Research Field: **“Intelligent Infrastructure for Energy”**

Original proposal:

“Optimal design platform for smart integration of renewable energy in rural area”

Introduction e-Asia project
Investigation of the non-electricity rural areas of Thailand

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Background

- Waseda university, NECTEC and other countries have joined the JST e-ASIA JRP since 2017 to identify the current status and barriers on each country regarding the energy infrastructure based on Technology exchanges and Collaborations among academies and research institutes

- One of the outcome is to develop the integrated strategic planning tool (named GGOD) including the database and optimization method.

- In the project, we are discussing design concepts of those infrastructures for the BEMS (Building Energy Management System) in Bangkok metropolitan area.

- In this JASTIP-NET 2018 program, we will investigate the other proper areas for the above concepts in the non-electricity rural areas of Thailand.

Activity of e-Asia project

The e-ASIA Joint Research Program

http://www.the-easia.org/jrp/

国立研究開発法人 科学技術振興機構
Japan Science and Technology Agency

◆ Member Organizations

20 organizations from 14 countries (as of December 2017)

Australia NHMRC	Cambodia MOH	Indonesia RISTEKDIKTI	Japan MEXT/JST AMED	Lao PDR MOST MOH
Malaysia MOSTI (Quasi-Member)	Myanmar MOE (formerly MOST)	New Zealand HRC	Philippines DOST	Russia RFBR
Thailand NSTDA ARDA TCELS TRF	USA NIAID(NIH) NCI(NIH)	Vietnam MOST	Sri Lanka NSF (Guest Partner)	Underline: Health Research Field only

◆ Scheme of Collaborative Research

- Research Team consisting of more than 3 countries
  ⇒ Multi-lateral Collaboration
- Researchers are supported by FA from their own country
  ⇒ Equal Partnership

◆ Field of Cooperation

Materials (Nanotechnology)

Agriculture (Food)

Alternative Energy

Health Research (Infectious Diseases, Cancer)

Disaster Risk Reduction and Management

Environment (Climate Change, Marine Science)

Advanced Interdisciplinary Research towards Innovation (Intelligent Infrastructure)

Intelligent Infrastructure for Energy

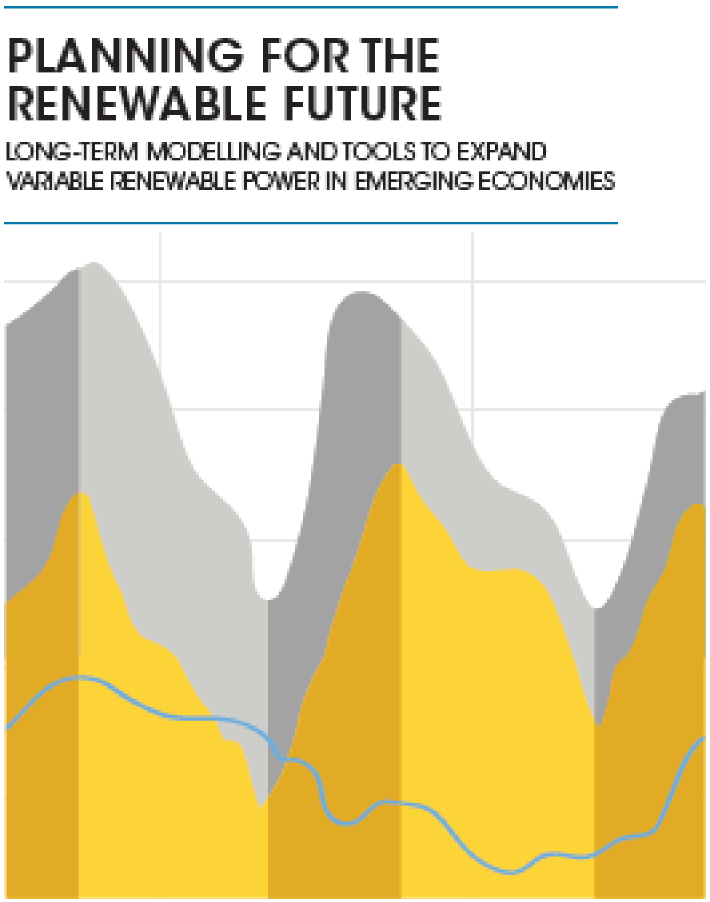
26	Research of Expandable Cluster-based Energy Infrastructure in e-Asia Countries	1. Japan: Prof.Yosuke Nakanishi, Waseda University	1.JST(Japan): New
		2. Thailand: Dr.Udom Lewlomphaisarl, National Electronics and Computer Technology Center	2. NSTDA(Thailand): New
		3. Philippines: Prof.Noel Estoperez, Mindanao State University-Iligan Institute of Technology	3. DOST(Philippines): New
		4. Indonesia: Prof.Abraham Lomi, Malang Institute of Technology	4.RISTEKDIKTI(Indonesia): In-kind

