

Spatial Information Science and Technology (SIST) for Energy Planning

Outline

- **What is SIST? - Components**
- **A Typical Database for Energy Planning**
- **Building Database for Mapping Energy Source**
- **Geospatial Analysis for Energy Mix**
- **Key Messages**

Knowledge Partnership Dialogue for Clean Energy
Mandarin Oriental Hotel, Jakarta 8-9 Oct, 2015
Central of Excellence on Clean Energy; Gov of Indonesia

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Components of SIST

SIST comprises

RST: Remote Sensing Technology

(ex. Space based technology, airborne, terrestrial & underwater sensors, etc.)

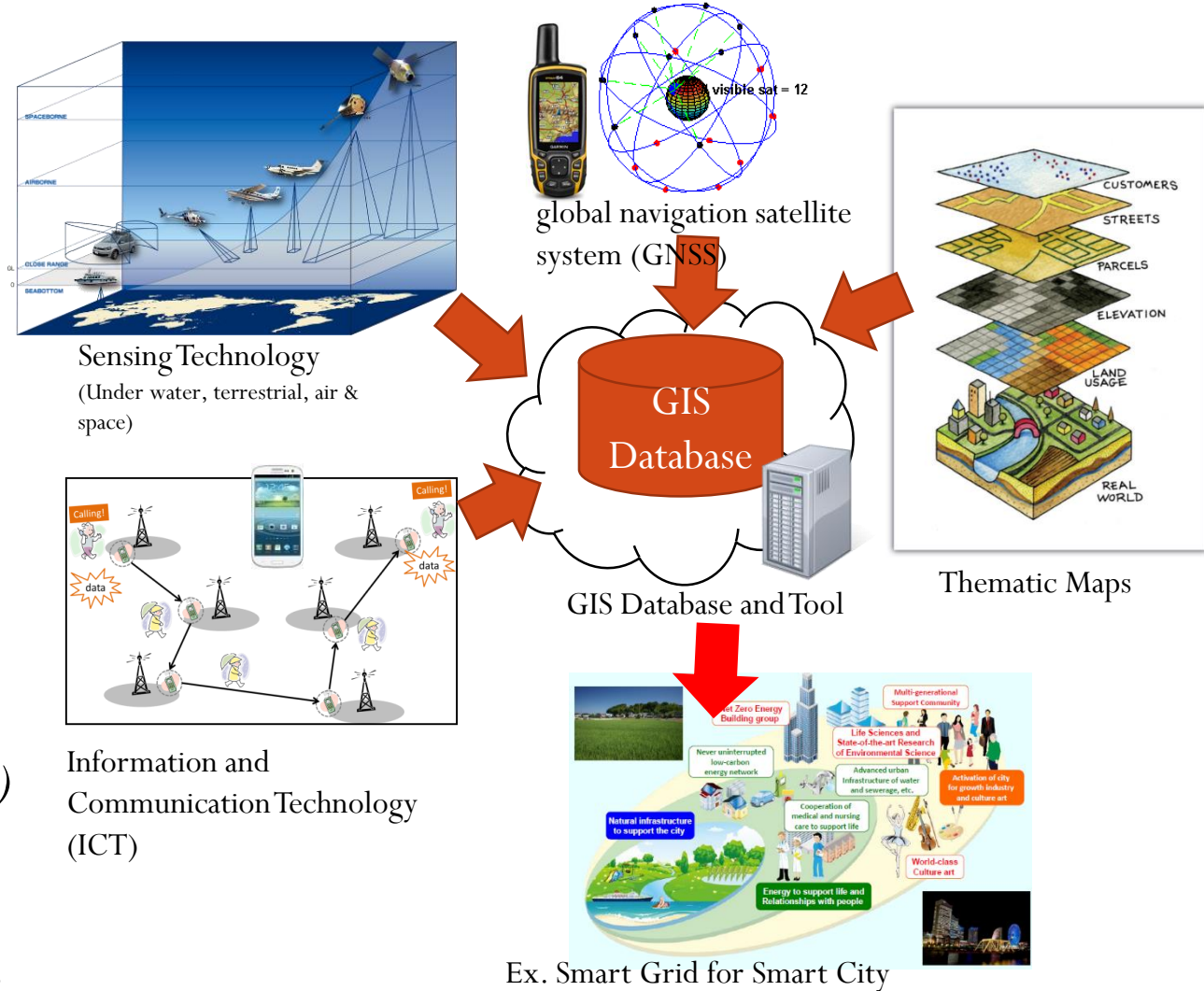
GNSS: Global Navigation Satellite System

(ex. GPS, GLONASS, Galileo)

