

Sustainable Resources Exploration in Federal Myanmar's Marine Frontier

SUSTAINABLE DEVELOPMENT GOALS



Moe Kyaw Thu (moe@jamstec.go.jp)

- 1985: B.Sc. (Honours) (University of Yangon)
- 1986-89: Demonstrator/ Master Course (University of Yangon)
- 1989-90: Manager (Geocomp Myanmar)



□ Deepwater Exploration, Research & Development (32 years)

- 1990-91: Muglogger (Geoservices, Singapore)

□ Offshore Observation and Monitoring (Geology-Geophysics-Geomechanics)(30 years)

- 1992-1999: M.Sc.-D.Sc. (University of Tokyo/ Ocean Research Institute)

□ Offshore Drilling Project Management (22 years)

- 1999-2004: *Logging Staff Scientist*/ Ocean Drilling Program, Tokyo/Columbia Universities
- 2001~ Present: *Principal Researcher/ Global Partnership Coordinator* (Institute for Marine-Earth Exploration & Engineering / Japan Agency for Marine-Earth Science & Technology)



Longest ongoing Civil War and Coup(s)

British Colony

1886

Japanese Occupation

1942

British

1945

Independence

1948

1948 →

Longest ongoing CIVIL WAR → Present

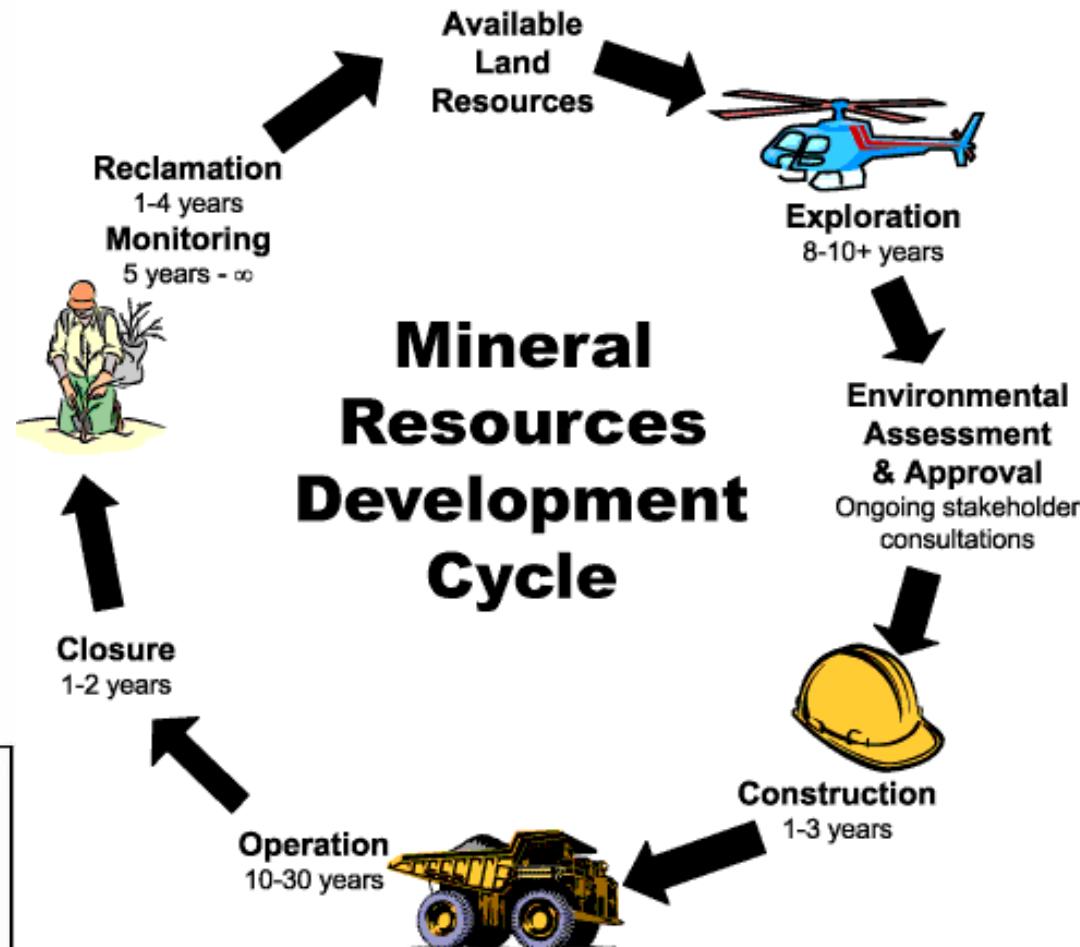
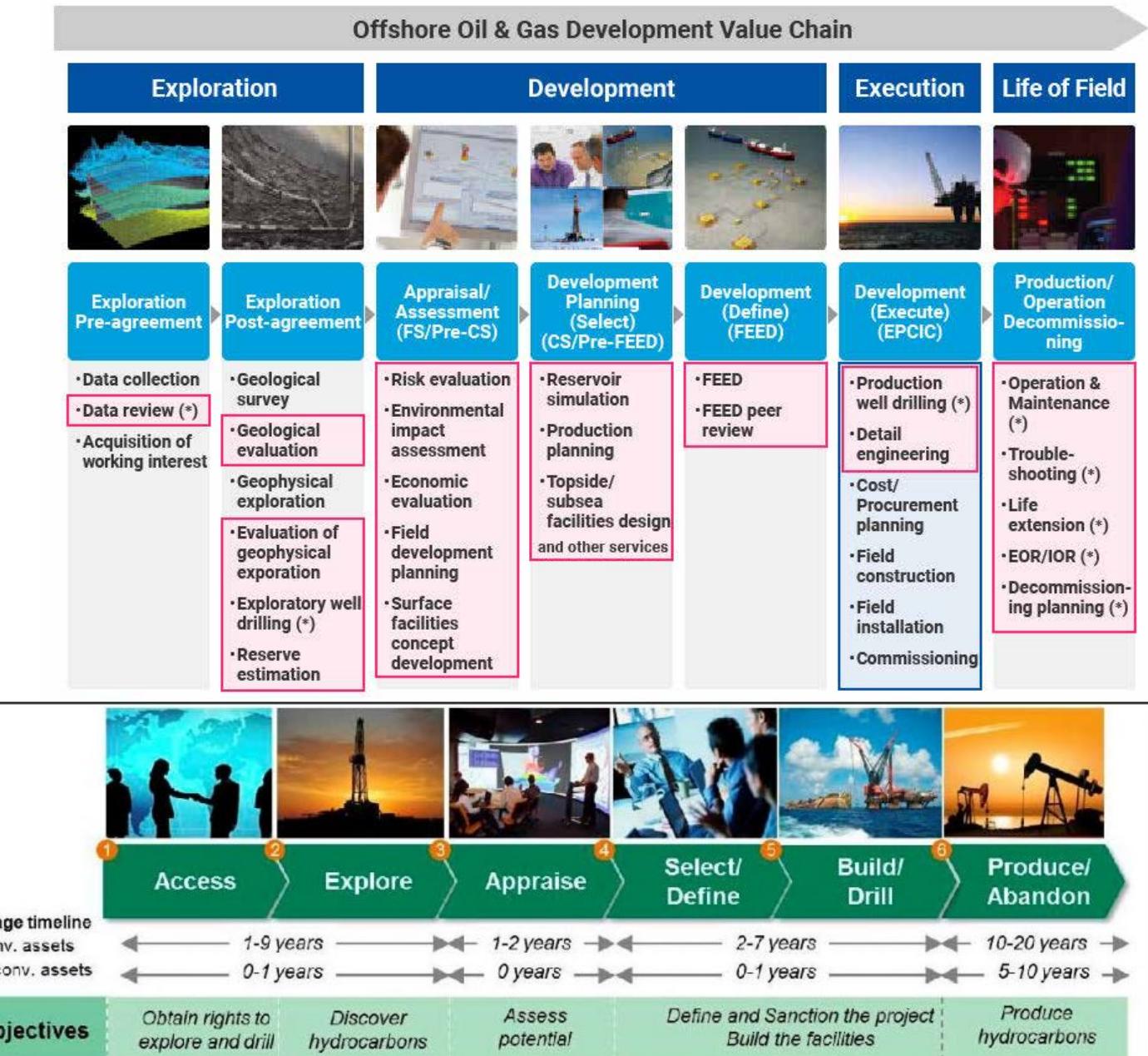


Geoscience Education & Mineral Exploration

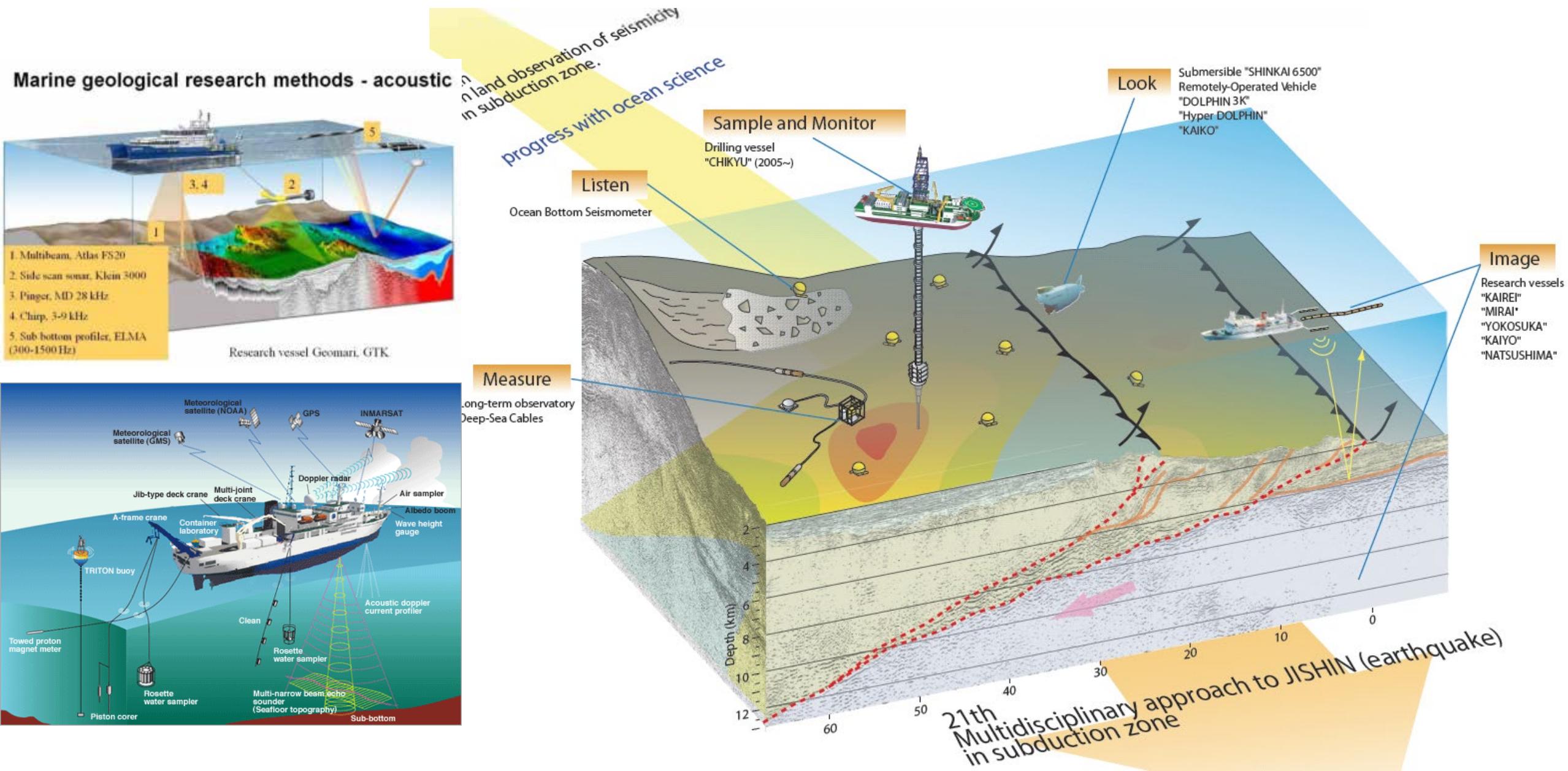
- ❖ One of the **World's oldest petroleum industries** (discovered in 1795 and exports since 1853) and **World-class mineral resources, 90% of Ruby and largest single source of Jade, copper, gold, lead, zinc, silver, tin and nickel, tin & tungsten, zinc**
- ❖ Nationalized businesses under military's socialism, isolated from outside world and mismanaged the economy, education and health care systems fell the country to **Least Developed Country (LDC)** status in 1987



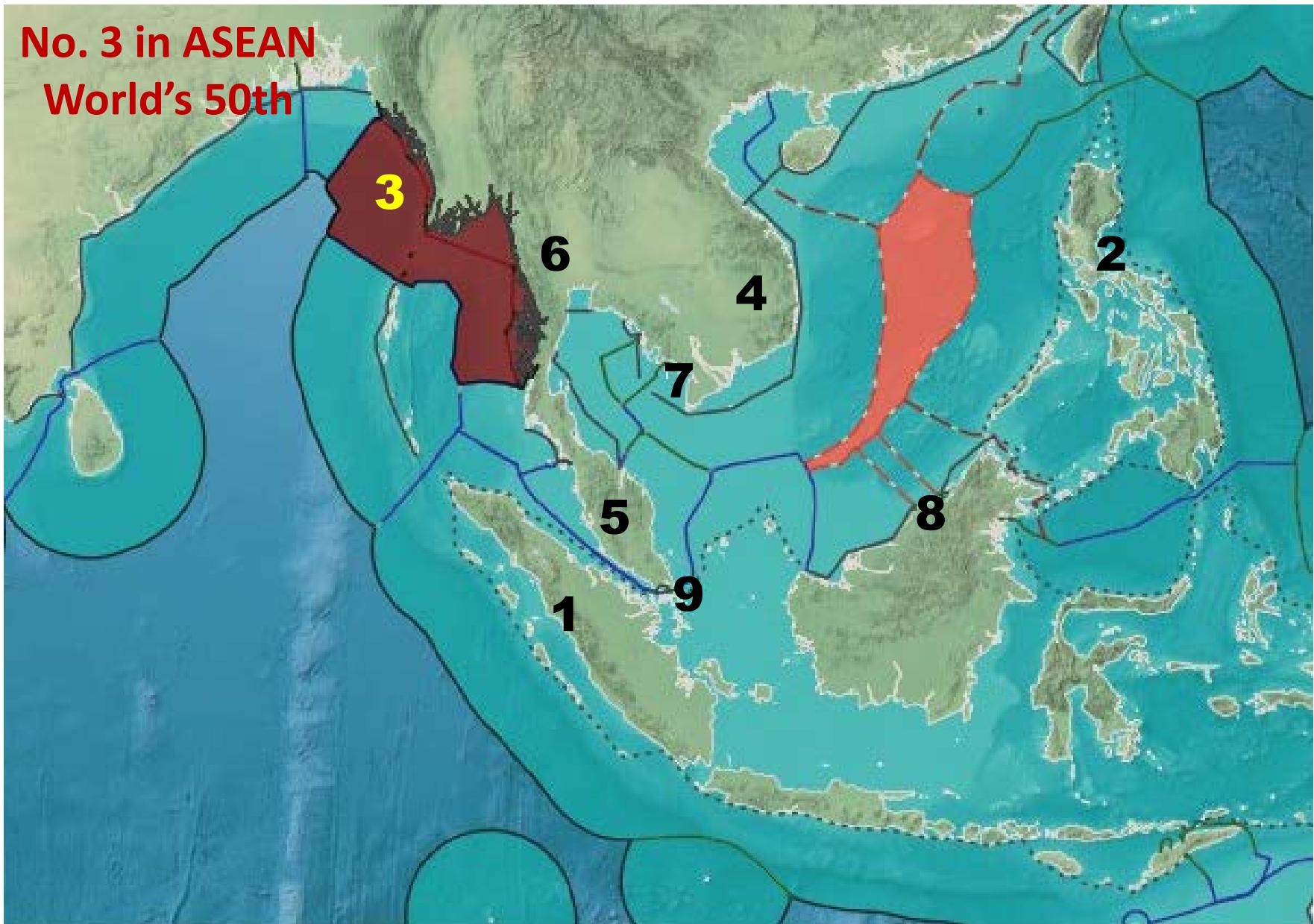
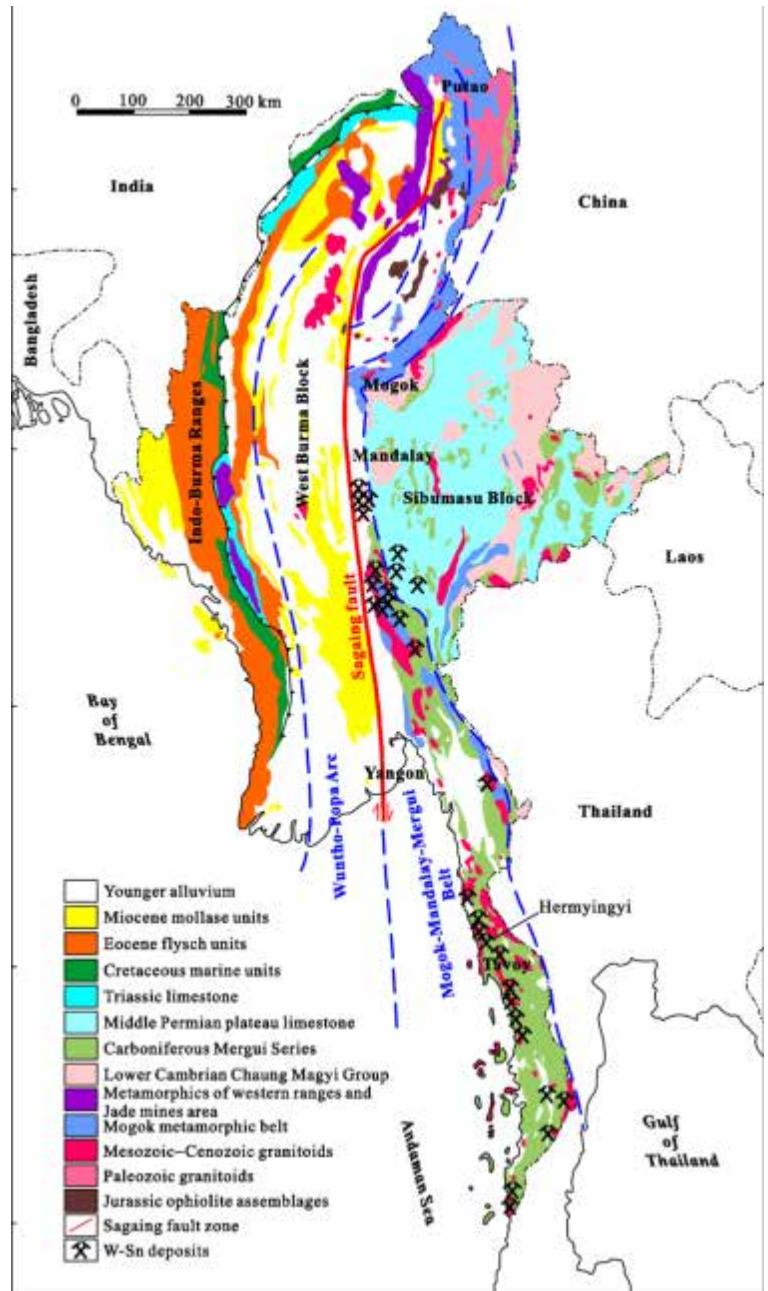
Resources Exploration Process