Project is from December 2017 to 2020

Research Fields of Participant Countries

Country	Organization	Work Package
Thailand	National Electronics and Computer Technology Center (NECTEC)	Hybrid Energy Storage System (HESS)
		Community EMS (CEMS)
The Philippines	Mindanao State University – Illigan Institute Technology	Micro-grid in a Remote Community
Indonesia	National Institute of Technology Malang	Development of Island Energy System
Japan	Waseda University Meisei University	Framework of GGOD (Conceptual design)

The report guides energy planners and modelling practitioners to better represent variable renewable energy (VRE) sources in long-term generation expansion planning, from the International Renewable Energy Agency.



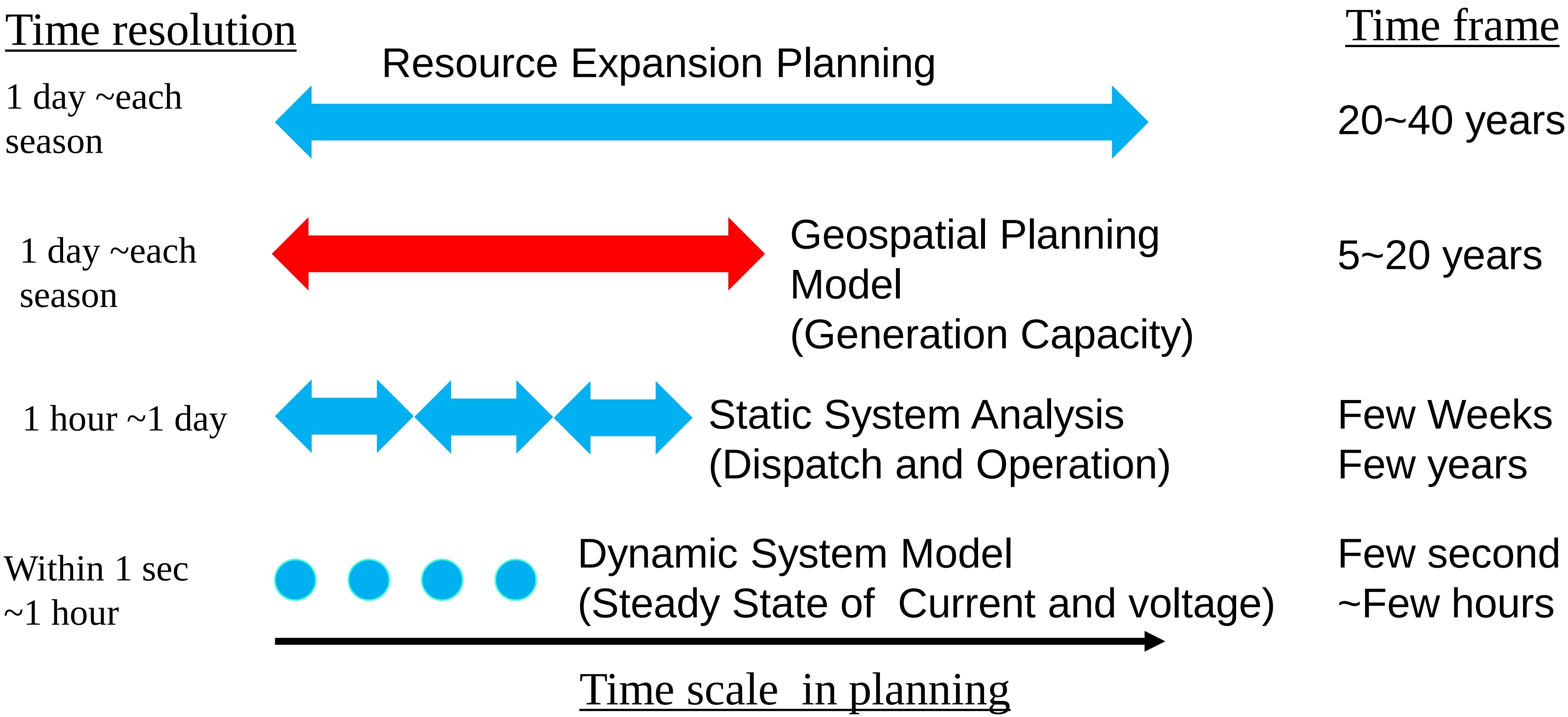
Four key stages on the strategy of the investment when planning for high share of VRE