ICT: Information and

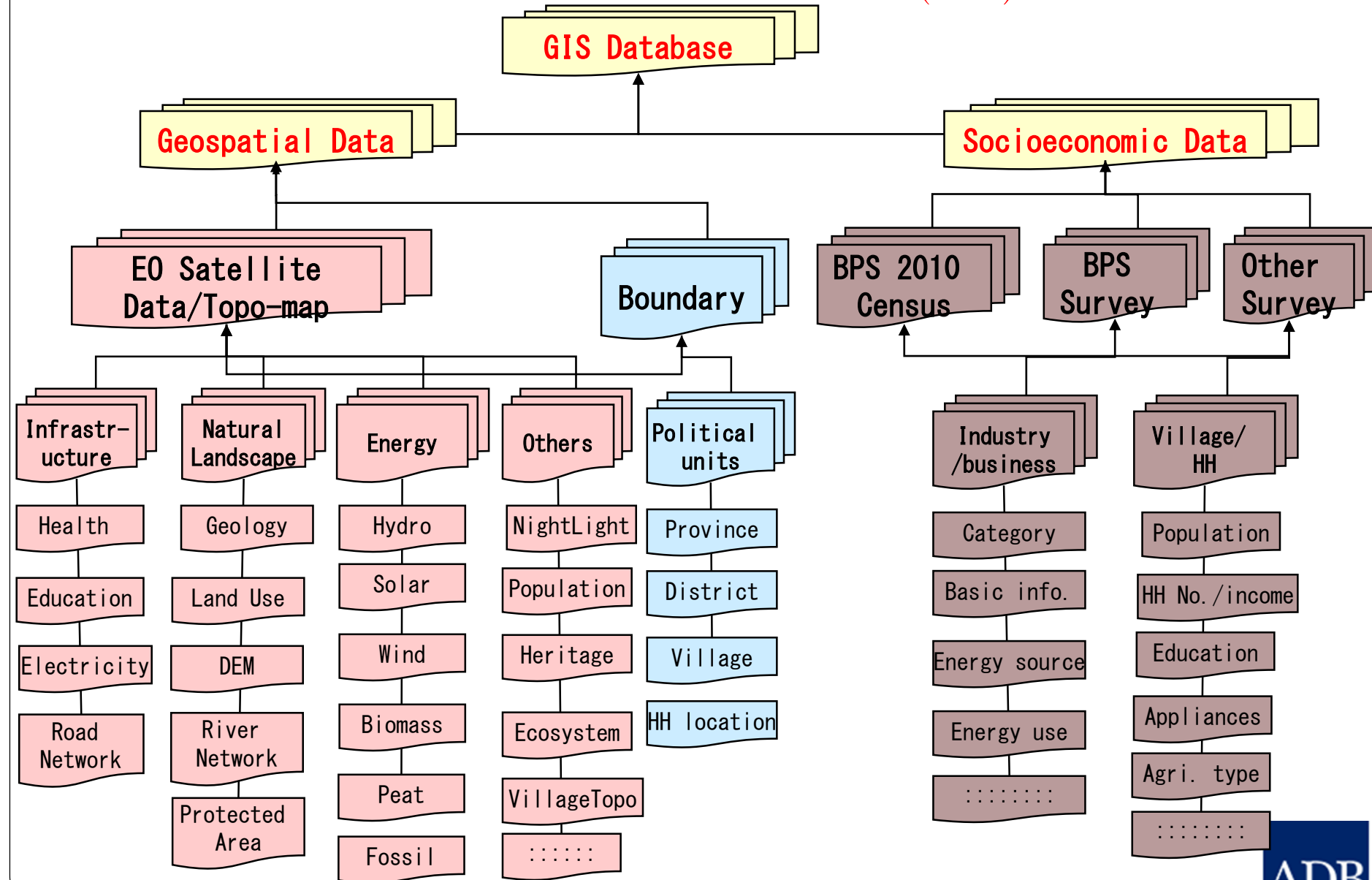
Communication Technology

GIS: Geographic Information System



A Typical Database for Energy – Planning

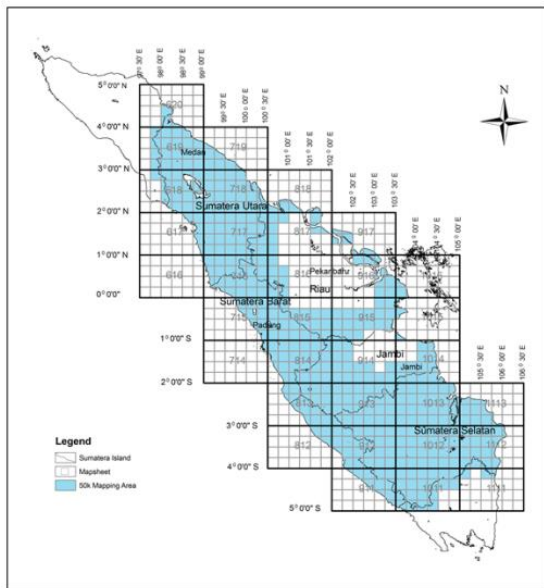
Establishment of GIS Database - Center of Excellence (COE) Indonesia