Marine Science Education & Research

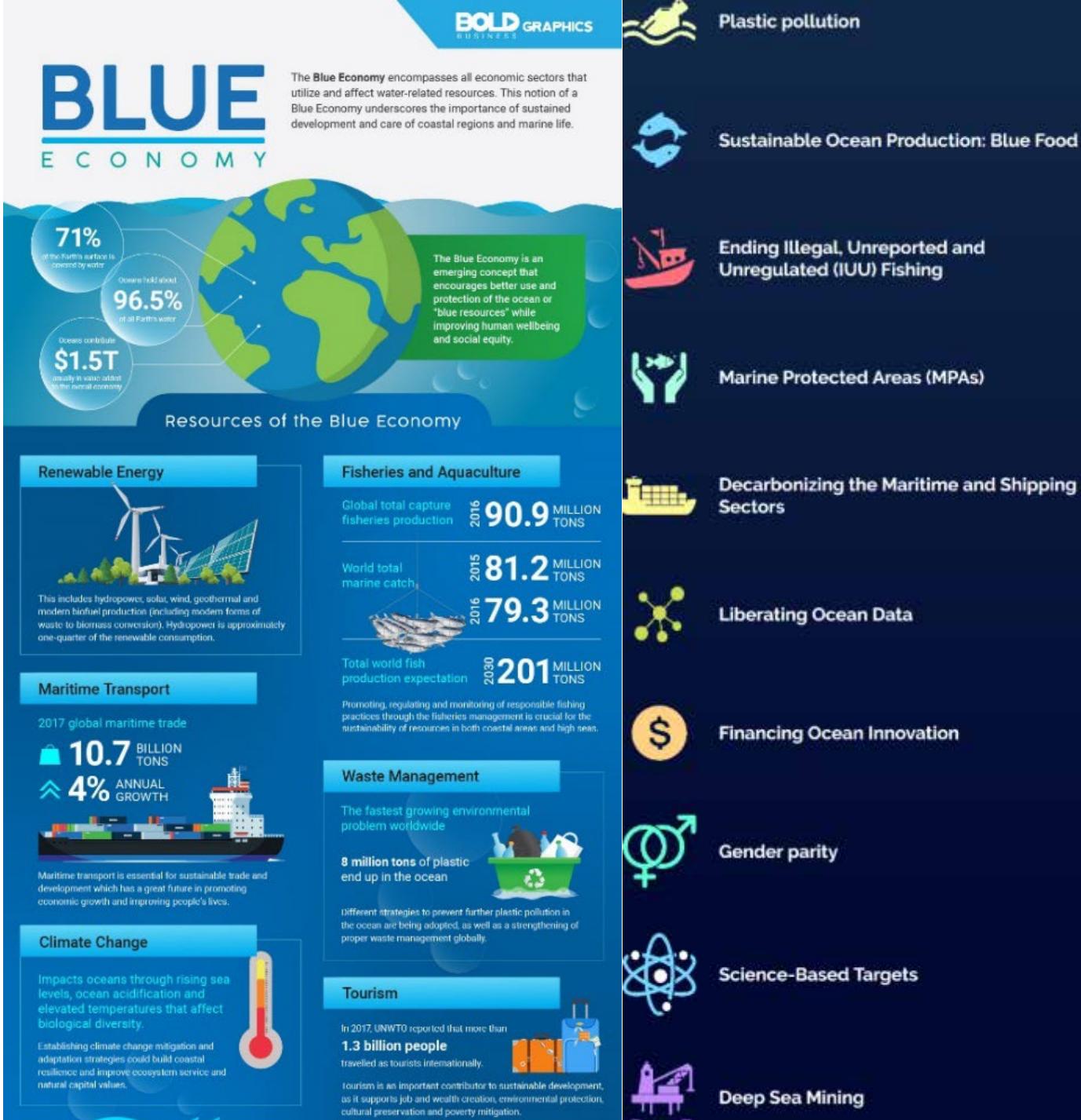


Mineral Resources and Exclusive Economic Zone



Blue Economy

- Fishery & Aquaculture
- Marine Transport
- Resources Exploration (O&G, Mining)
- Tourism & Recreation (Environment)
- Energy (Wind, Current)



Painful Lessons in Marine Frontiers

Missed Opportunities

- 1966~ Marine Science Edu-R&D
(Ranked 10 in ASEAN)
- 1989~ Resources Exploration
(All foreign funds-technology)
- 2005-12 EEZ-Mapping
(No data, education & research)
- 1999~ Disaster Research-Monitoring
(No Research Center- function)

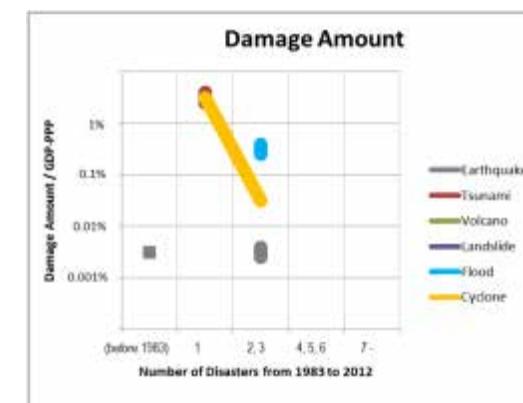
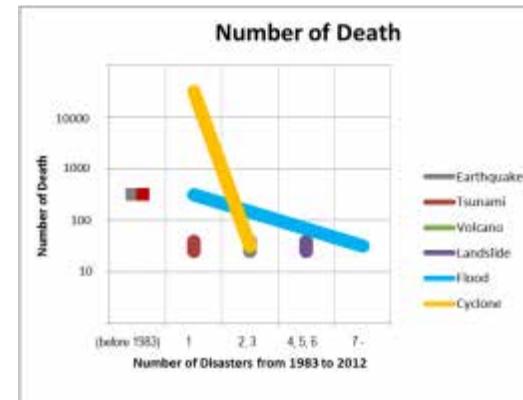
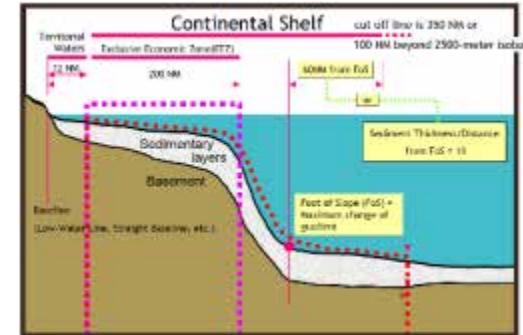
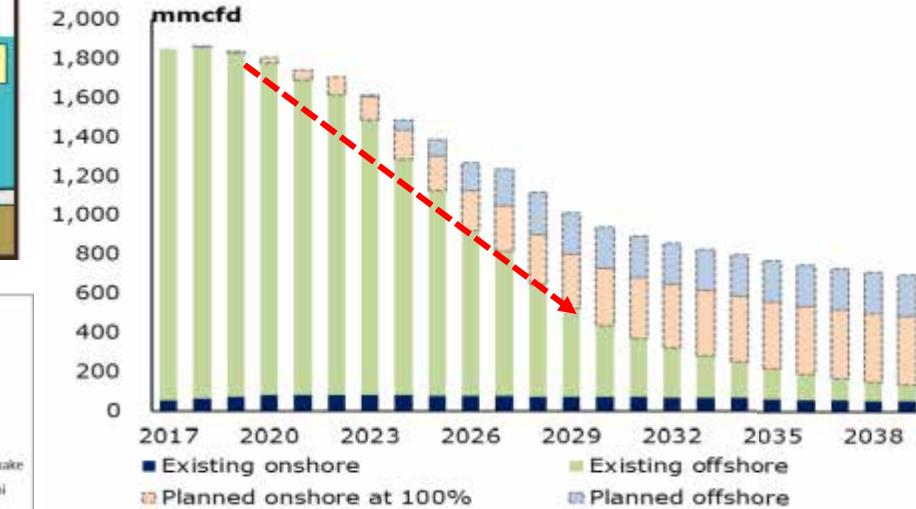


Figure 4.4: Domestic Production Outlook in Myanmar



	Marine Science	Marine Geohazard & Geology	Marine Ecosystem	Ocean & Climate
Indonesia	1116	271	167	129
Philippines	730	100	154	60
Myanmar	31	11	5	2
Vietnam	946	154	144	95
Malaysia	3315	375	355	208
Thailand	2323	205	239	123
Cambodia	59	14	59	8
Brunei Darussalam	66	11	66	7
Singapore	2307	152	220	152
Laos P.D.R.	73	15	15	4

I. Marine Science Education & Research

- ❖ 1966: Marine Zoology- Botany in University of Yangon
- ❖ 1968: Marine Zoology- Botany in Mawlamyine College
- ❖ 1986: **Marine Science Department** in Mawlamyine University
- ❖ Expanding along coast: Myeik (2001); Pathein (2002); Sittway (2018)



❖ Courses

❖ Oceanography (Physical, Chemical)

❖ Biology (Fishery, Aquaculture, MicroBio)

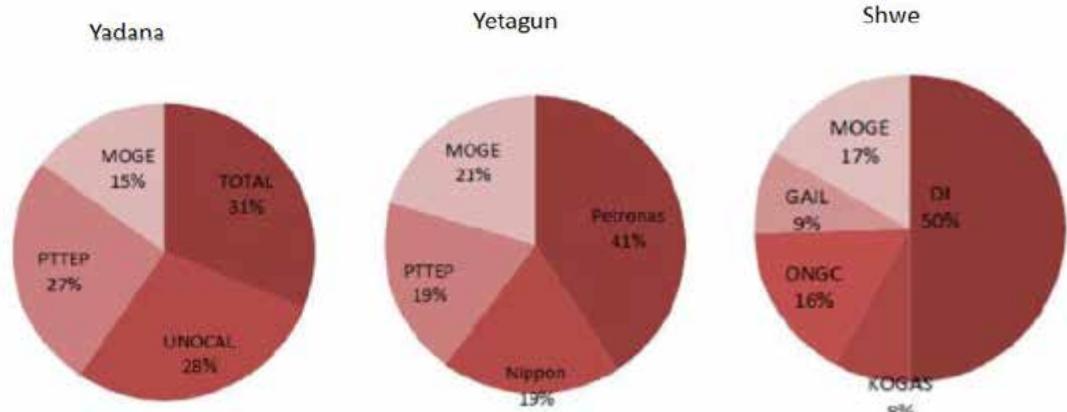
❖ Environment (Mangrove)

❖ GEOSCIENCES

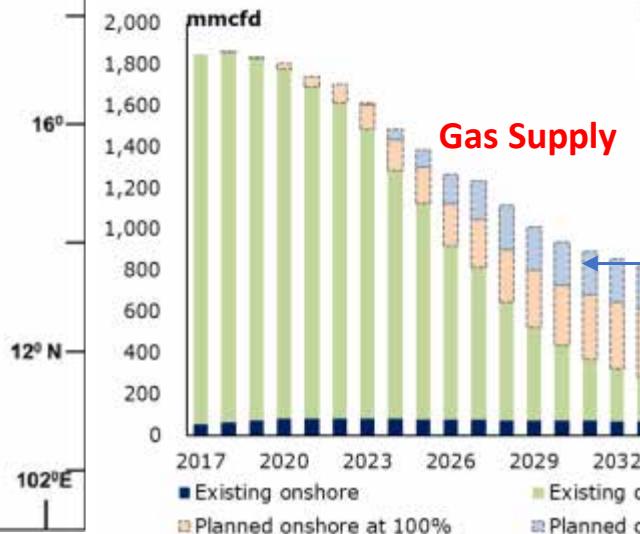
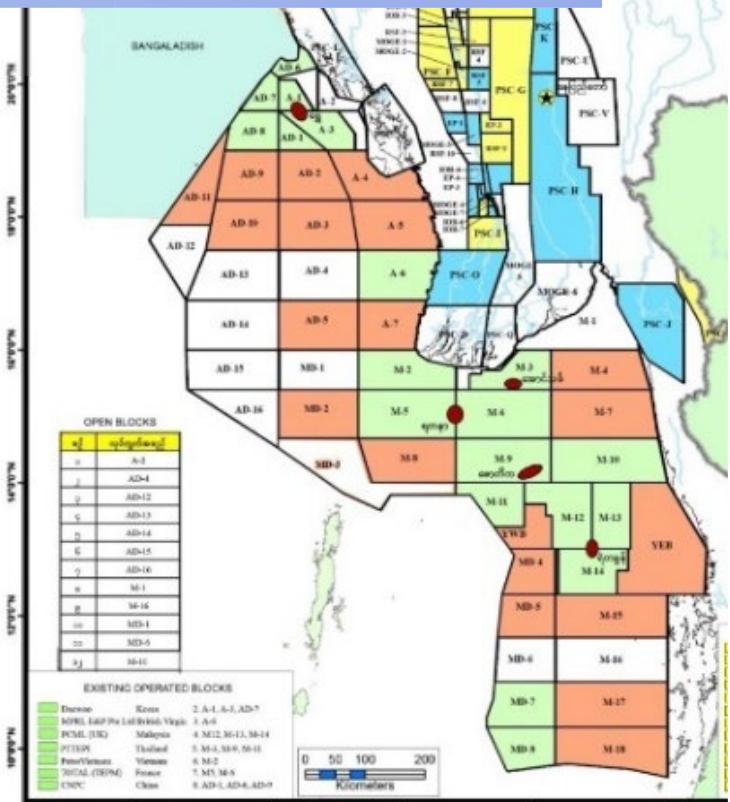
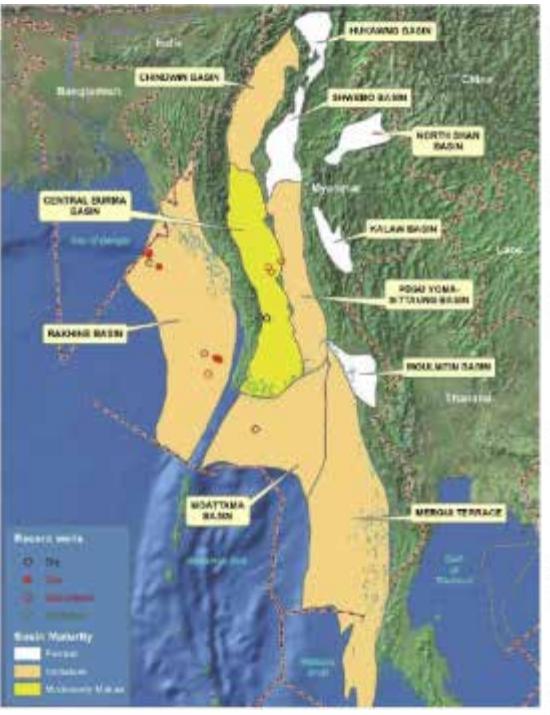
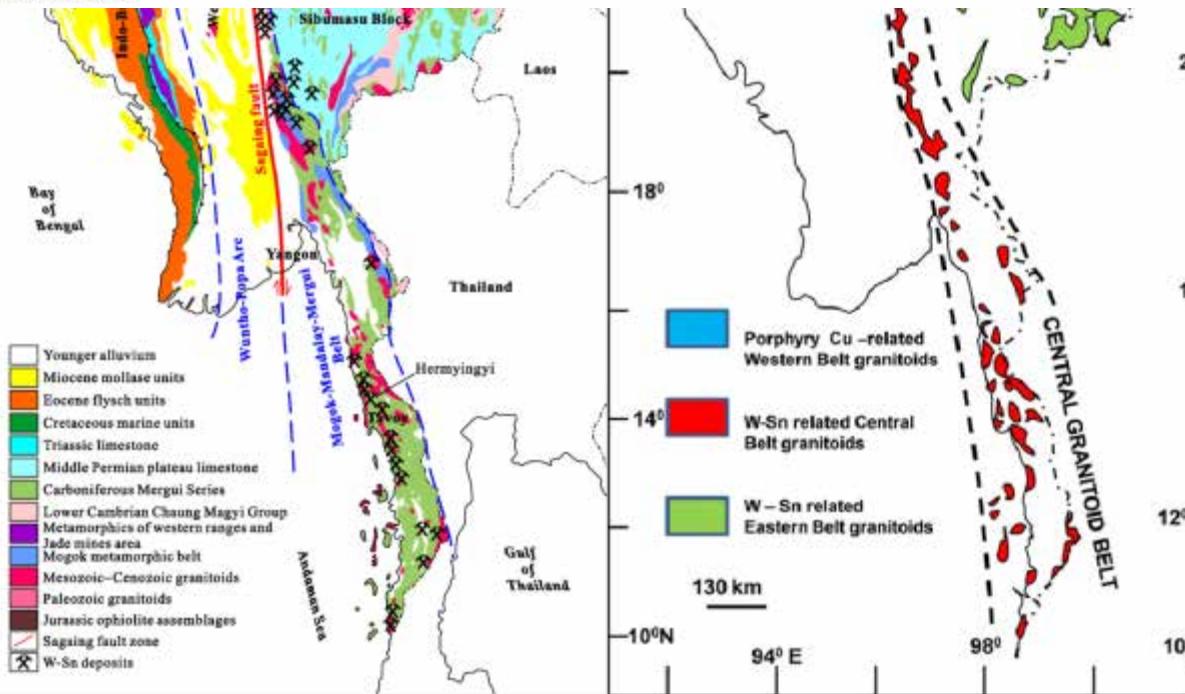
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II. Offshore Exploration

