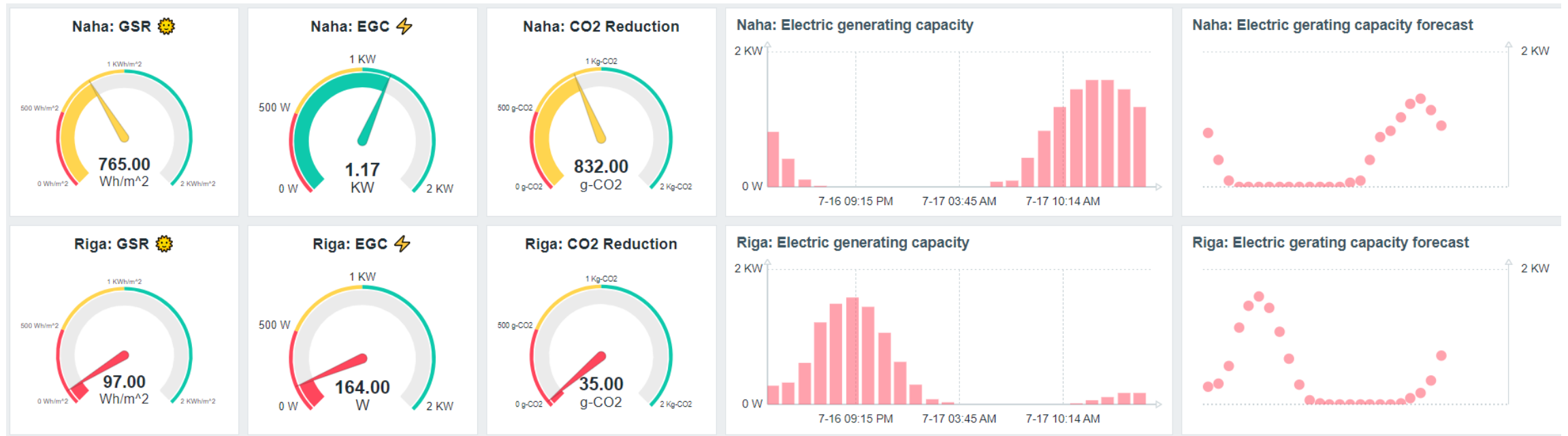
- Iconic display using value mapping



- Adding column for longitude and sorting geographically

# Site-to-Site Comparison

- Display current values using gauge widget
- Display history and forecast values using graph widget

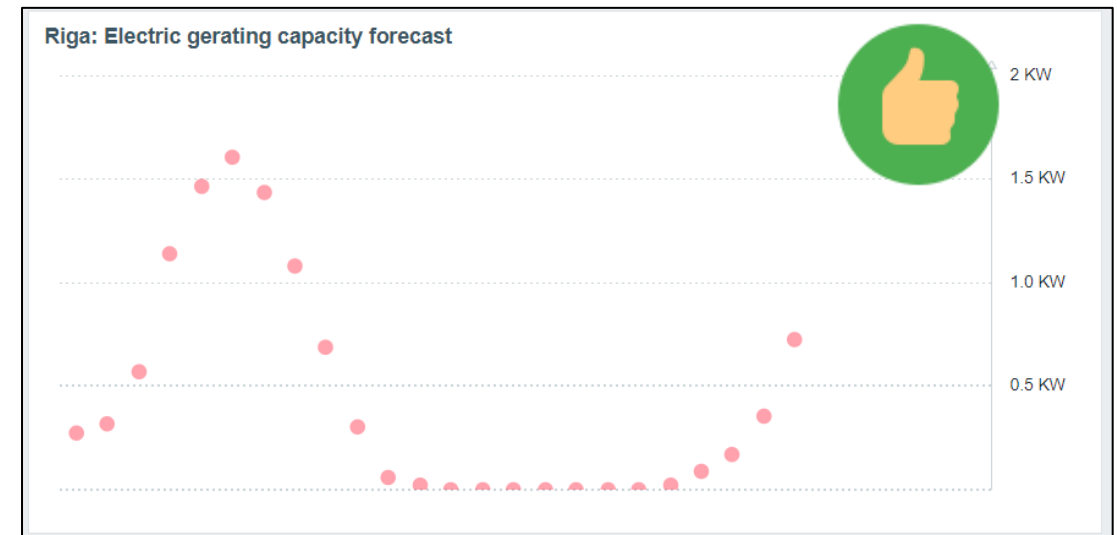
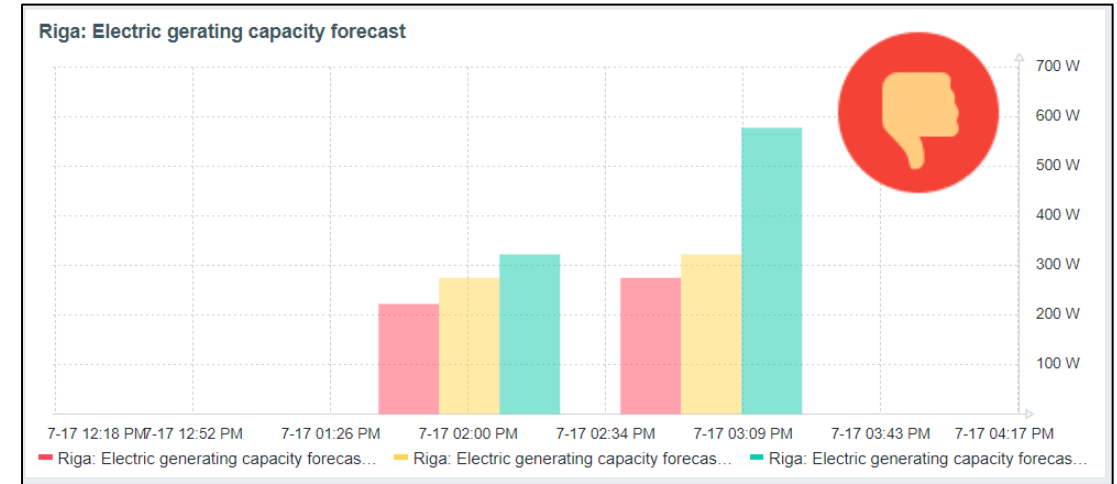