Building Database for Mapping Energy Source & Use

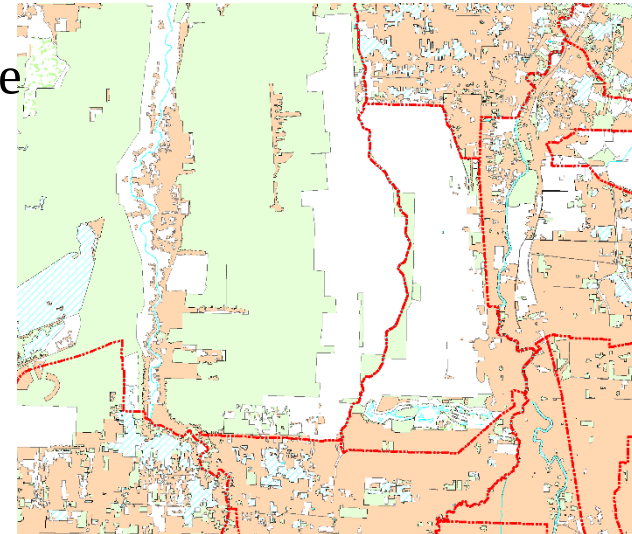
Sources of Data: Topographic Base Map

- Agency: Topographic Base Mapping Division, Badan Informasi Geospasial (BIG), Indonesia
- Most recent mapping at 1:50 000 → Sumatra Island



Main Features (group) are

- Building
- Transport
- Hypsography
- Land use/Land cover
- Admin boundary
- Geographic names