- Long-term generation expansion planning (typically spanning a period of 20-40 years),
- Geo-spatial planning for transmission (typically spanning a period of 5-20 years),
- Dispatch simulation (typically spanning a period of weeks to several years)
- Technical network studies (typically spanning up to five years).

https://www.irena.org/DocumentDownloads/Publications/IRENA_Planning_for_the_Renewable_Future_2017.pdf

Timespan in Renewable Energy Planning

- One of key technologies of GGOD is a geospatial planning.



Ref. Planning for the renewable future: Long-term modelling and tools to expand variable renewable power in emerging economics (© IRENA 2017)

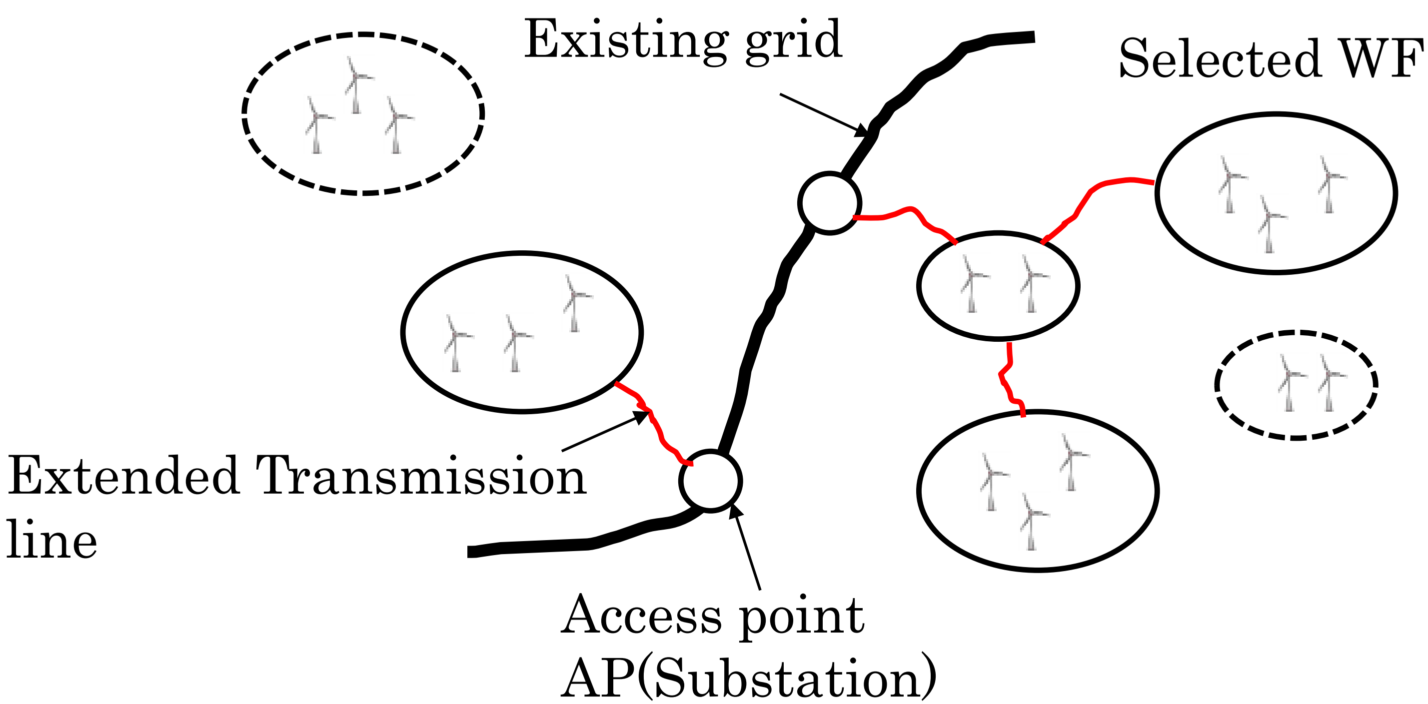
Grid of Grid Optimal Designer (GGOD)

- Optimization tool
  - Automatic, Manual
- Resource integration planning
  - Issues of resource expansion
  - Issues of transaction operation
  - Issues of congestion mitigation
- Geospatial data integration

GGOD gives the picture for energy suppliers and consumers in non-electrification areas.