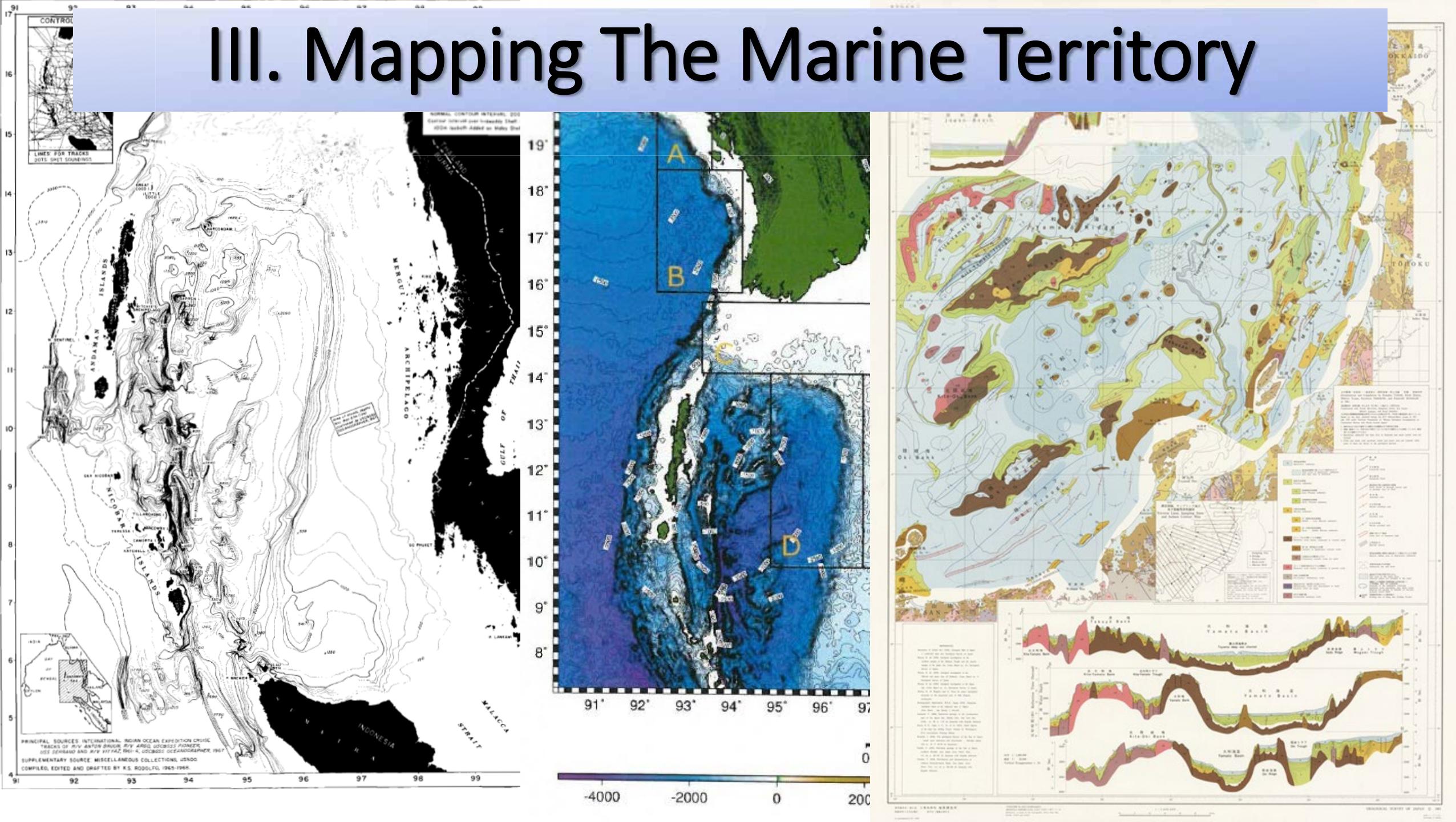
Figure 9 Production Sharing Agreement Structures of Natural Gas Fields in Myanmar



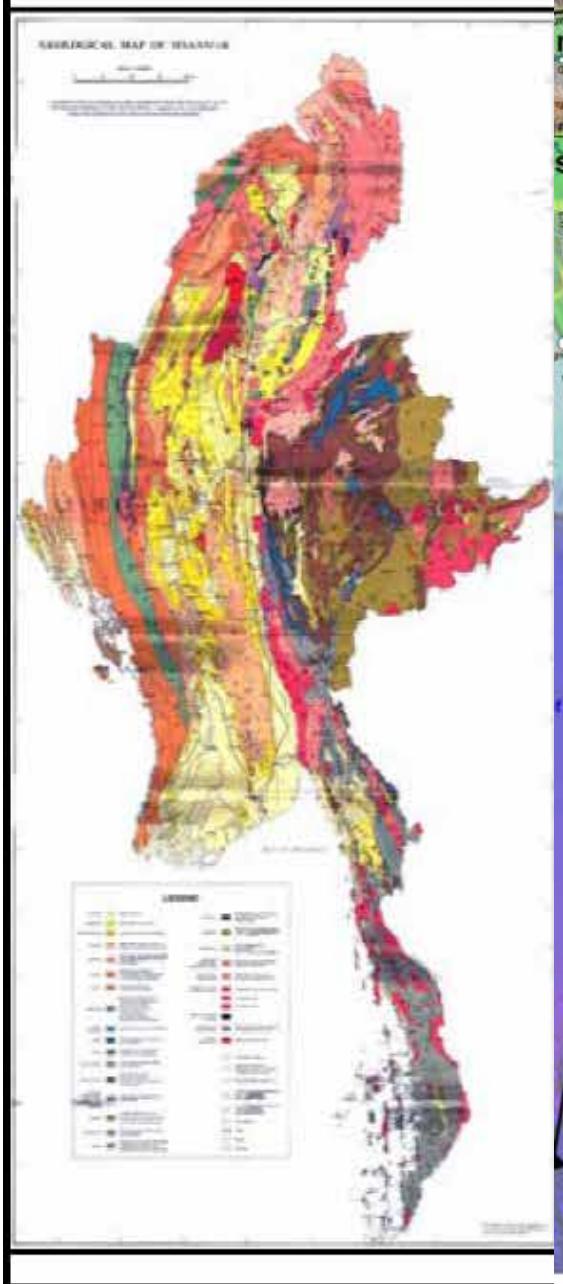
Source: MOGE



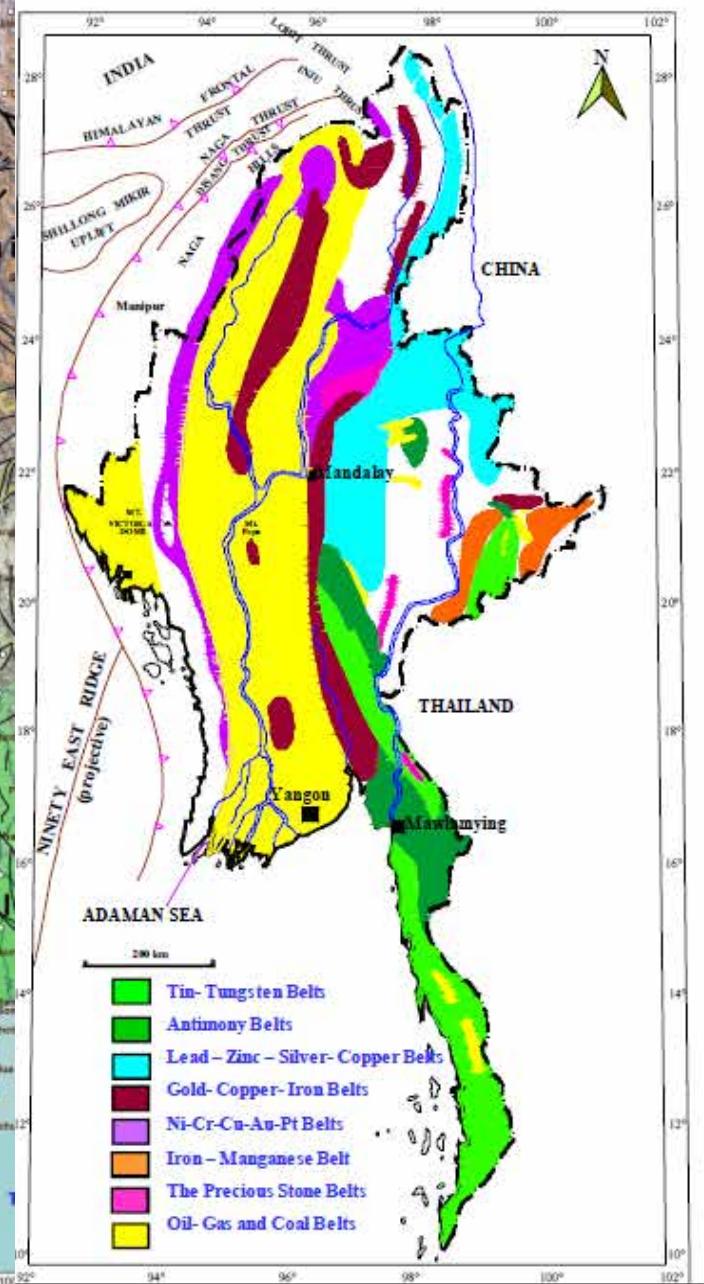
III. Mapping The Marine Territory



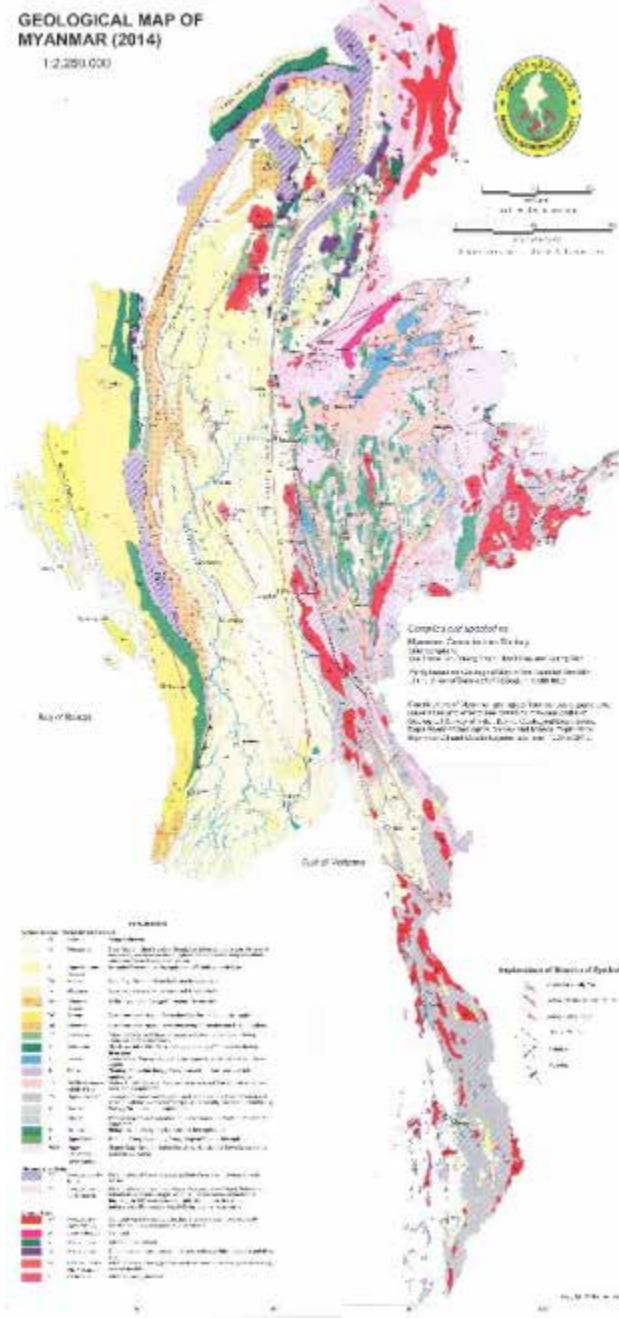
Geological Map of Myanmar (1977)