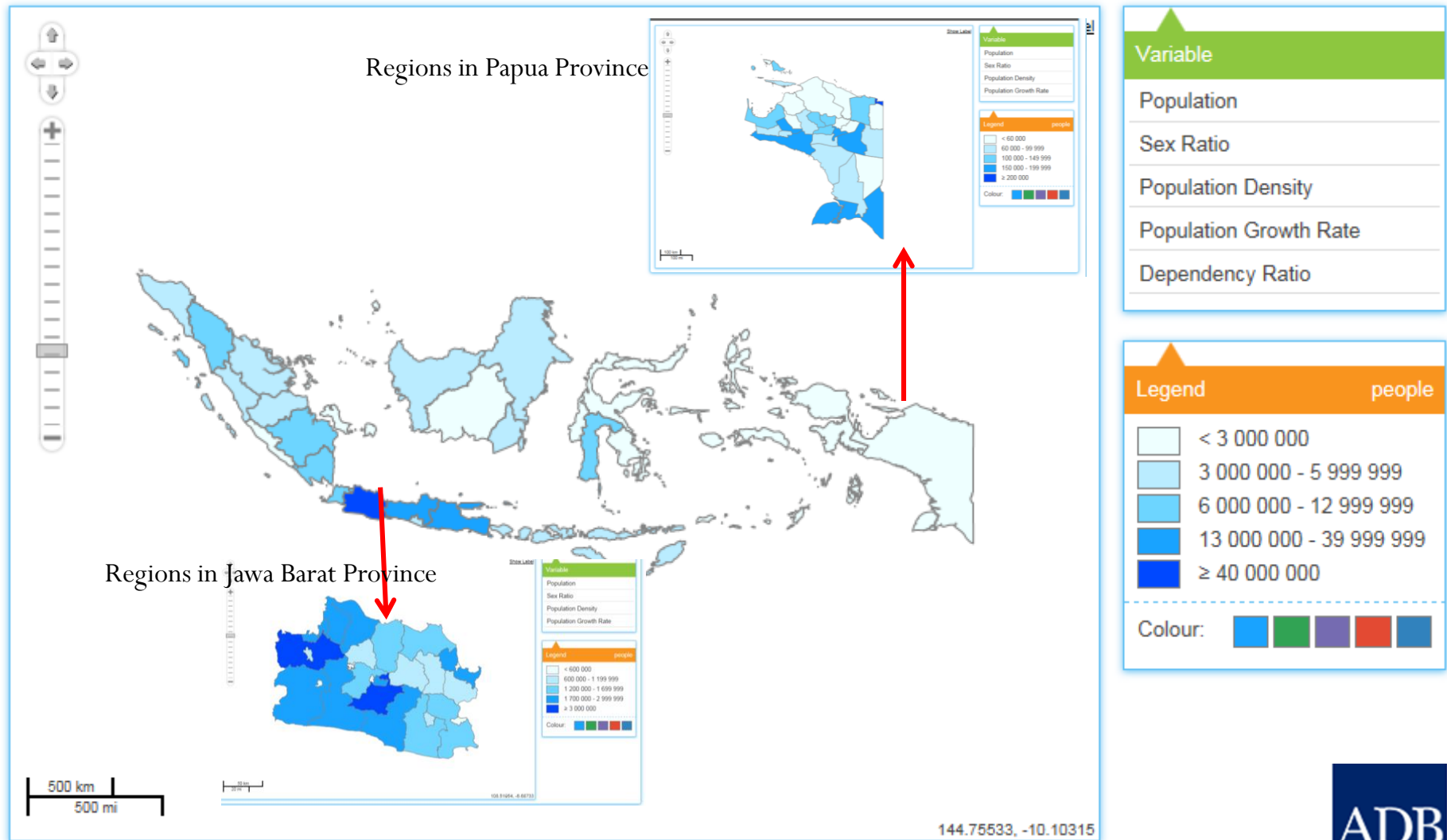


Source: Badan Informasi Geospasial (BIG) (www.bakosurtanal.go.id/)

Building Database for Mapping Energy Source & Use (contd.)

Aggregated Provincial/Regional Population

Source: Badan Pusat Statistik → Census 2010 (www.bps.go.id)

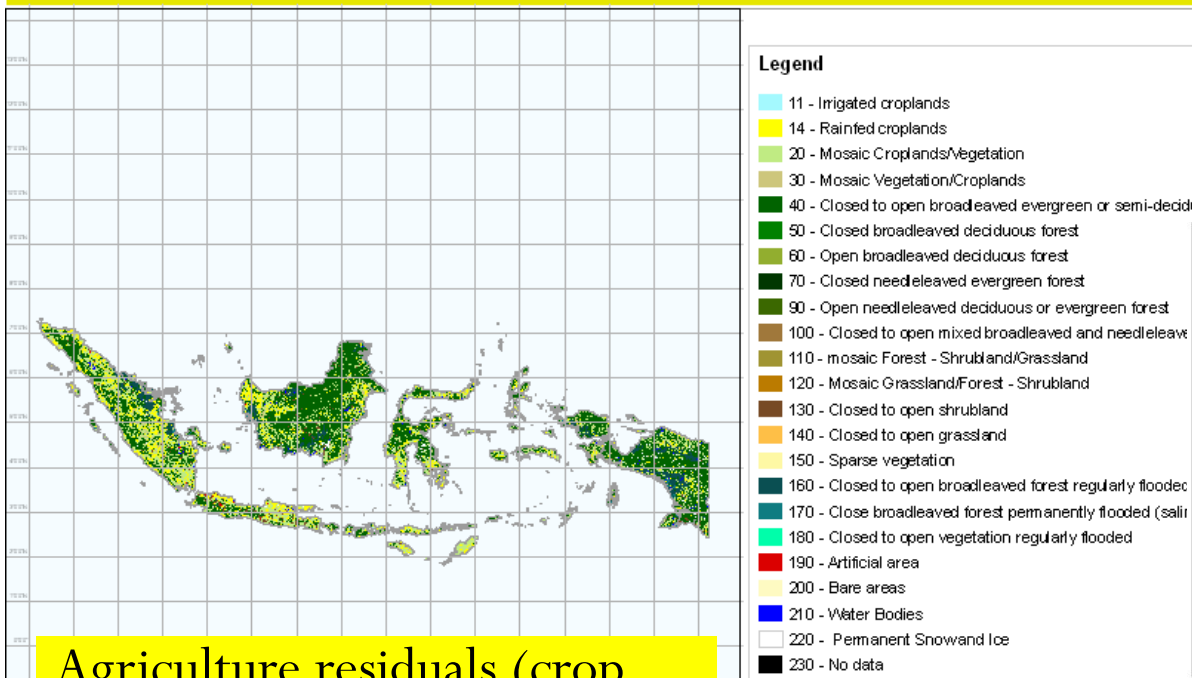
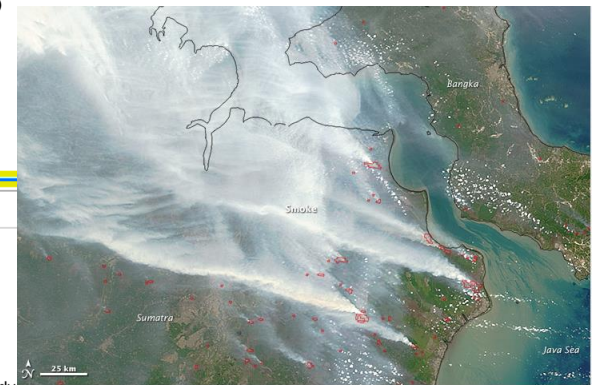


Building Database for Mapping Energy Source & Use (contd..)