# Graph display of forecast values

- Graphs usually display values at the time the values are taken

Some ingenuity is required to display the forecast values on the graph

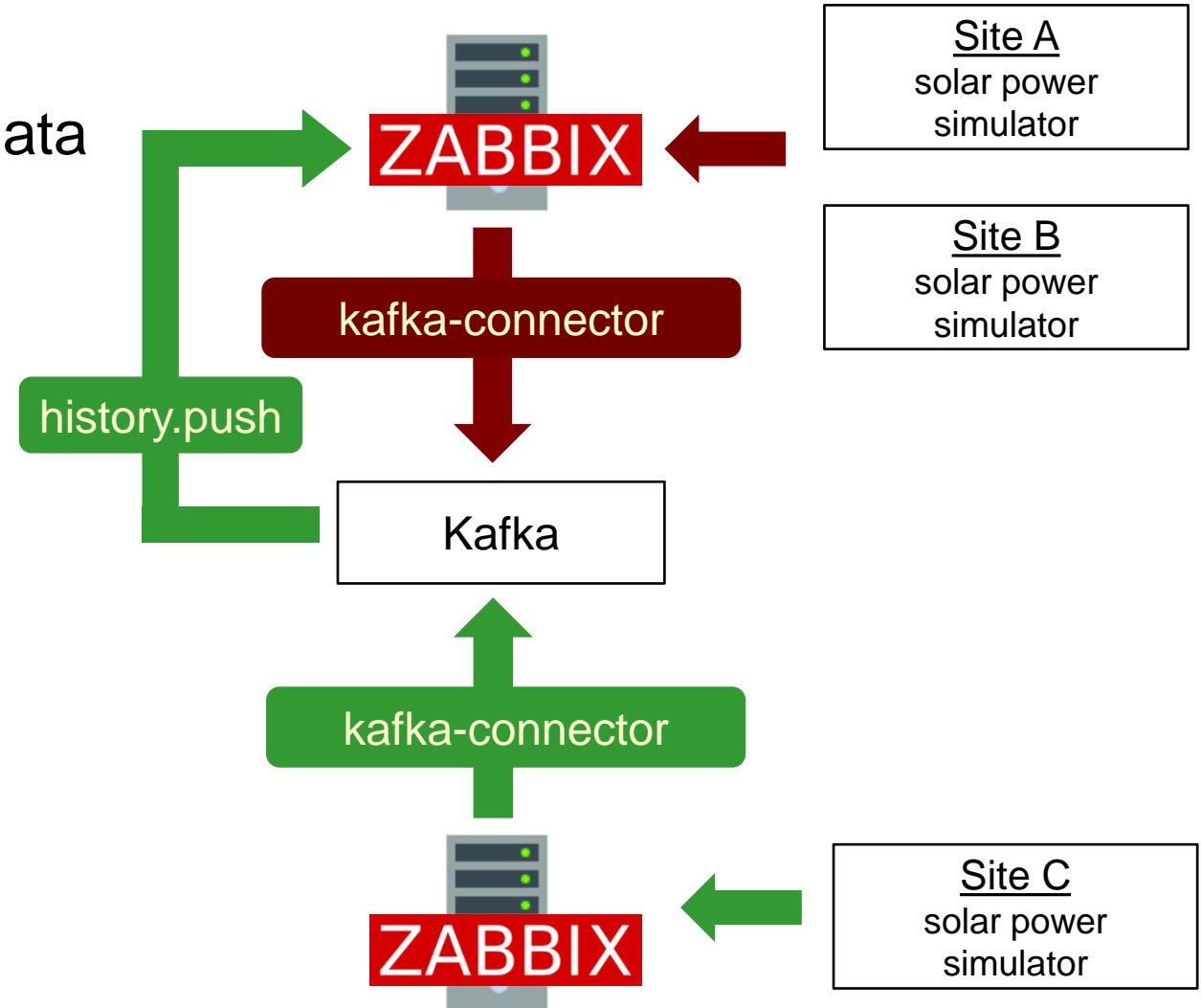
- Display only the latest values per forecast hour using aggregation
- Display values at forecast time using time shift



# Zabbix and Kafka integration

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- Zabbix to Kafka
  - Aggregating multiple Zabbixes data in Kafka with **kafka-connector**
- Kafka to Zabbix
  - Integrating data in Kafka from other Zabbixes via Zabbix API **history.push**



- To achieve a sustainable mobility society, we are working on utilizing green energy.
- Zabbix is suited for real time, flexible visualization of solar power generation status linked to the latest weather forecasts.
- We will verify the architecture that utilizes green energy including solar and wind.