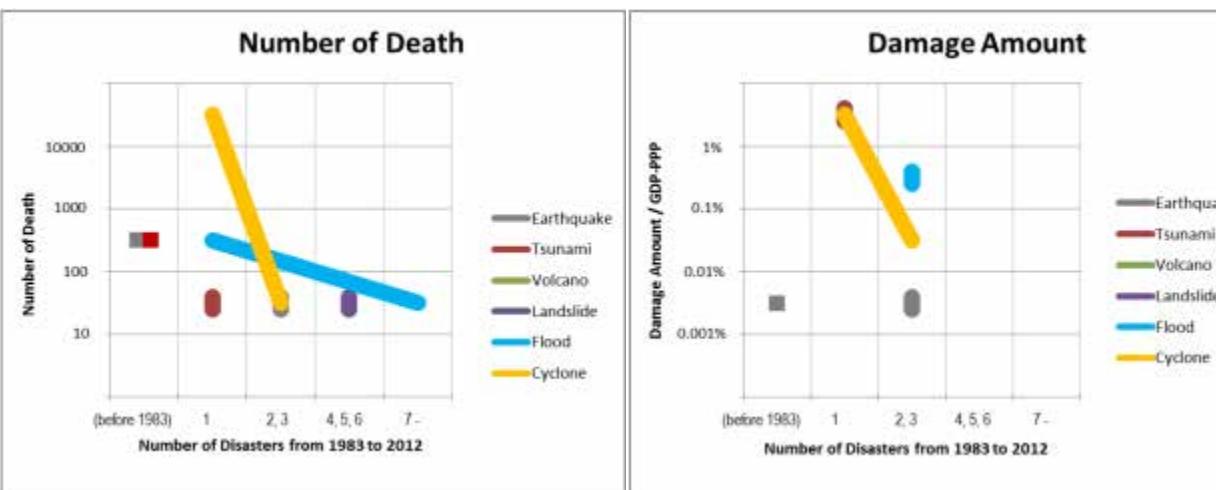
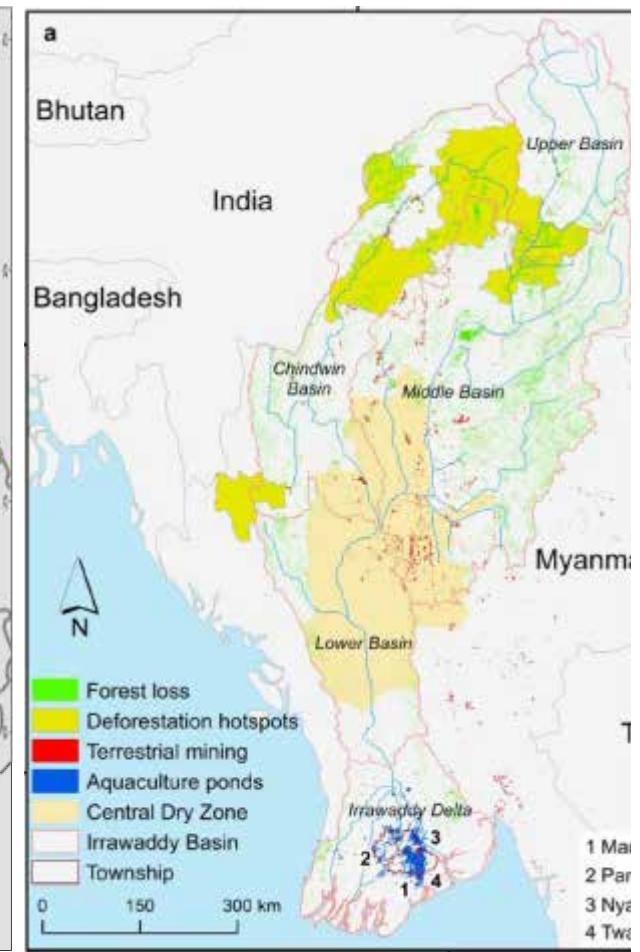
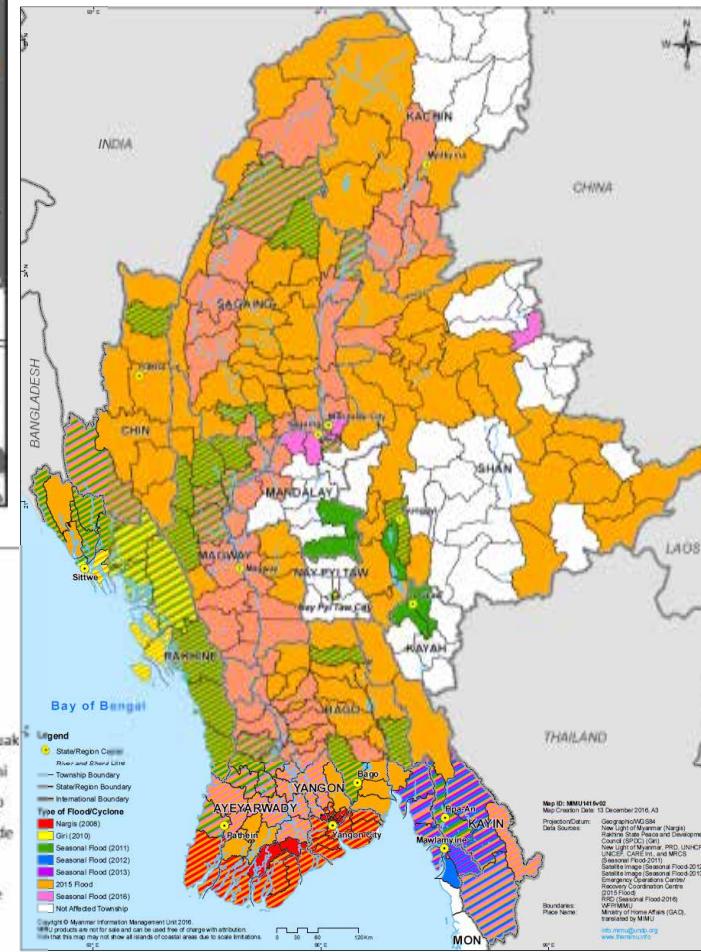
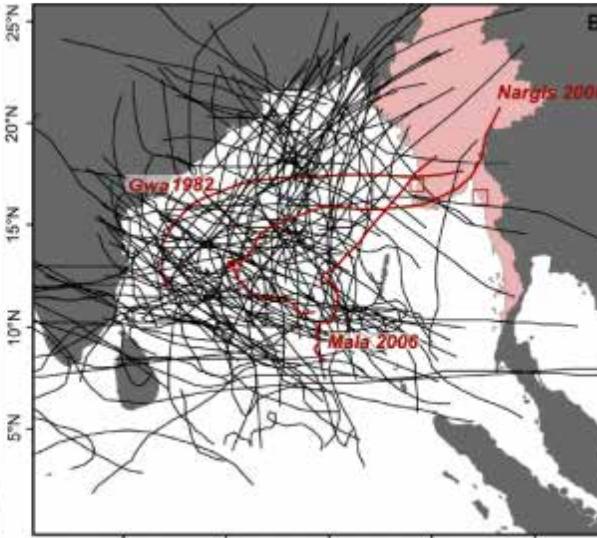
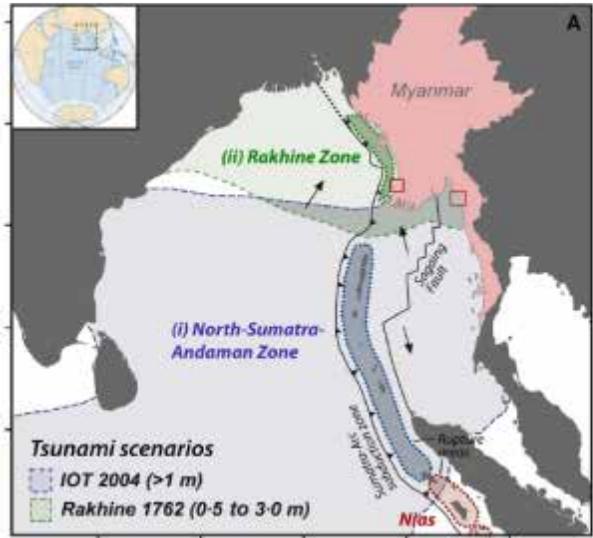
MINERAL PROVINCES OF MYANMAR



Geological Map (2014)



IV. Disaster Monitoring & Mitigation

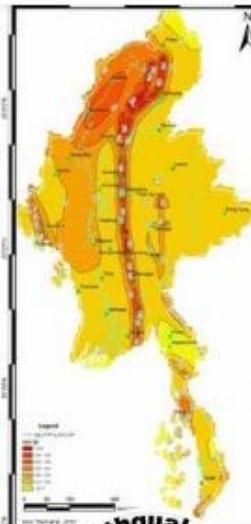


Disaster Monitoring & Mitigation



Development of a Comprehensive Disaster Resilience System and Collaboration Platform in Myanmar

Build Safe Cities Through Disaster Risk Assessment and Thorough Preparation



မြန်မာနိုင်ငံ၏လျှပ်
အချက်အလက် များ
နှင့်
ပညာရှင်များ ၏
လွတ်လပ်သော
ယူဆချက်များ



Prof. / Director
MEGURO Kimiro
(International Center for Urban Safety Engineering, Institute of Industrial Science, The University of Tokyo)



former Pro-Rector
Khin Than Yu
(Yangon Technological University (YTU))



Myanmar Earthquake Committee

@MyanmarEarthquakeCommittee · Nonprofit Organization

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Quantitative and Comprehensive Earthquake Risk Evaluation for Better Disaster Preparedness in Urban Areas of Myanmar

Principal Investigator (Affiliation)

Research Institutions in Japan

The University of Tokyo / Hokkaido University / Tohoku University / Keio University

Research Institutions in Myanmar

Yangon Technological University (YTU) / Myanmar Engineering Society (MES) / Relief and Resettlement Department (RRD) / Department of Meteorology and Hydrology (DMH) / Directorate of Water Resources and Improvement of River Systems (DWIR) / Ministry of Construction (MOC) / Irrigation Department (ID) / Yangon City Development Committee (YCDC) / Mandalay Technological University (MTU) / etc.

Adoption fiscal year

FY 2014

Principal Investigator (Affiliation)

Prof. MATSUSHIMA Shinichi
(Disaster Prevention Research Institute, Kyoto University)

[researchmap](#)

Research Institutions in Japan

Kyoto University

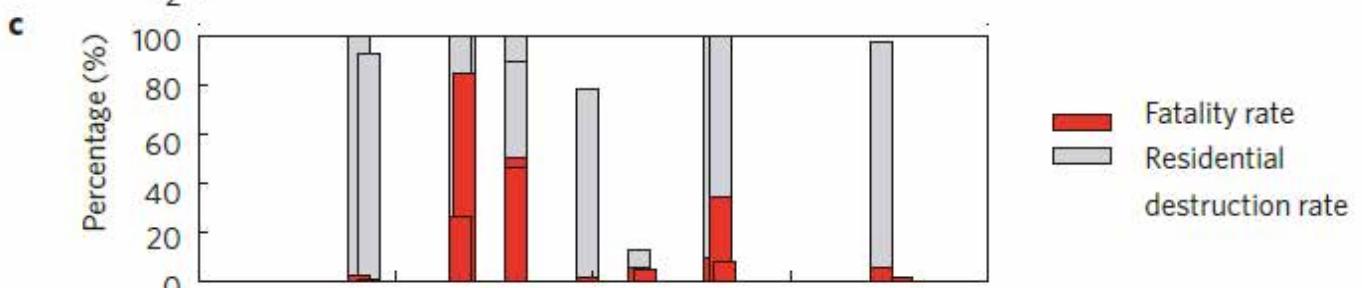
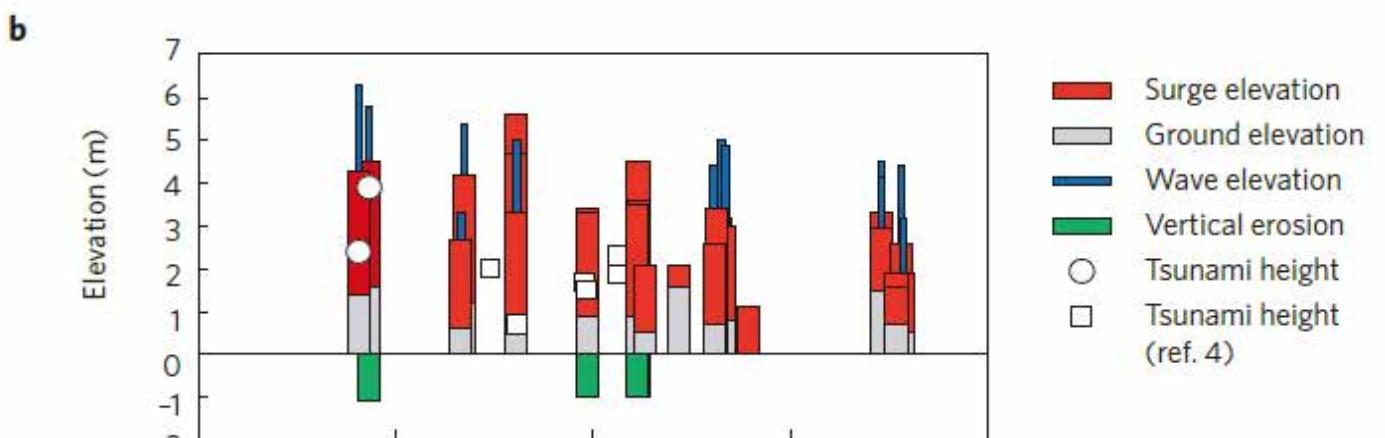
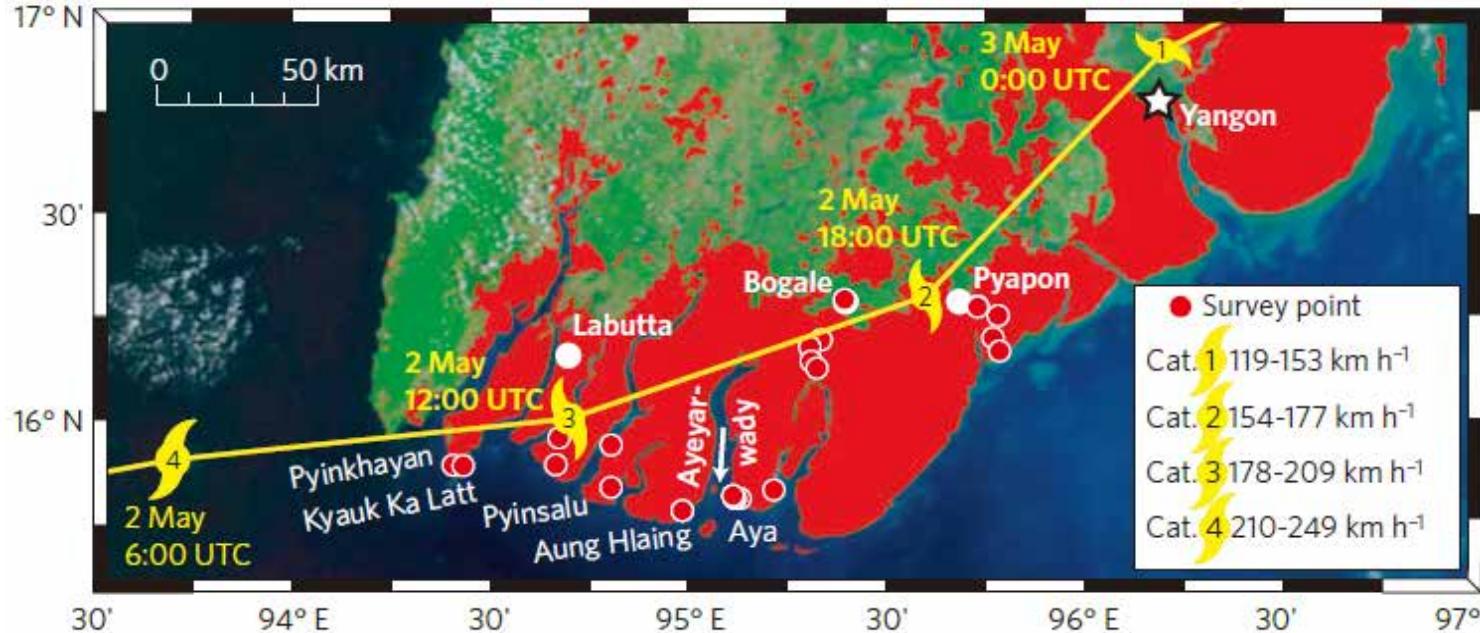
Research Institutions in Myanmar

-

Adoption fiscal year

FY 2020





နှစ် ၃၀ ဘဝနဲ့ရင်းပြီး နားလည်လတော့ !!

Myanmar's Marine Frontier

Blue Economy (Fishery, Transport)

Energy & Minerals (O&G, Mining)

Disasters (Tsunami, Flood, Cyclone)

Environment (Coast, Coral, Plastic)

Actions in Need

Exploration
Value-added Products

Survey-Monitor
Mitigate

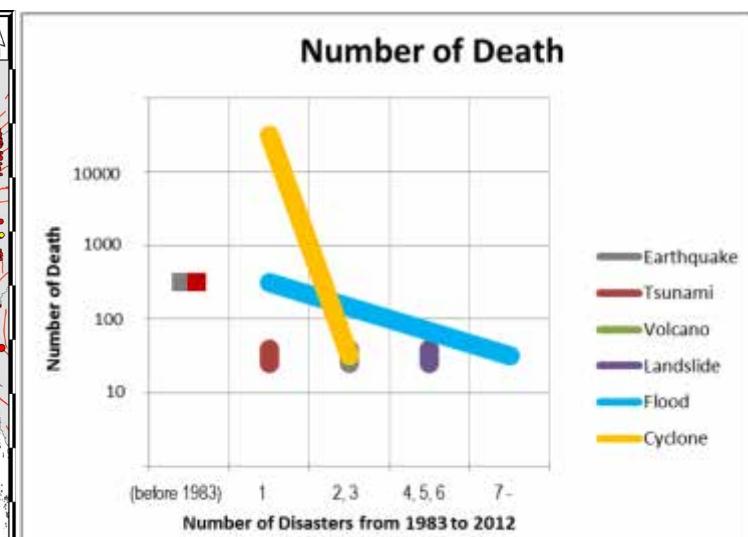
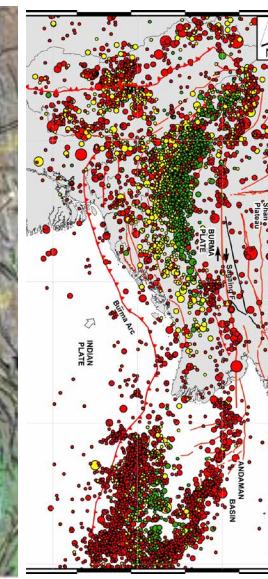
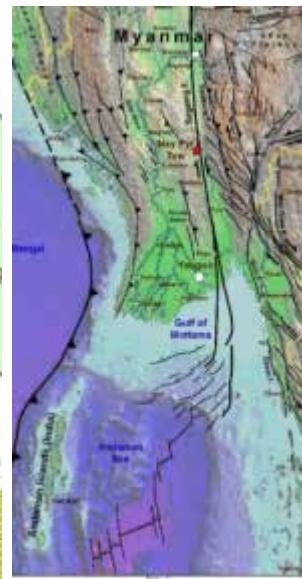
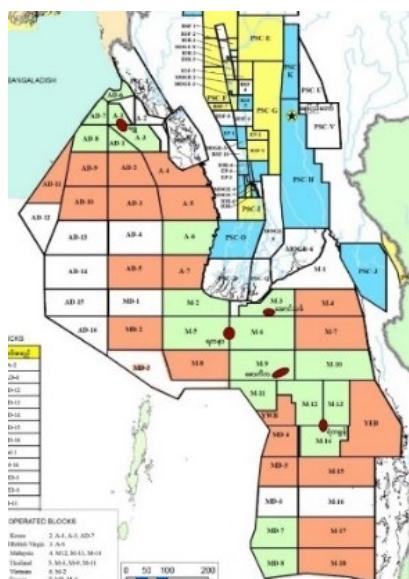
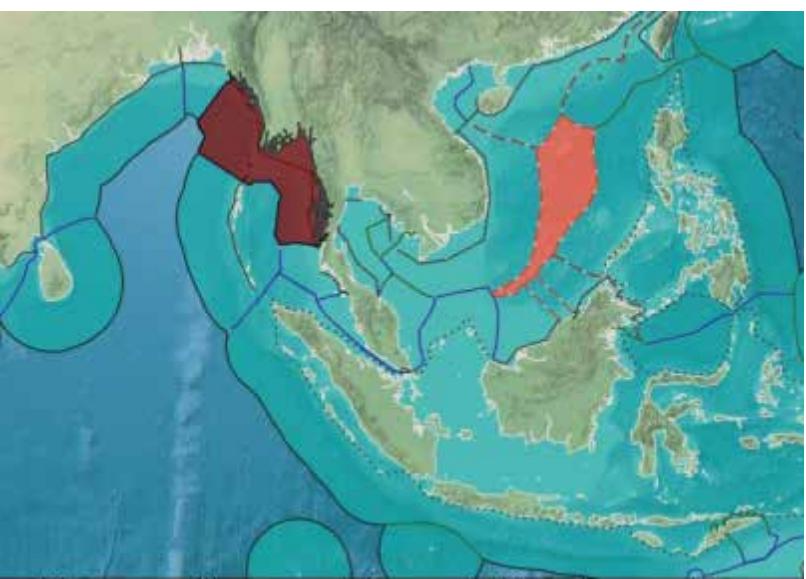
Solutions

Human Resources ← ?????