Forestry In Indonesia: Source of Energy for Household

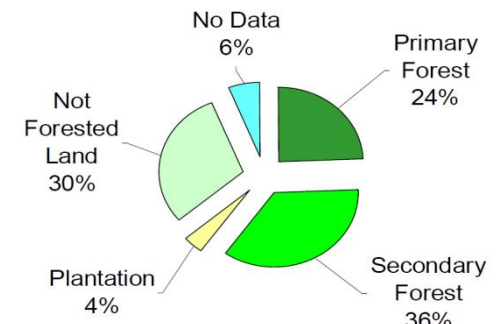
- The Ministry of Forestry manages → forest statistics 2013 (www.dephut.go.id)
- UN-FAO → LU/LC map
- Peatlands: Source of Fuel (17 MJ/kg) or Pollution (Peat fires)

FAO (<http://www.fao.org/docrep/x5872e/x5872e0b.htm#9.2.4> Types of fuel peat - peat pellet 15% moisture - 17 MJ/kg)

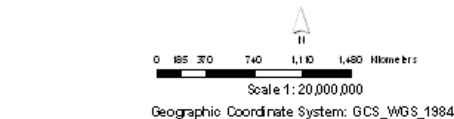


Agriculture residuals (crop and agroforestry) – Biomass may be considered as a renewable energy source.

Production Forest Area (60.9 million ha)



Source: FAO (data -CFIM, BFP, Ministry of Forestry, Indonesia, 2005)



Source: GLOBECOVER by ESA/UNEP/FAO/JRC/AGBP/GOFC-GOLD

FAO 2009

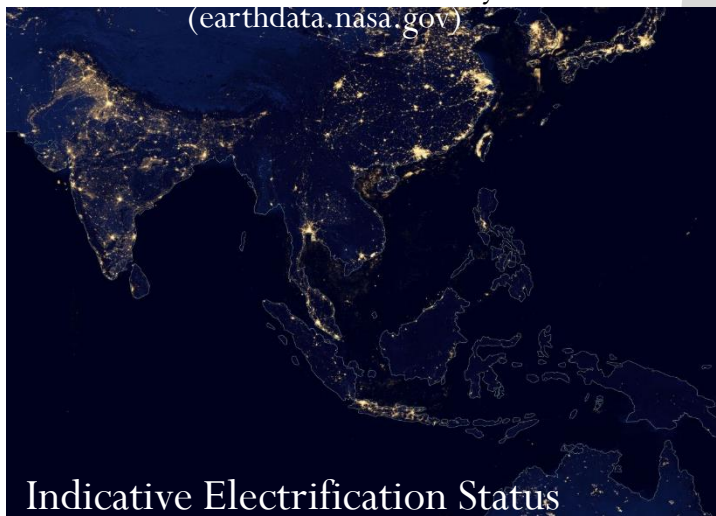


Building Database for Mapping Energy Source & Use (cont.)

RST for Mapping Landscape

NASA - USA

Earth at Night 2012 Suomi NPP / VIIRS via
NASA Earth Observatory
(earthdata.nasa.gov)



Indicative Electrification Status

RGB -b758 -urban/non-urban separation
Part of Jakarta Area



<https://agungwah.wordpress.com/2014/02/07/first-landsat-8-image-of-jakarta-indonesia/>

National Institute of Aeronautics and Space (LAPAN) - Indonesia

JAXA - Japan

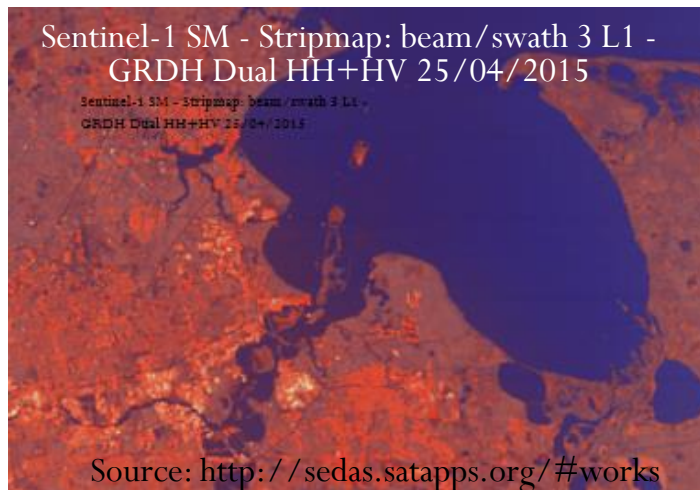
ALOS 2 -JAXA -Merapi, Indonesia (Nov, 2014)
Stripmap 3m (HH)