Objectives of Facility Expansion Planning

- Selection of Wind farms --- More than target total power
- Configuration of transmission network --- Cost minimum



Automatic Selections of Wind Power Facilities

- Feasible wind farms and transmission networks are found automatically and optimal configurations are proposed.

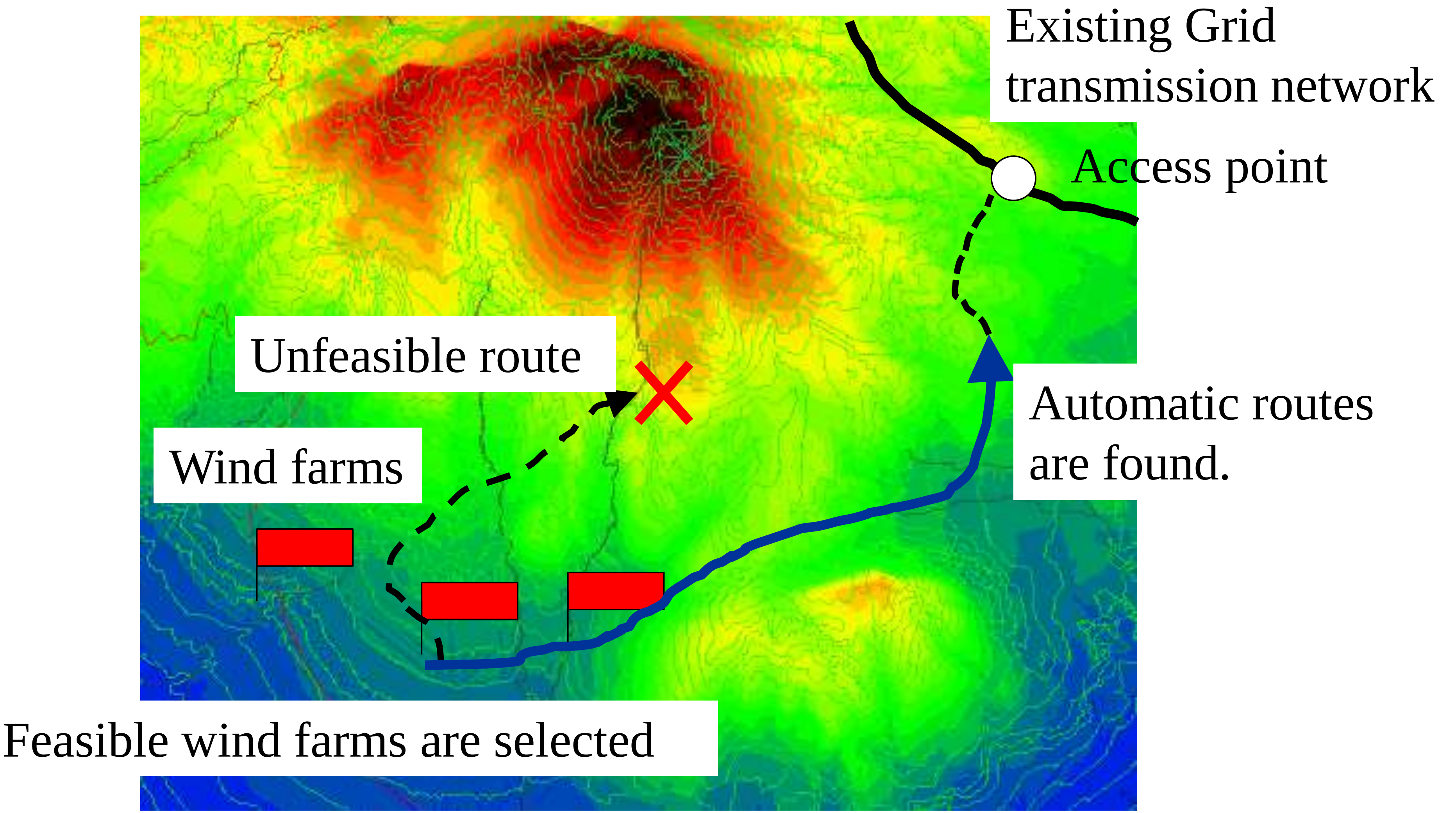
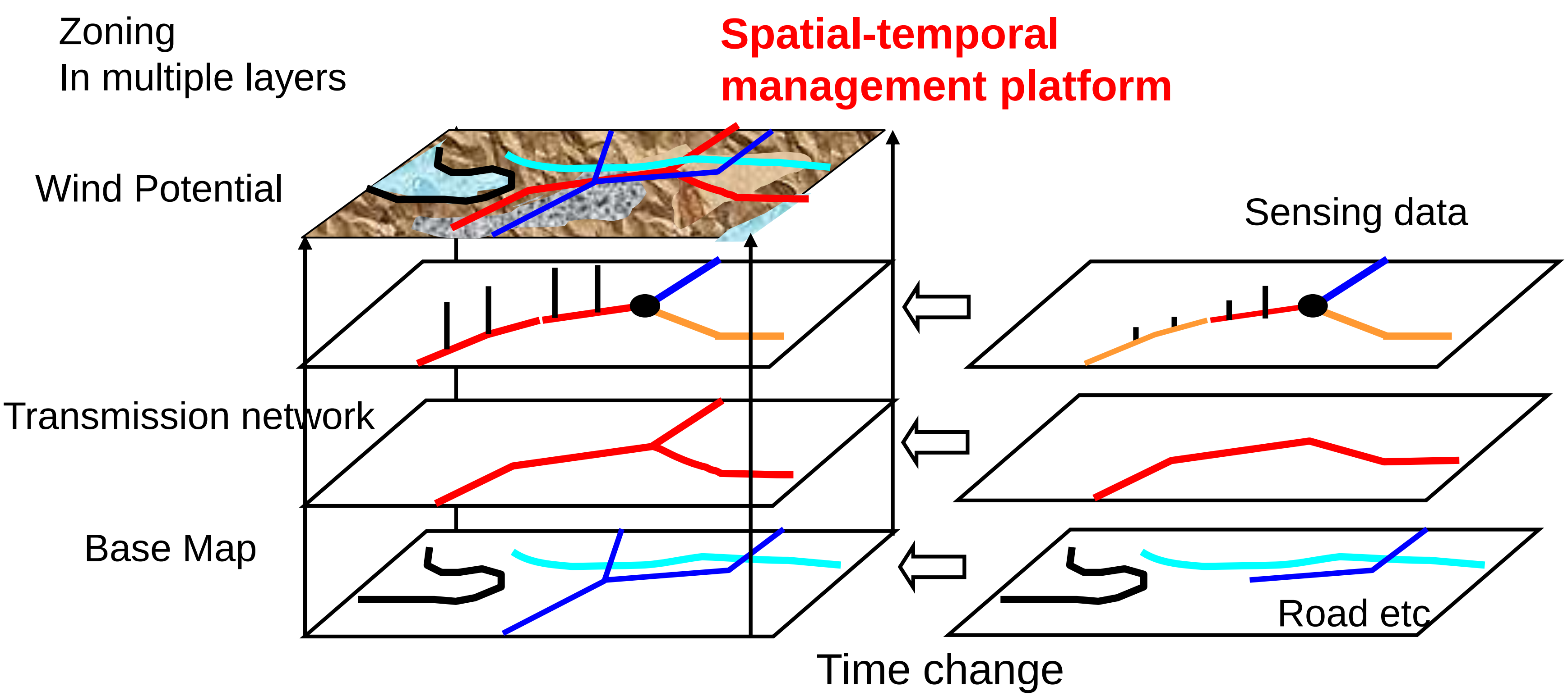