Technology-Facility ← ?????

Funding ← ?????

Actions & Outcomes



Myanmar Spring (2011-16)

- ❖ Unpredictable Changes surprised the World
 - ❖ Smooth Political Change
 - ❖ Reformer President
 - ❖ Main opposition (NLD) cooperation
- ❖ Three Milestones
 - ❖ From Military to Democracy (discipline flourishing)
 - ❖ From War to Peace (failed unity & rise of Buddhist Nationalism)
 - ❖ From Command Economy to Market Economy
- ❖ International Relations
- ❖ Reform (Land Rights and Political Powerlessness, Military Mindset)



Mineral Resources Industry

- ❖ Extracted Industries contribute **35% to Exports**, 4.8% to GDP, 5.2% government revenue and 0.25% to Employment
- ❖ Law & Regulations: Mining law, Gemstone Law, Petroleum Act but contracts typically govern all projects, contracts are confidential.
- ❖ Tax Revenues: collected by Finance Ministry, not sub-national governments
- ❖ Despite regulations, mining disasters continue in Myanmar and cases reached as many as 160 casualties from jade mine mudslide.

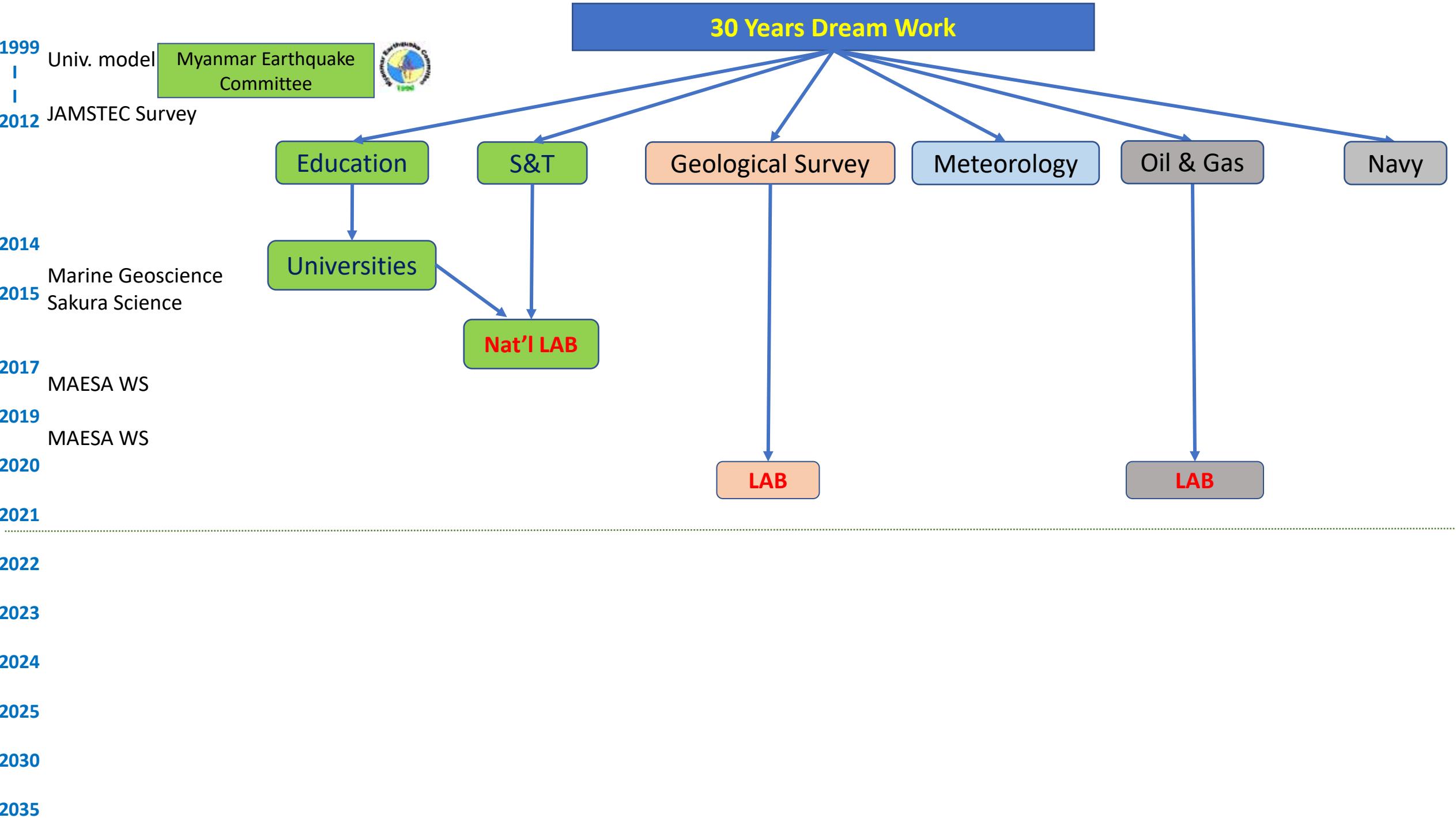


International Cooperation in STI

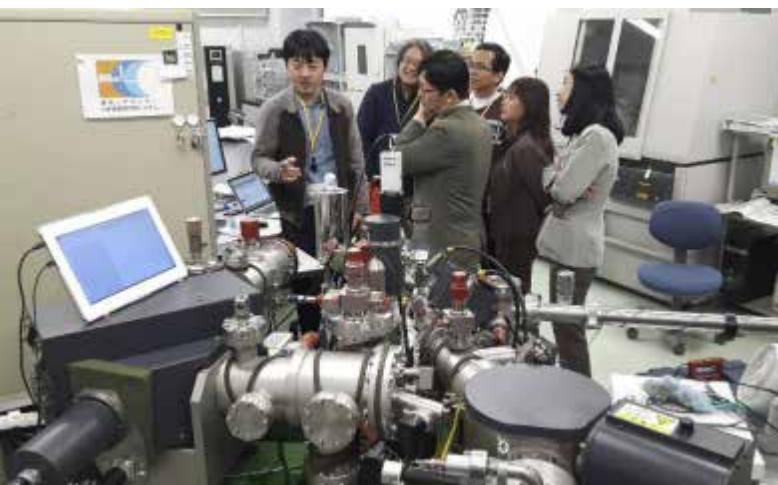


- ❖ Government organizations, educational institutions and public benefitted from **numerous international aid programs and projects**, ASEAN STI network, UN and G7-EU agencies, in training, capacity building, technology transfer and graduate studies.
- ❖ **Tens of thousands of talent students** entered prestigious Universities abroad under scholarships and stipends
- ❖ Many **Small and Medium Enterprises** of young entrepreneurs expanded their businesses to neighboring countries as well as young graduates experienced at foreign businesses as stepping stone for their better future



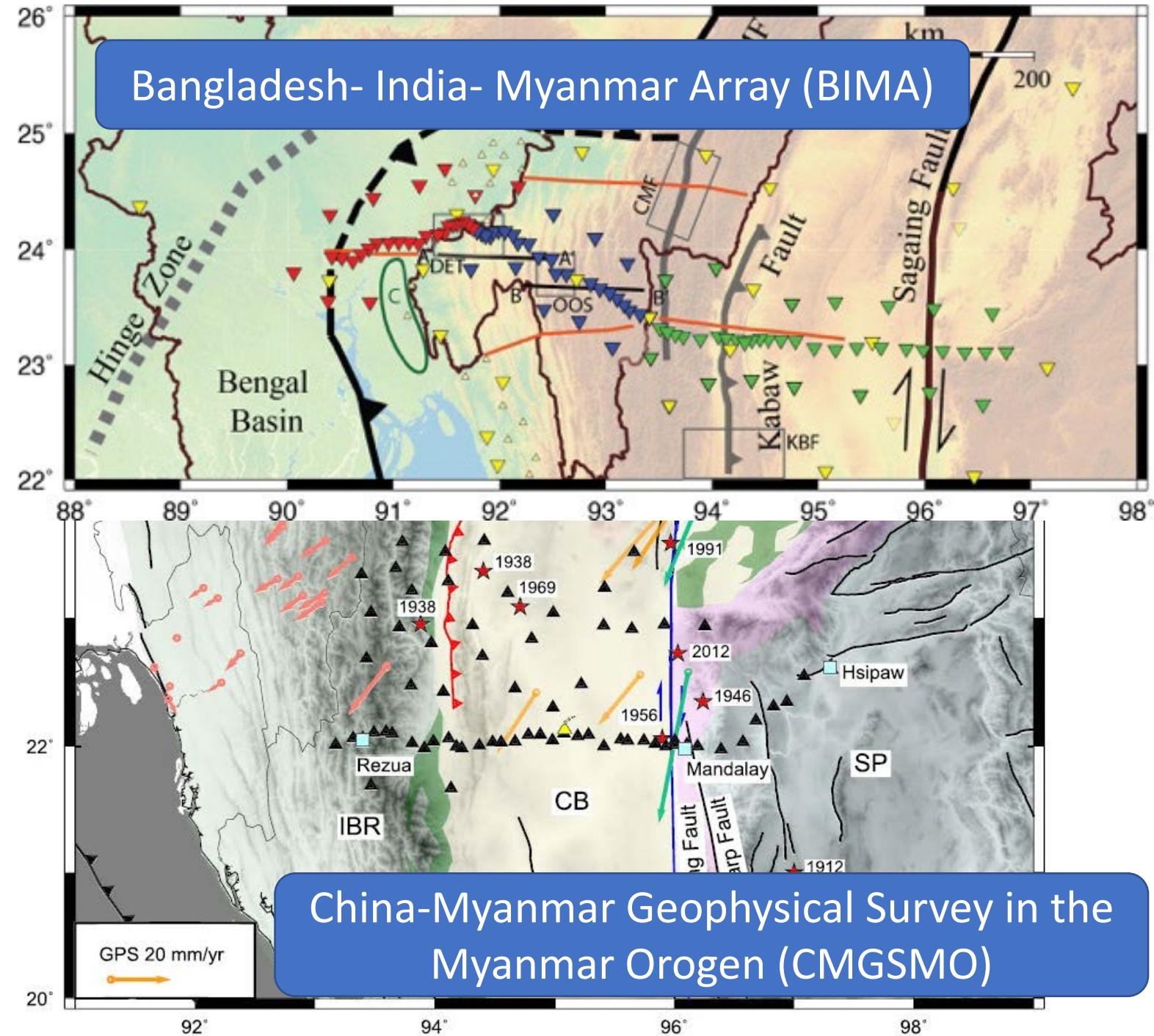
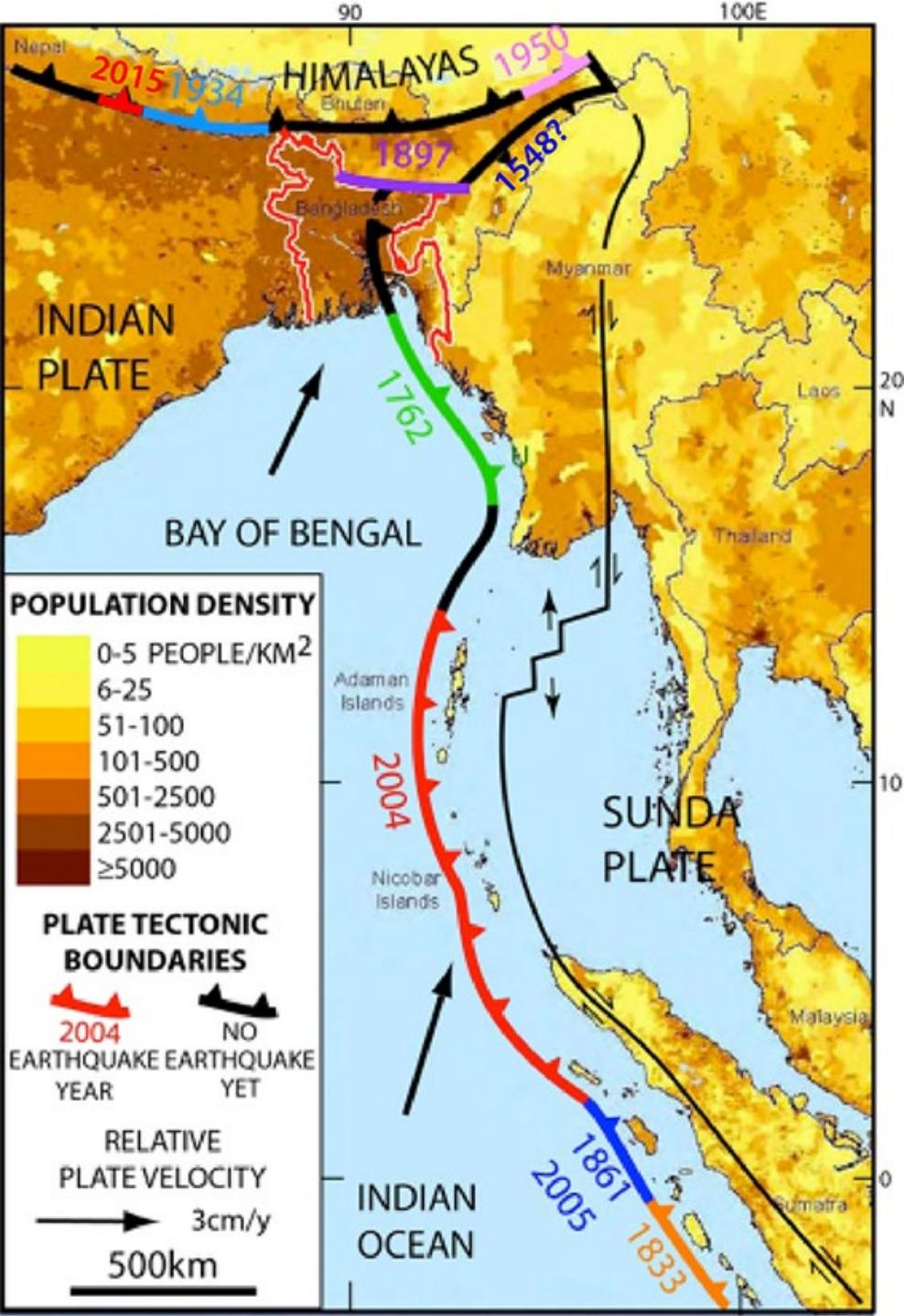


Myanmar Marine Geosciences Initiative (2014-20)



YTU, MEC, D.U., M.U., AGD, DMH, MOGE (42~) in Japan
+ hundreds of students in Myanmar



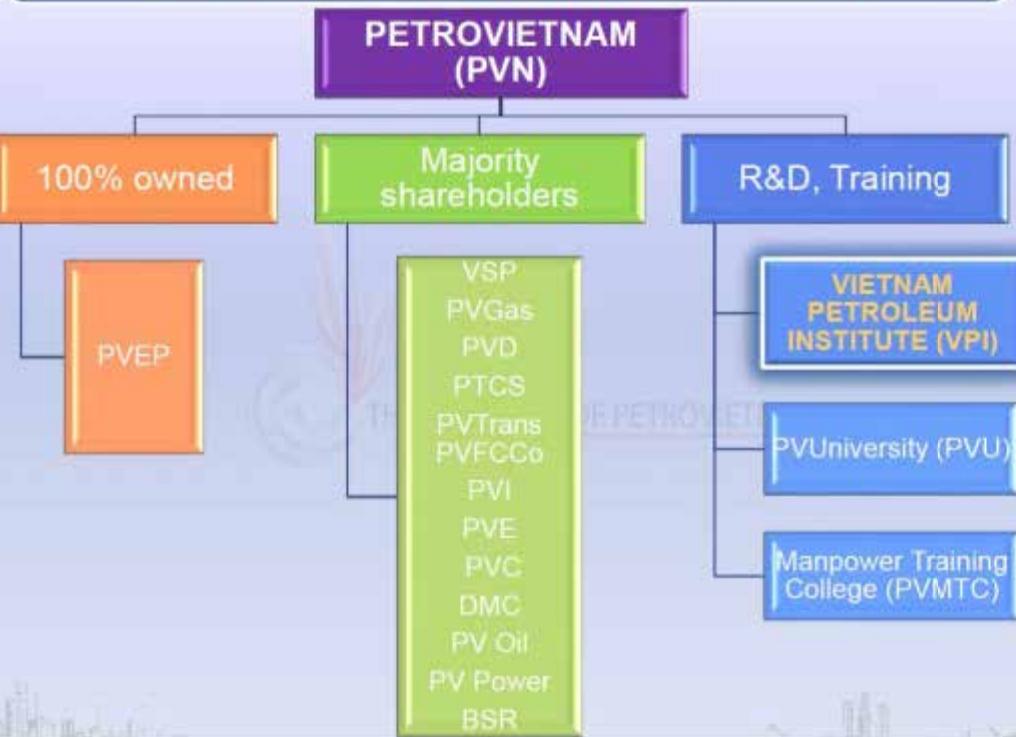


Marine Geosciences Initiative with China (2016-21)



Industry Examples: Petronas, PTTEP, PetroVietnam

PETROVIETNAM SUBSIDIARIES



VPI - FUNCTIONS

RESEARCH

- Conduct basic and specialized surveys
- Carry out scientific and technological studies to support the whole range of oil and gas activities.