Source <http://www.eorc.jaxa.jp/>

ESA - EU

Sentinel-1 SM - Stripmap: beam/swath 3 L1 -
GRDH Dual HH+HV 25/04/2015



Source: <http://sedas.satapps.org/#works>

*Other EO Satellite
Data Provides:
ISRO, CNSA, KARI &
others*



Building Database for Mapping Energy Source & Use (contd.)

Renewable Energy Source: ex. Wind and Solar Irradiance

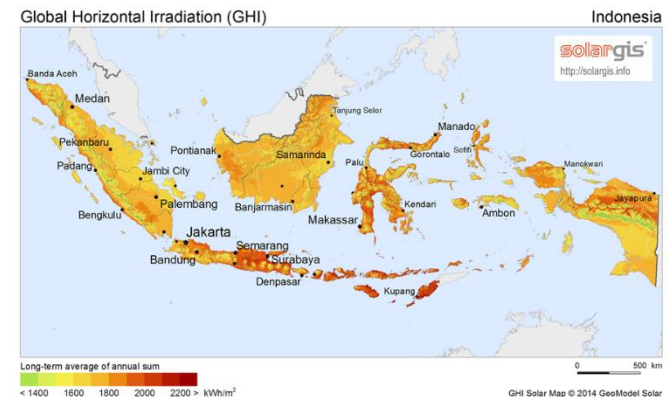
Annual Monthly Averaged Wind Speed At
10 m Above The Surface Of The Earth For
Terrain Similar To Airports (m/s)
(Sample Data Around Indonesia;)

Longitude/ Latitude	107	108	109	110	111	112	113	114	115	116	117	118	119	120
5.82	4.54	4.49	4.43	4.32	4.16	3.99	3.64	3.28	2.99	2.77	2.36	2.85	3.14	3.31
4.82	4.28	4.18	4.09	3.93	3.72	3.51	2.81	2.37	2.12	2.06	2	2.57	2.98	3.23
3.82	4.03	3.89	3.76	3.54	3.22	2.91	2.28	1.88	1.69	1.72	1.75	2.38	2.87	3.18
2.82	3.78	3.61	3.45	3.13	2.66	2.02	1.78	1.55	1.46	1.54	1.62	2.28	2.82	3.16
1.82	3.57	3.3	3.03	2.67	2.2	1.61	1.48	1.36	1.34	1.45	1.56	2.23	2.77	3.08
0.82	3.38	2.73	2.34	2	1.72	1.44	1.37	1.3	1.33	1.46	1.59	2.22	2.72	2.95
-0.18	3.27	2.57	2.13	1.81	1.61	1.42	1.4	1.37	1.45	1.64	1.83	2.28	2.57	2.7
-1.18	3.24	2.58	2.17	1.88	1.71	1.55	1.56	1.56	1.71	2	2.48	2.22	2.15	2.16
-2.18	3.21	2.72	2.48	2.29	2.15	2	1.95	1.9	2.04	2.36	2.91	2.43	2.17	2.14
-3.18	3.18	3.25	3.32	3.29	3.15	3	2.58	2.38	2.43	2.74	3.29	2.73	2.43	2.45
-4.18	3.11	3.38	3.64	3.74	3.66	3.59	3.12	2.94	2.95	3.18	3.67	3.14	2.89	2.92
-5.18	2.76	3.31	3.64	3.83	3.87	3.92	3.89	3.86	3.89	3.99	4.08	3.97	3.85	3.85
-6.18	3.01	3.45	3.64	3.78	3.87	3.97	4.09	4.21	4.28	4.3	4.32	4.28	4.24	4.23

Annual Monthly Averaged Insolation Incident
On A Horizontal Surface (kWh/m²/day)
(Sample Data Around Indonesia)

Source: NASA (eosweb.larc.nasa.gov/sse)