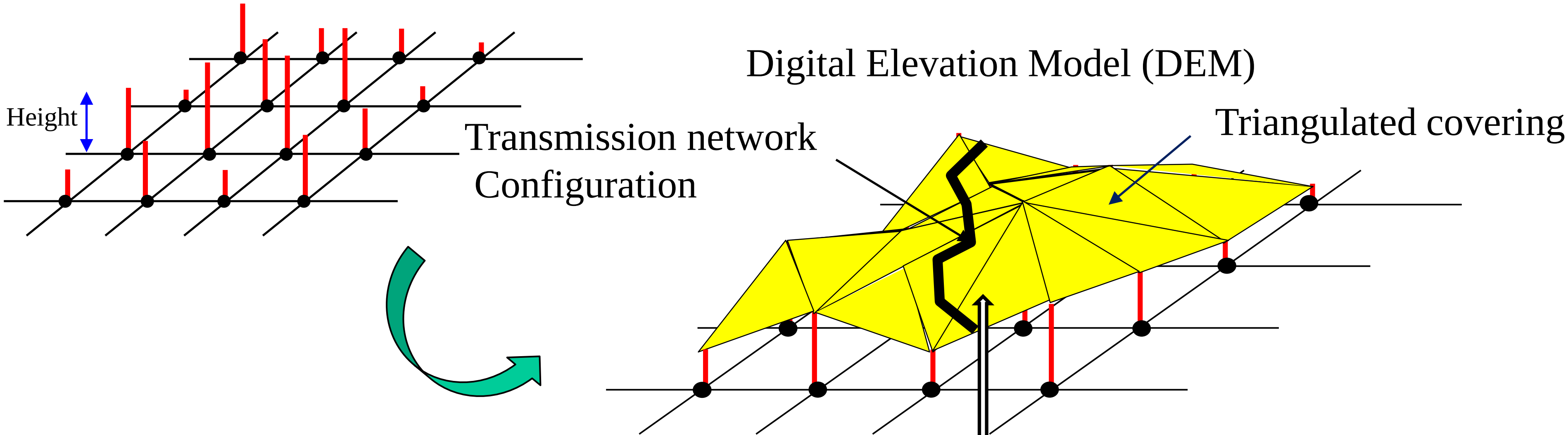
Image of 4D-GIS

- The 4D-GIS manages the 3D data plus time change data beyond the limitations of 2D map data utilization
- The 4D-GIS is a essential information integration platform



DEM Model in 4D-GIS

DEM : Digital Elevation Model



Attribute Table

Location-based relation

ID	S-Time	E-time	Position	Items
1	2/5/2016	-	(X1,Y1)	*****
2	2/5/2016	-	(X1,Y1)	*****
3	2/5/2016	-	(X3,Y3)	*****

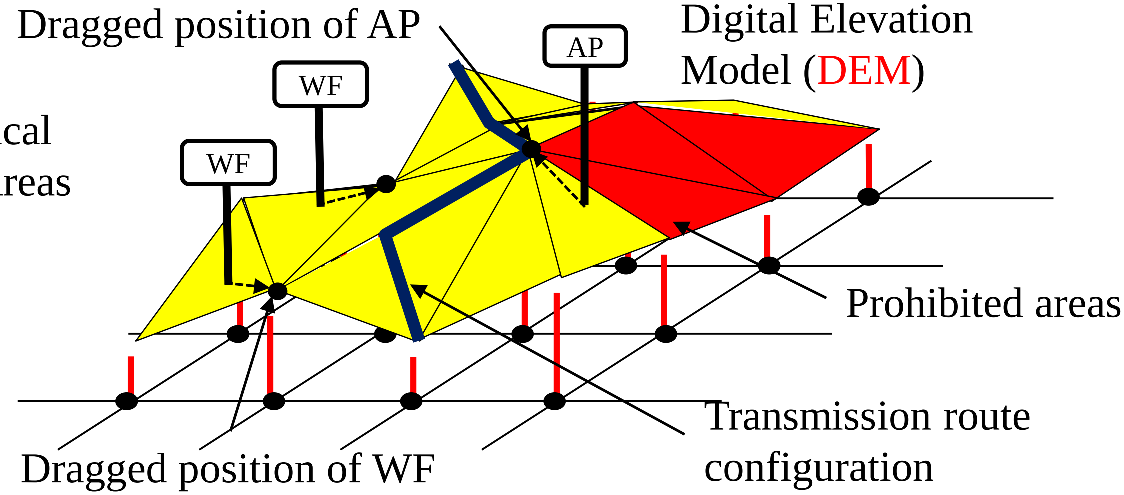
Field data move

Time change data management

History Table

ID	S-Time	E-time	Position	Items
1	2/5/2016	10/11/2016	(X1,Y1)	*****
*	*****	*****	*****	*****

Cost Surface as the constraint for the network design



Example of Cost Surface Element

Category	Factor	Consideration
Geographical	Land heights and slopes	Transmission routes are prohibited in areas where the height and slope are greater than the predefined threshold.
Environmental	Preservation of nature	Transmission routes are designed not to go through conservation areas and national parks.
Economical	Line cost	Route cost is proportional to route length.
	Substation cost	Substation construction costs are reduced by minimizing the number of substations.

Important cost surface elements are collected.

THANK YOU FOR YOUR KIND LISTENING

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