SERVICE – CONSULTANCY – TECHNOLOGY APPLICATION AND TRANSFER:

- Provide consultancy and appraisal services for oil & gas related projects;
- Sample analysis for upstream, downstream and HSE activities;
- Produce and trade products and transfer technology and know-how

TRAINING - INFORMATION - DATA ARCHIVE:

- Provide doctoral and advanced professional training;
- Archive and manage all data and documents of petroleum activities;
- Compile and publish the Petrovietnam Journal;
- Organize conference and exhibition

Laying the Groundwork for Marine Geosciences in Myanmar (2017)



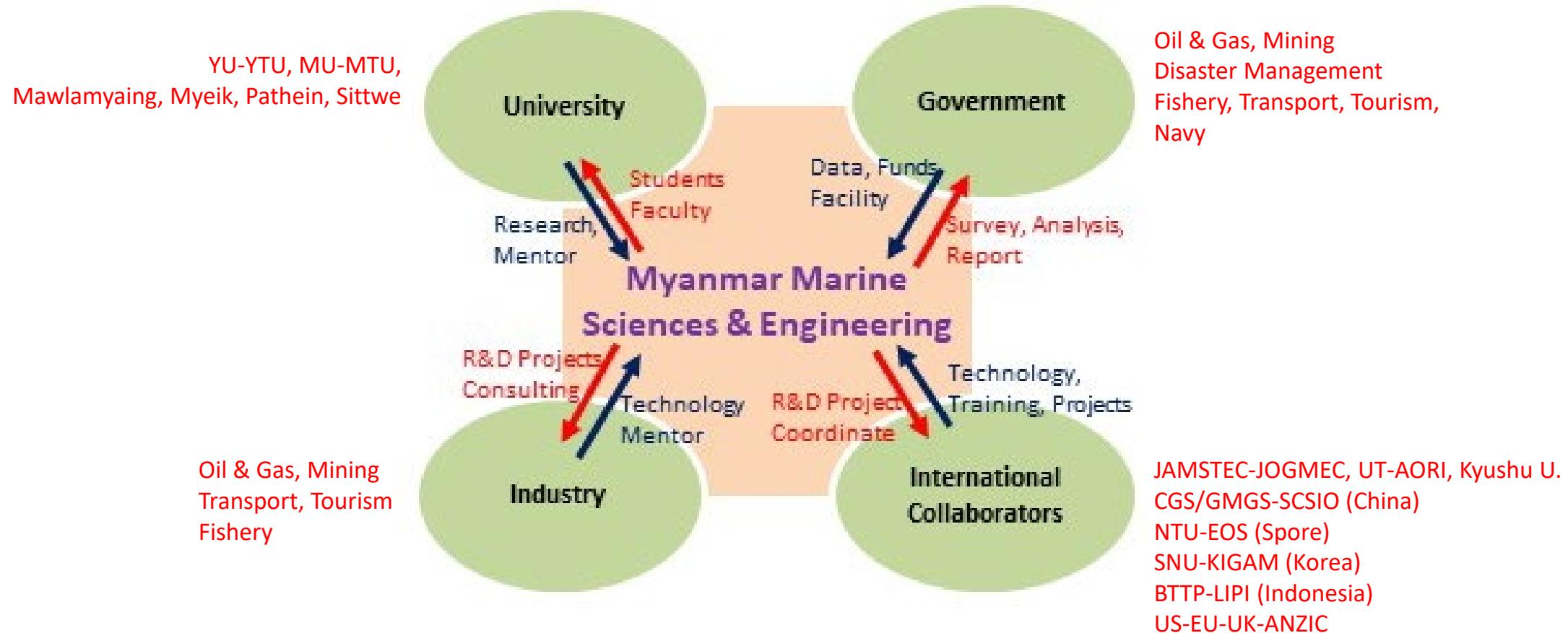
UK-Germany-France
US
Japan
China-India-Korea-Indonesia

Better Coordination and Capacity Development of Marine Research Projects in Myanmar (2019)

- MAESA 2017 action items status
- Lessons Learnt for better coordination
- Broader Marine Sciences Education & Research
- Planning for Future Collaboration



Government-University-Industry Partnership



Sustainable Development Roadmap for Long Lasting Prosperity

တစ်နှစ်တပိုင်ကြီးစားလဲခဲ့တဲ့ နှစ် jo!!

Myanmar's Marine Frontier

Blue Economy (Fishery, Transport)

Energy & Minerals (O&G, Mining)

Disasters (Tsunami, Flood, Cyclone)

Environment (Coast, Coral, Plastic)

Actions in Need

Exploration
Value-added Products

Survey-Monitor
Mitigate

Solutions

Human Resources

Technology-Facility

Funding

Actions & Outcomes

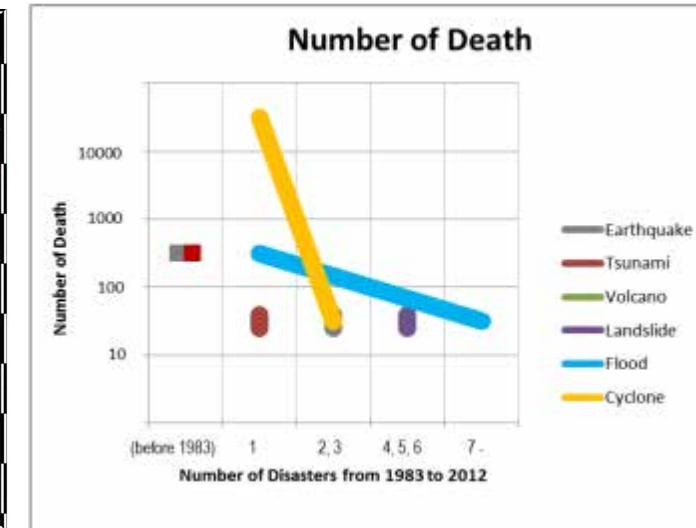
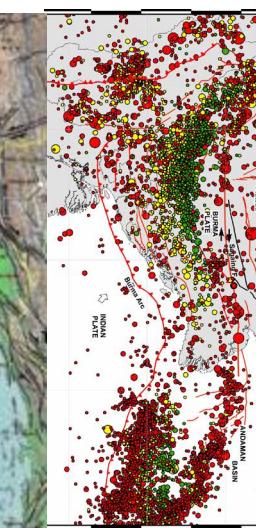
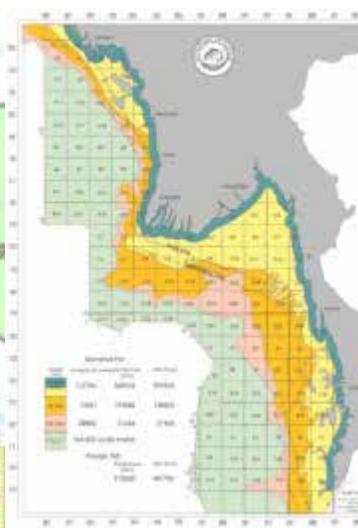
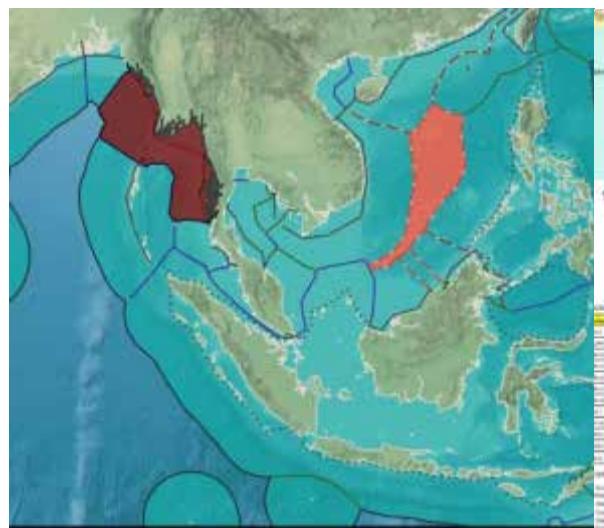
Capacity Building

Labs/ Maps/ Research

Offshore Exploration

\$ 5 mil

\$ 1 bil

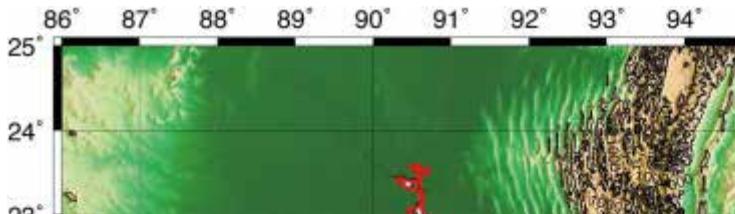


Planning for Future (Federal Union)

Mega-Projects in Planning

❖ Seafloor geoscientific mapping

under **Seabed2030**

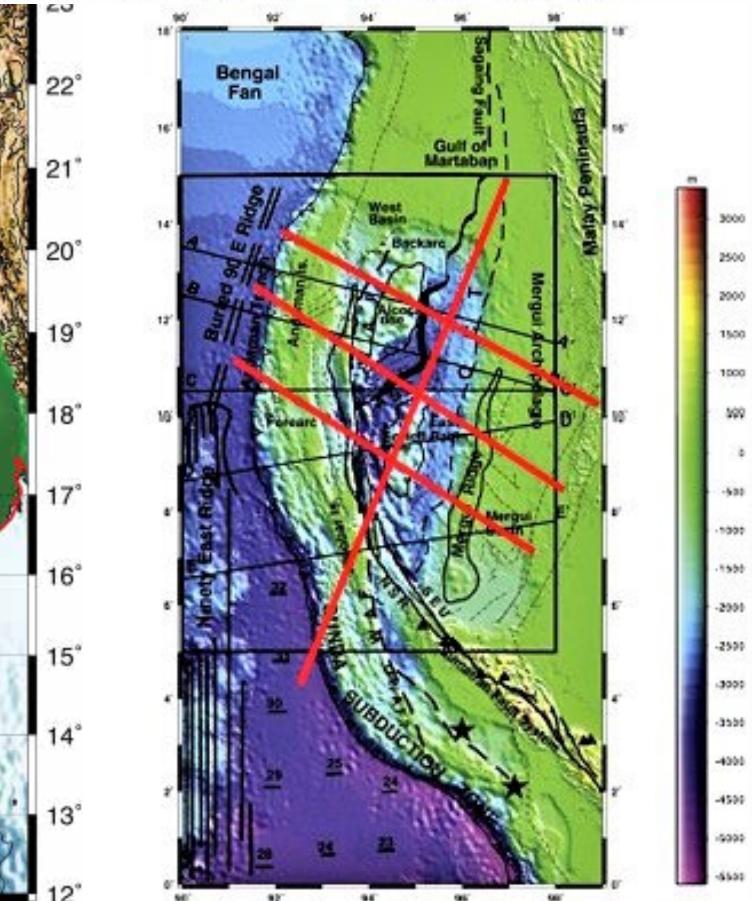
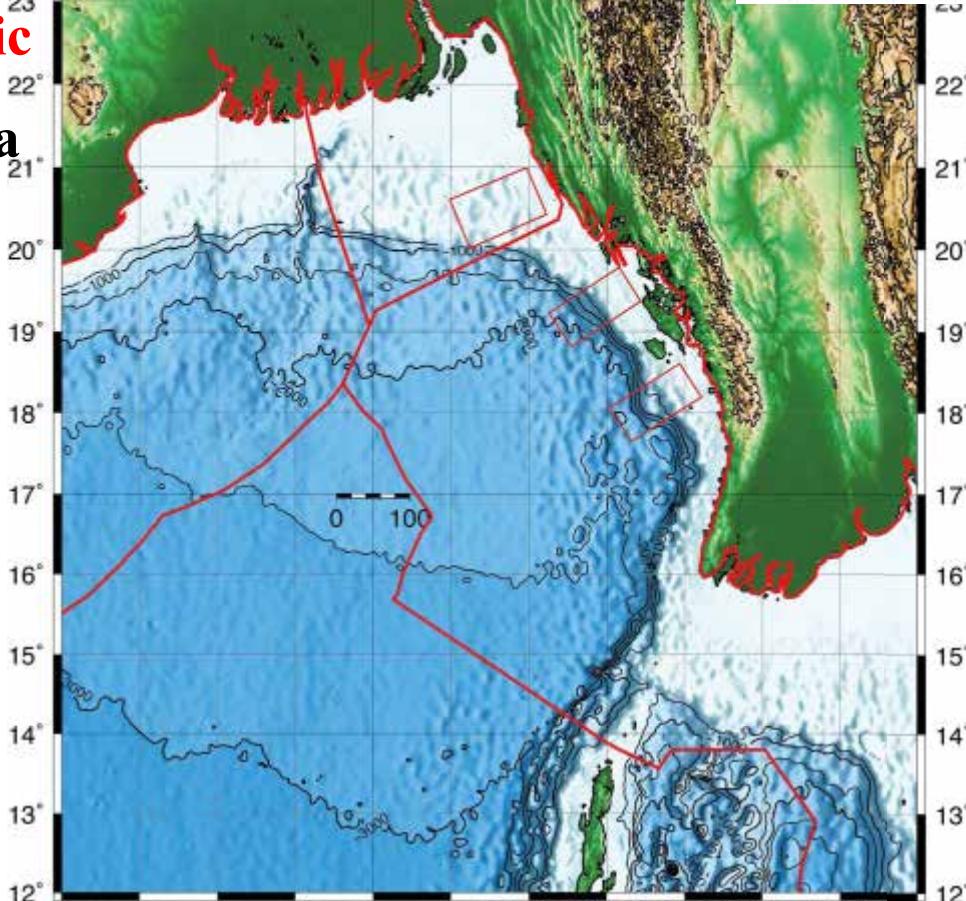