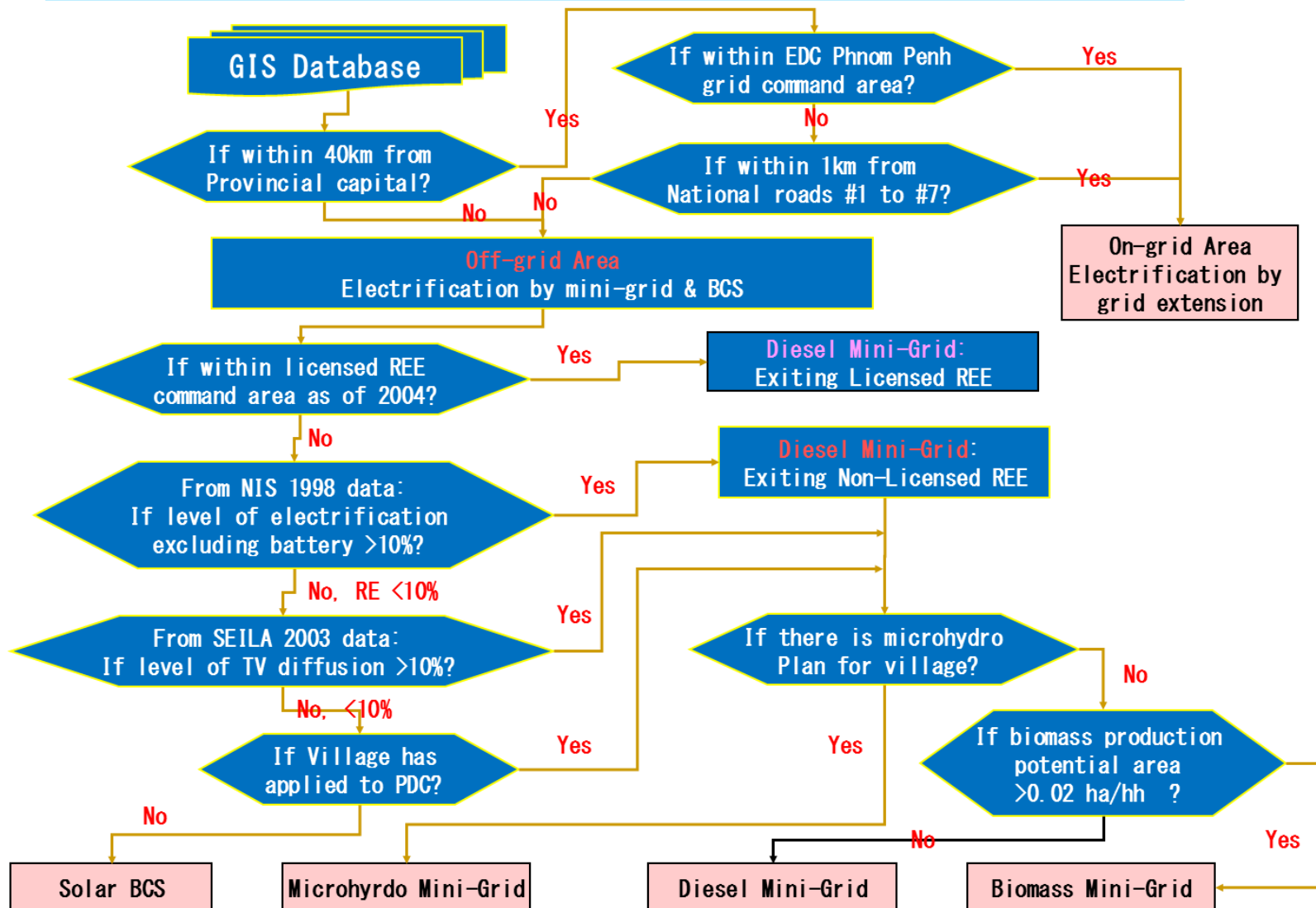
Longitude/ Latitude	107	108	109	110	111	112	113	114	115	116	117	118	119	120
5.82	5.4	5.41	5.39	5.32	5.25	5.22	5.24	5.41	5.65	5.12	4.98	5.01	5.57	5.87
4.82	5.37	5.34	5.31	5.14	5.01	4.98	5.18	5.24	5.05	4.89	4.9	4.98	5.68	5.69
3.82	5.32	5.04	5.02	4.84	4.75	4.92	5.05	5.02	5.11	4.88	4.88	5.25	5.47	5.58
2.82	5.23	5.03	4.8	4.76	4.81	4.6	4.84	5	4.99	4.82	4.77	5.13	5.4	5.57
1.82	5.17	5.11	4.77	4.62	4.7	4.7	4.8	4.93	4.89	4.85	4.8	4.81	5.56	5.77
0.82	5.14	5.23	4.85	4.79	4.78	4.79	4.81	4.78	4.79	4.88	4.78	5.07	5.49	5.11
-0.18	5.11	5.2	5.12	4.88	4.8	4.71	4.66	4.7	4.76	4.75	4.6	5.17	5.45	5.39
-1.18	5.12	5.16	5.23	5.02	4.84	4.8	4.84	4.84	4.75	4.58	4.85	5.22	5.57	4.96
-2.18	5.13	5.06	5.25	4.97	4.74	4.82	4.87	4.92	4.85	4.61	5.23	5.51	5.37	4.9
-3.18	5.2	5.24	5.26	5.15	5.18	4.97	5.06	5.07	4.64	4.77	5.36	5.66	5.4	4.95
-4.18	5.11	5.14	5.2	5.23	5.24	5.27	5.29	5.31	5.4	5.43	5.46	5.62	5.67	5.05
-5.18	5.17	5.13	5.14	5.23	5.33	5.43	5.52	5.56	5.55	5.59	5.65	5.79	5.87	5.21
-6.18	4.81	5.08	5.43	5.48	5.42	5.58	5.81	5.8	5.78	5.81	5.84	5.92	5.96	5.99



Geospatial Analysis for Energy Mix

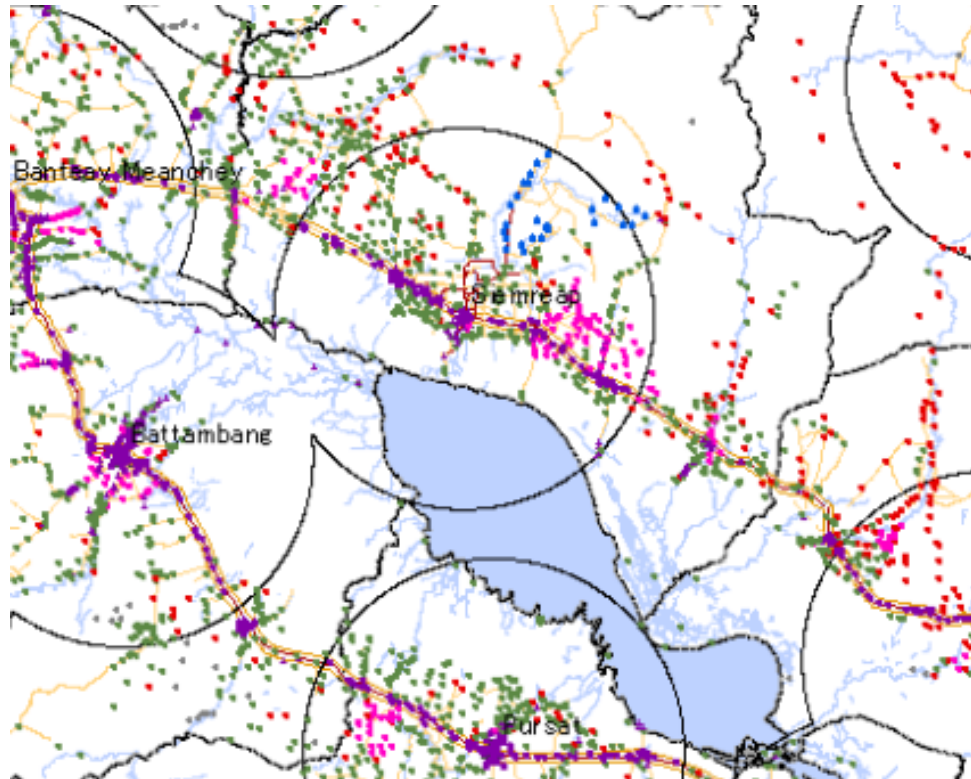
Building Logical Algorithm

Flow of the Energy Selection Simulation Model: Energy Mix and on & Off Grid Electrification



Geospatial Analysis for Energy Mix

Result



Result: Energy Mix and on & Off Grid Electrification

- Solar BCS
- Hydro Mini-grid
- Grid Extension Or Biomass Mini-grid in Plain Area
- Biomass Mini-grid in Other Area
- Grid Extension Or Diesel Mini-grid in Plain Area
- Diesel Mini-grid in Other Area
- On-grid
- Licensee REE Mini-grid
- Non Licensee REE Mini-grid

Key Messages

- SIST is well recognized technology for Landscape Analysis
- SIST could helps COE for
 - Building required database
 - Mapping electrification status of the country, population distribution
 - Mapping & estimation of energy sources for viability of harvesting
 - Simulation of energy mix and planning
 - Transparent and objective analysis
 - Mainstreaming environmental and social safeguard issues
 - and so on.....
- SIST saves cost and time