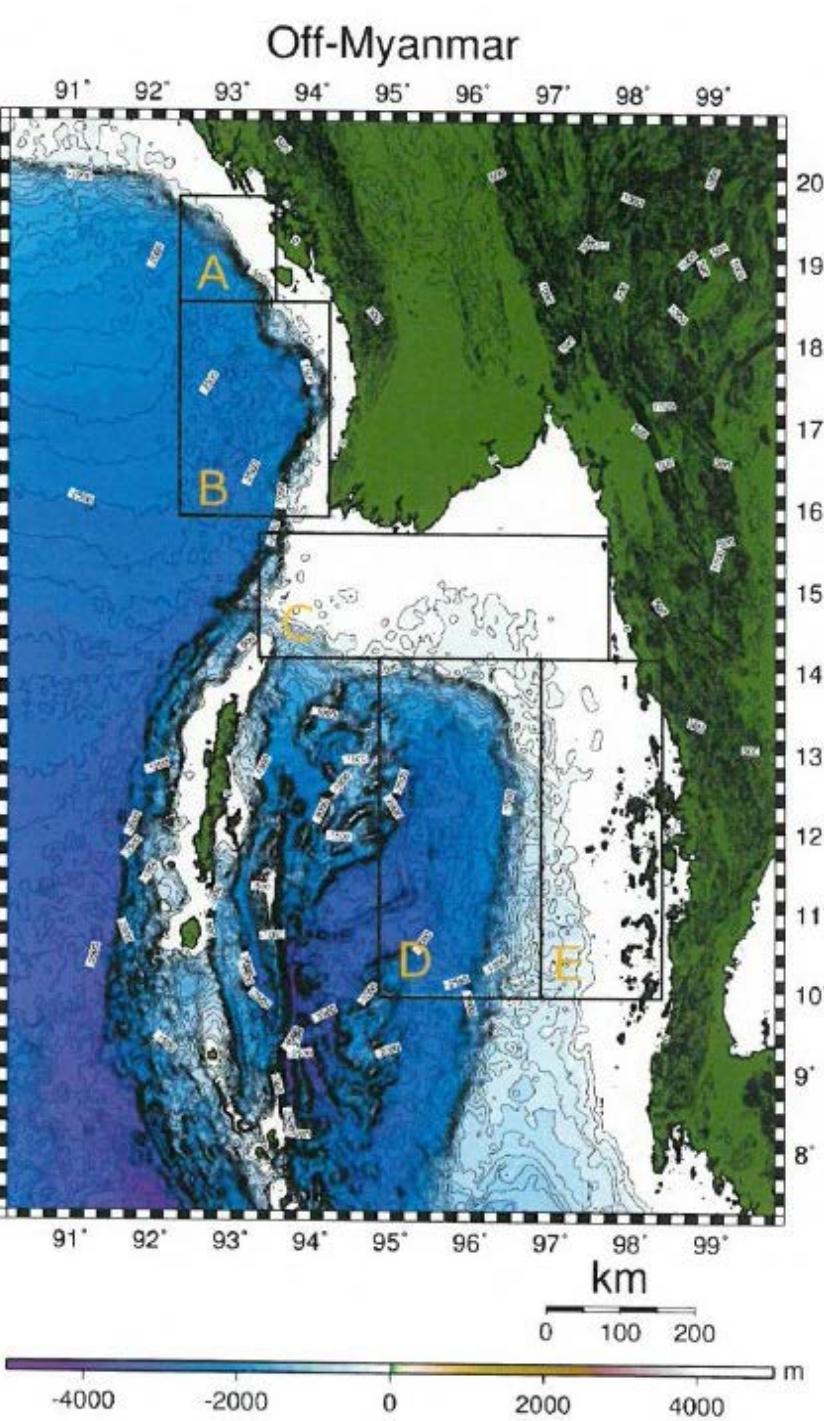
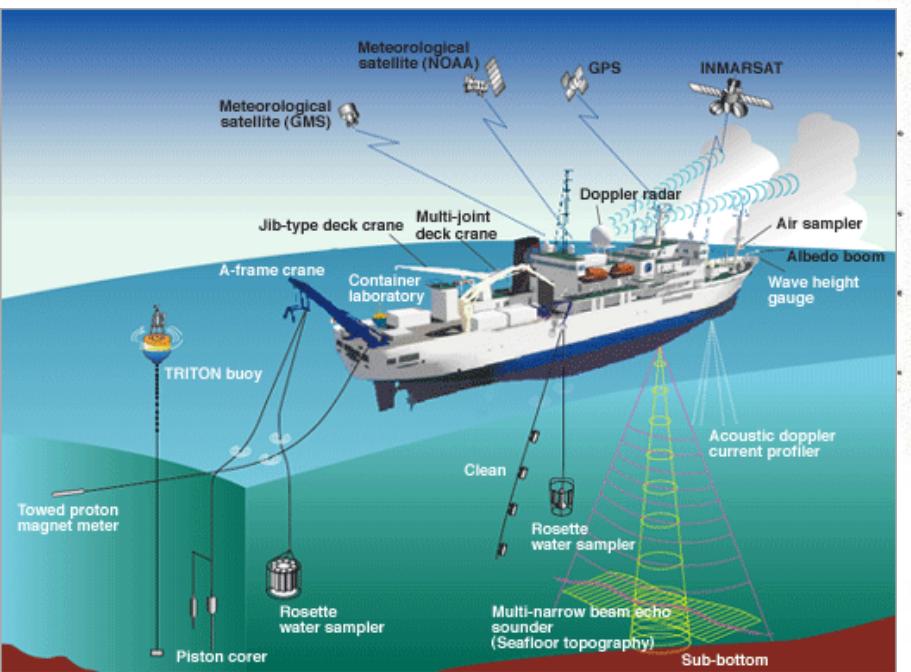
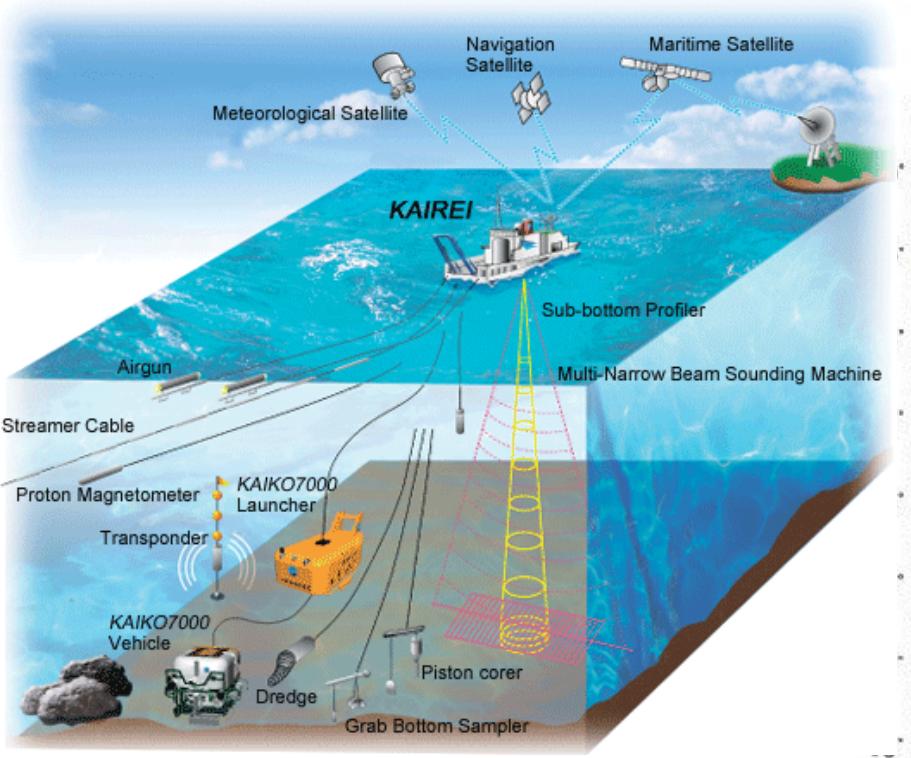
❖ Structure, tectonic and catastrophic

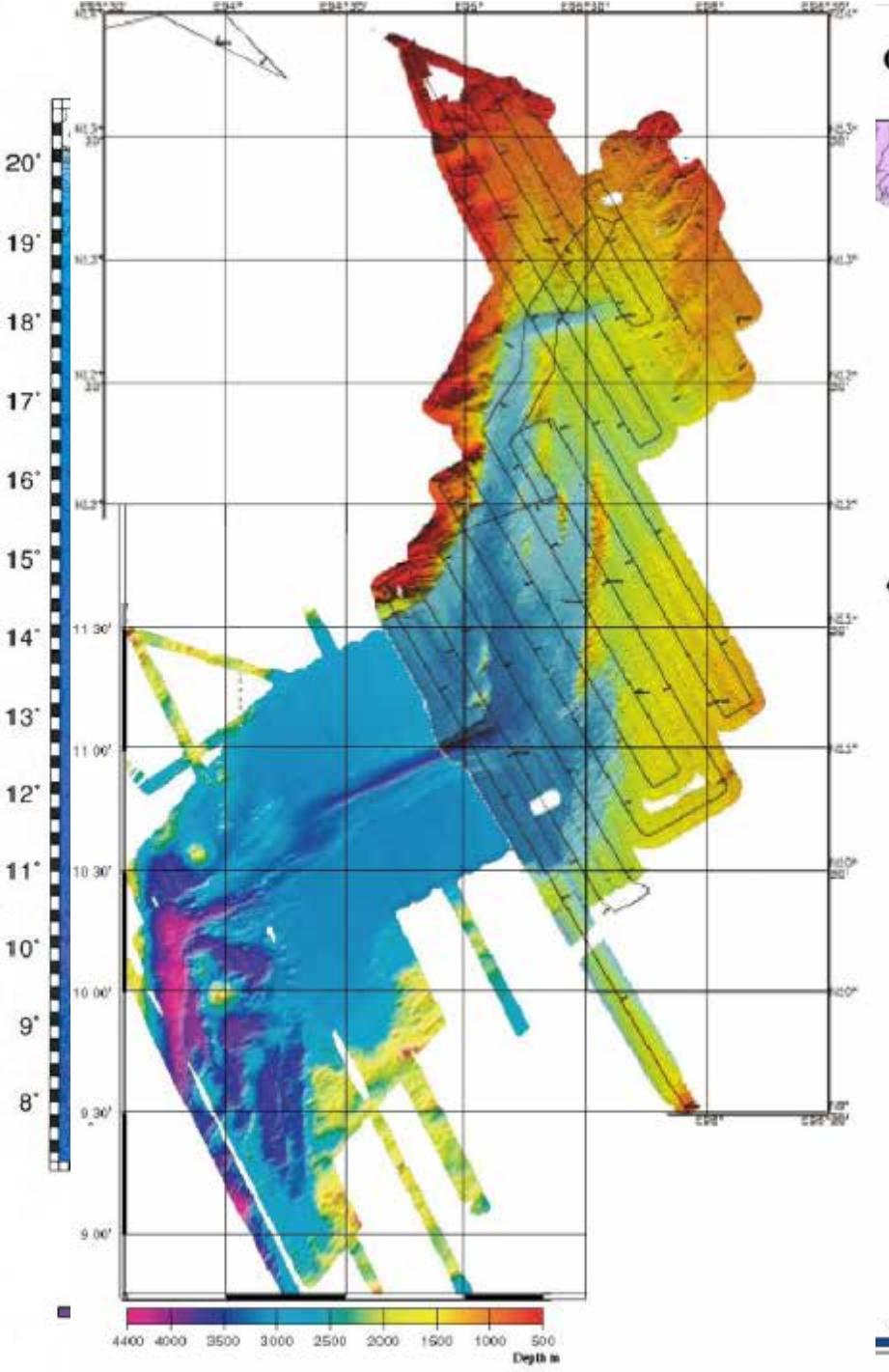
potential of Andaman Basin (China

Geological Survey), and Offshore

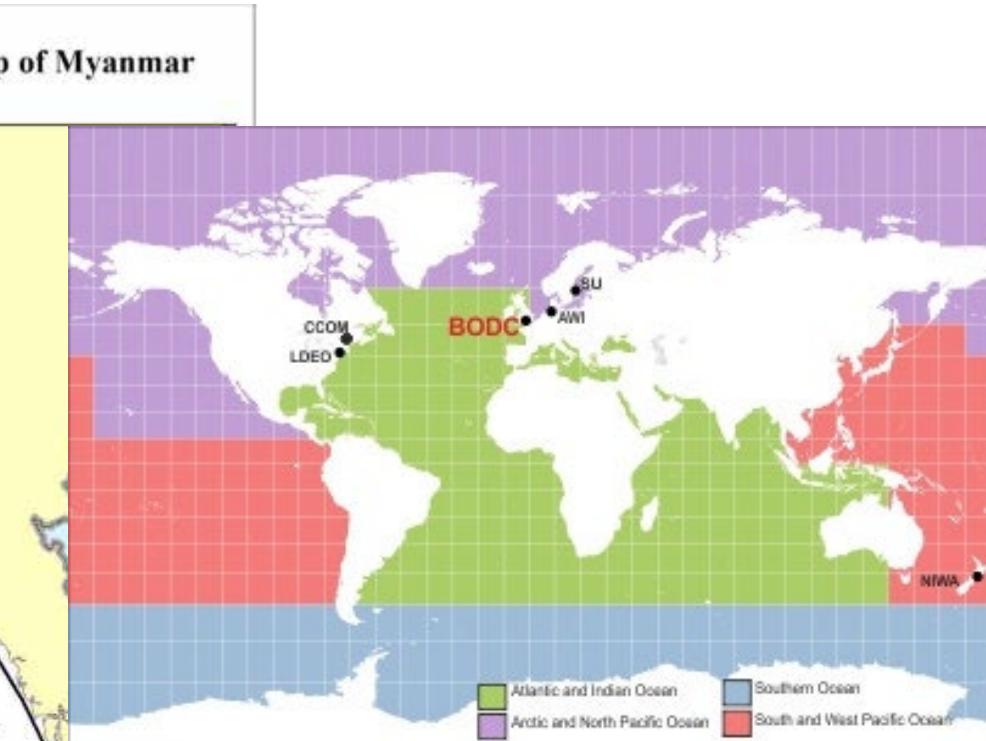
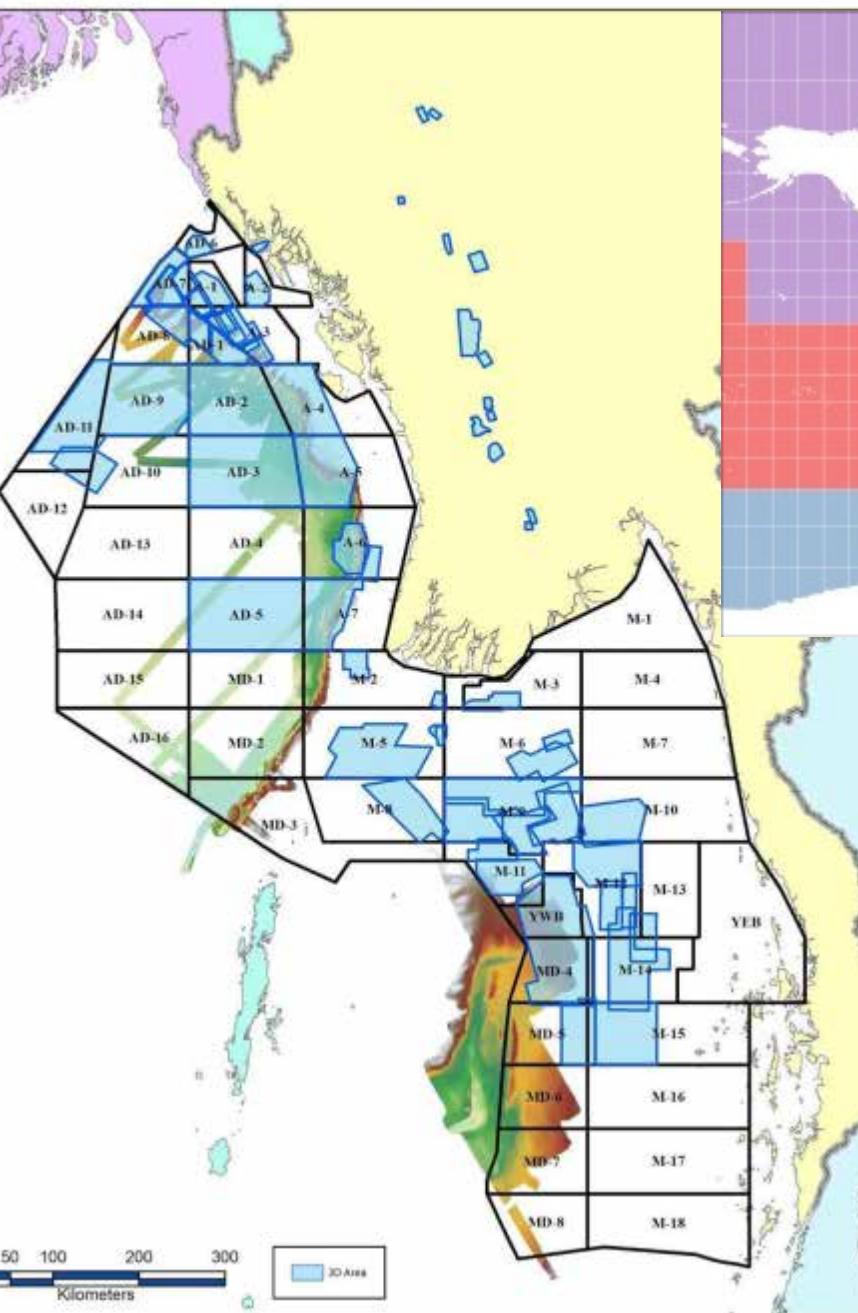
Rakhine (NSF, US)







Offshore & Onshore 3D Seismic Footprint Map of Myanmar



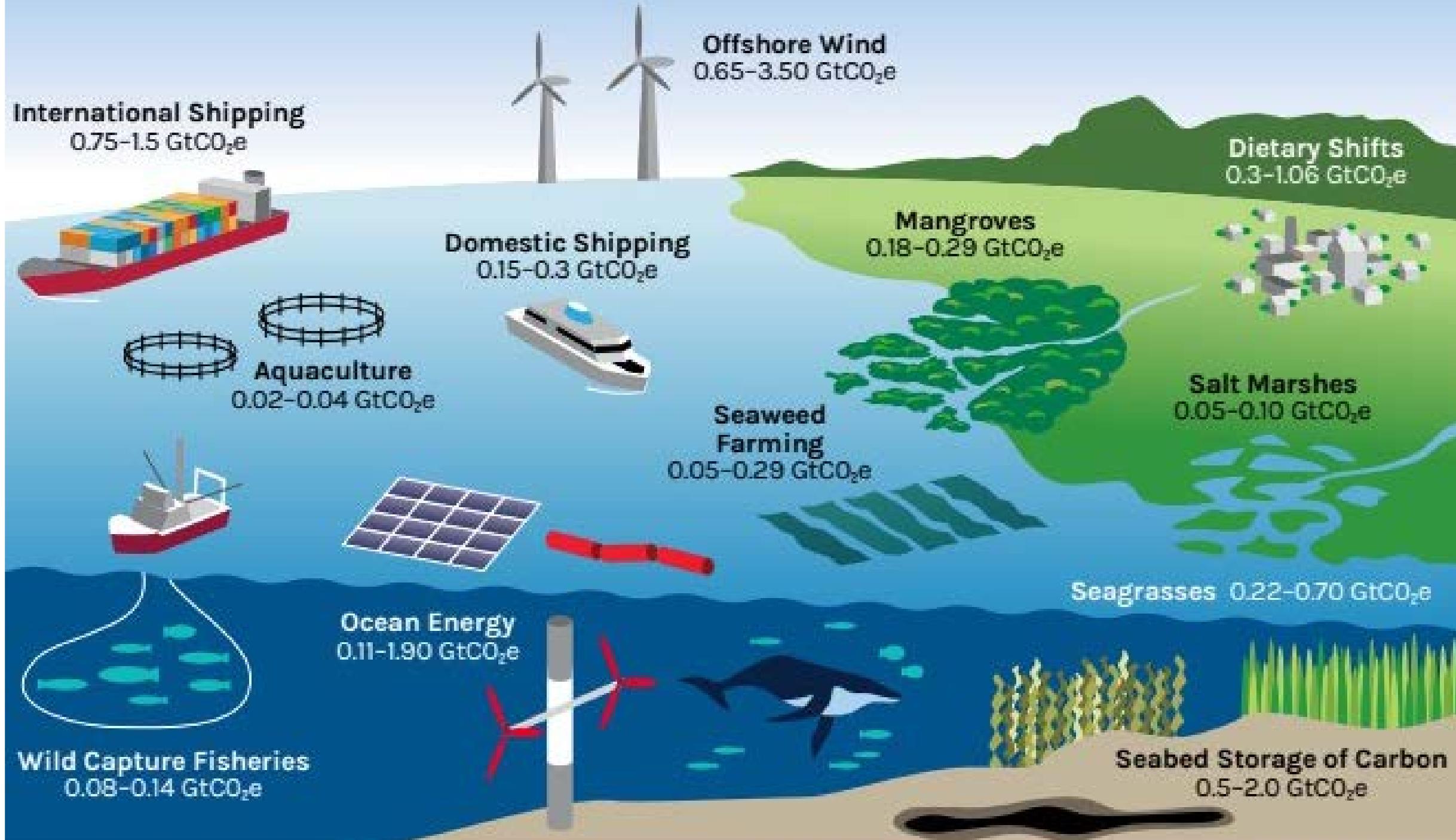
THE NIPPON FOUNDATION-GEBCO
SEABED 2030

SUSTAINABLE DEVELOPMENT GOALS



Renewable Energy: Challenges & Opportunities





What's driving this change?

PROS AND CONS of wind energy

PROS

Renewable & clean source of energy



CONS

Intermittent



Low operating costs



Efficient use of land space



Noise and visual pollution



Some adverse environmental impact



Total Energy Generation Potential

Per year, daily megawatt hours (MWh)



rising production and innovation in renewables increases their efficiency, cost of production falls.



Solar Photovoltaic



Gas Peaker Plants



Solar Thermal Tower



Onshore Wind



Nuclear



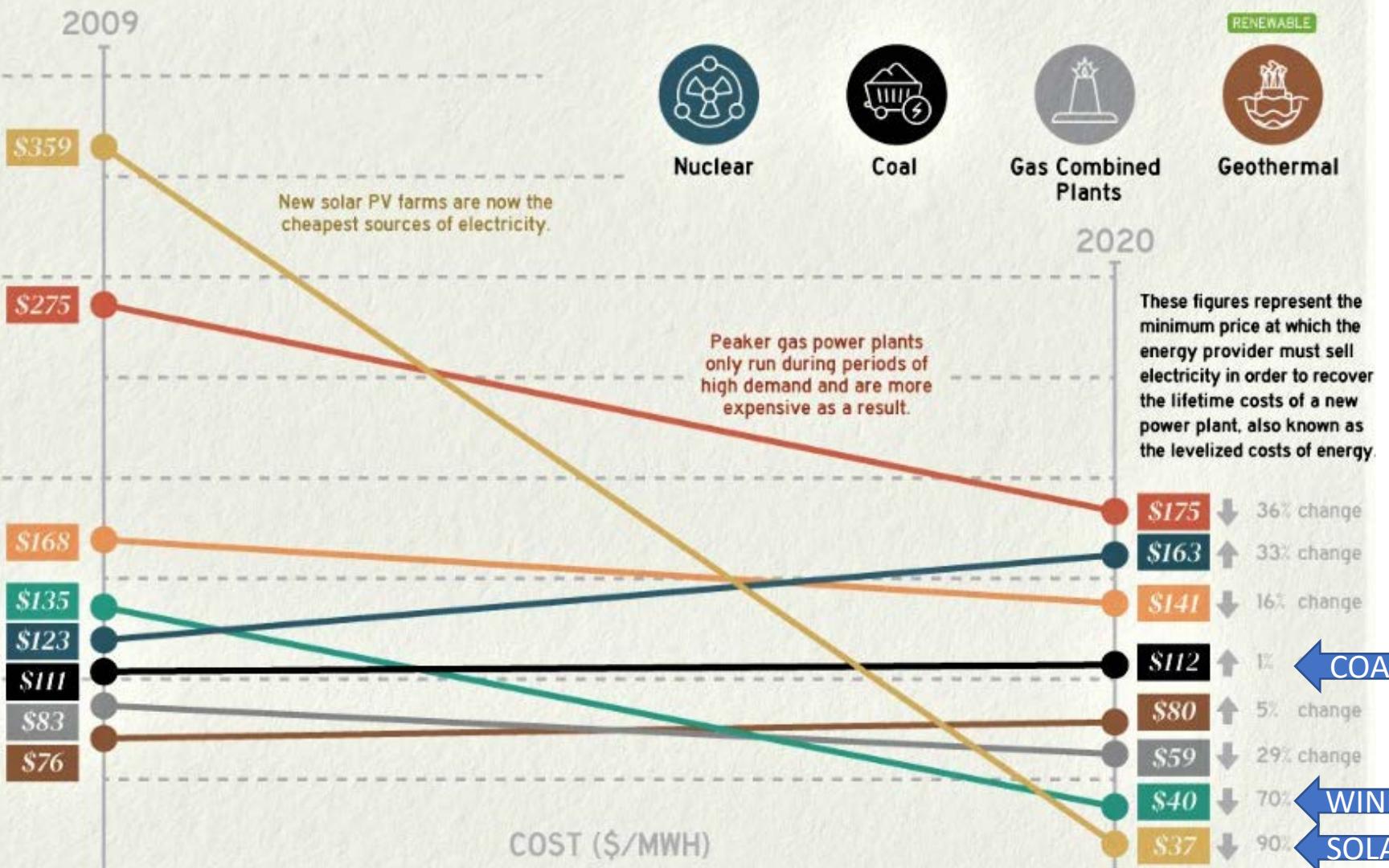
Coal



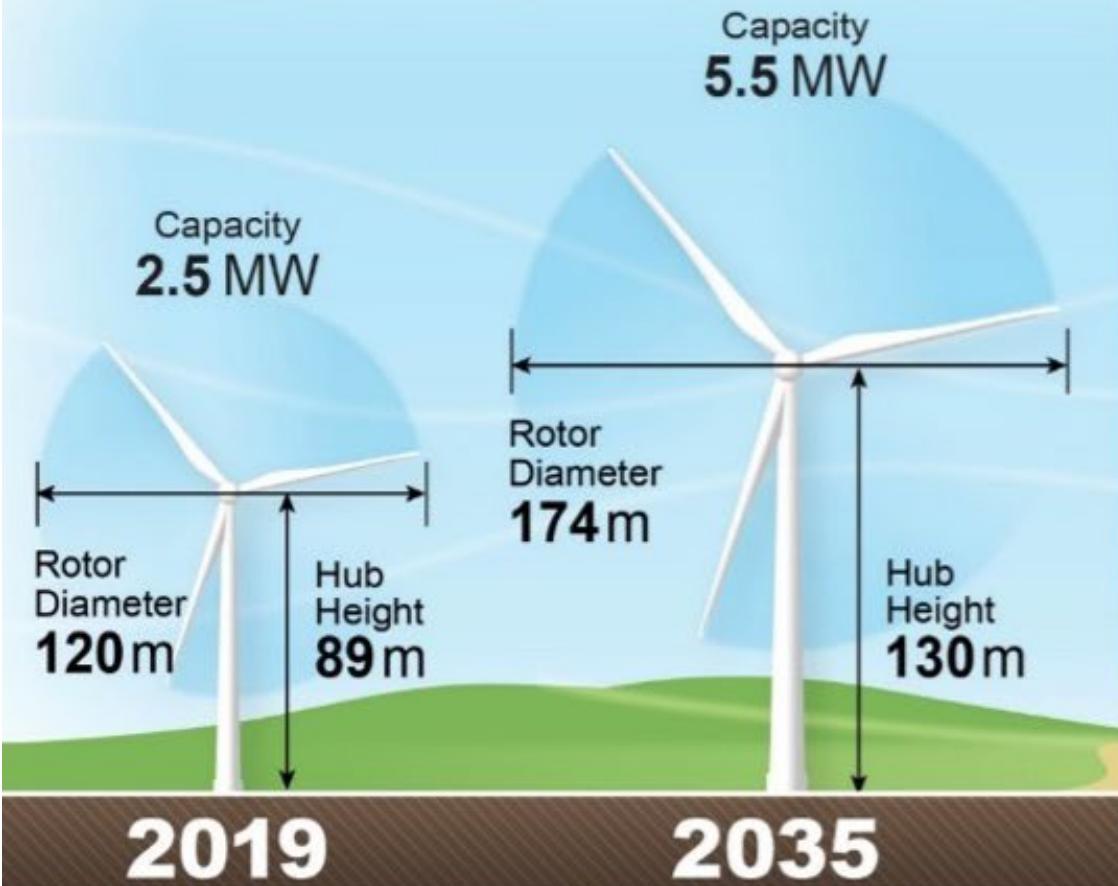
Gas Combined Plants



Geothermal



Onshore Wind Turbines



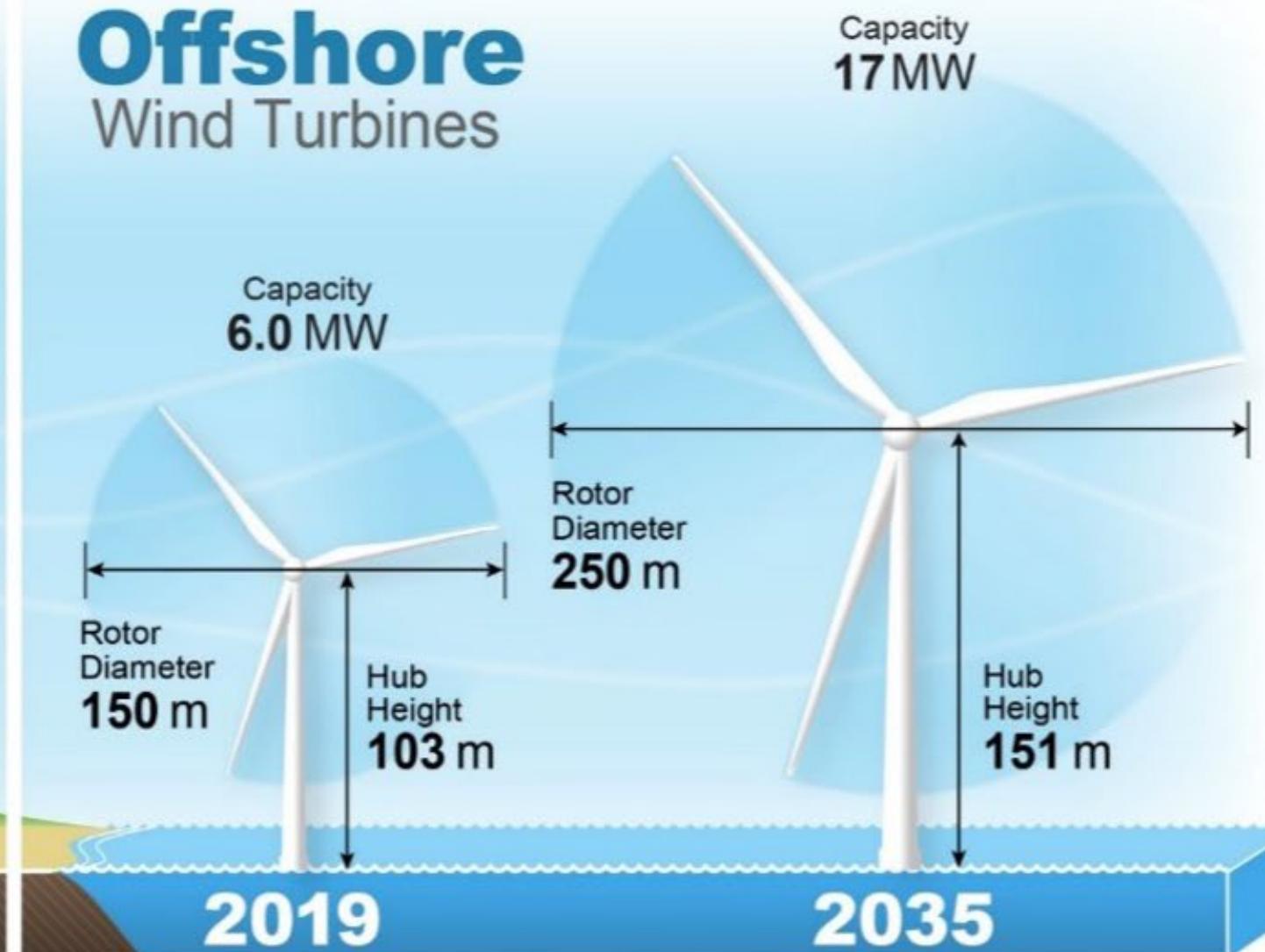
2019

Specific Power
221 W/m²

2035

Specific Power
231 W/m²

Offshore Wind Turbines



2019

Specific Power
340 W/m²

2035

Specific Power
346 W/m²

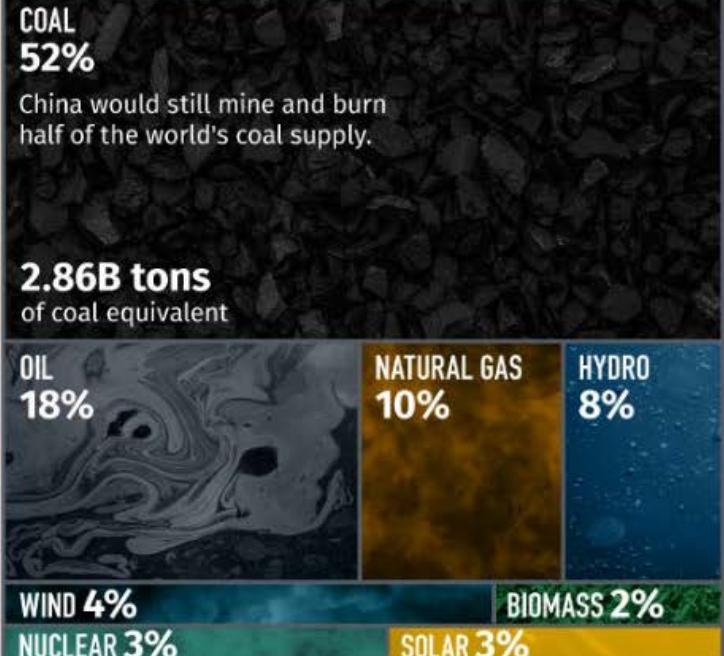


VISUALIZING
CHINA'S ENERGY TRANSITION
IN 5 CHARTS

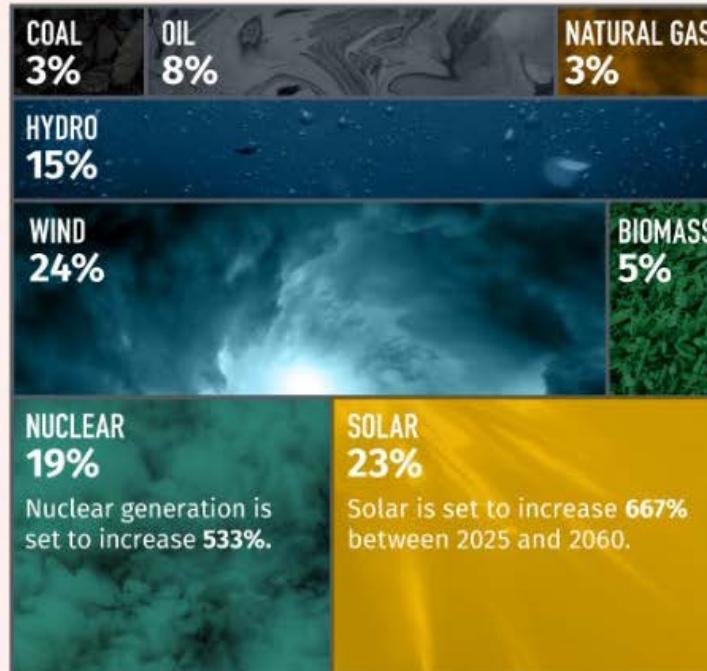
CHINA HAS AN AMBITIOUS PLAN TO COMPLETELY CHANGE ITS ENERGY MIX AND REDUCE ITS CARBON EMISSIONS.

CHINA'S EVOLVING ENERGY MIX

2025



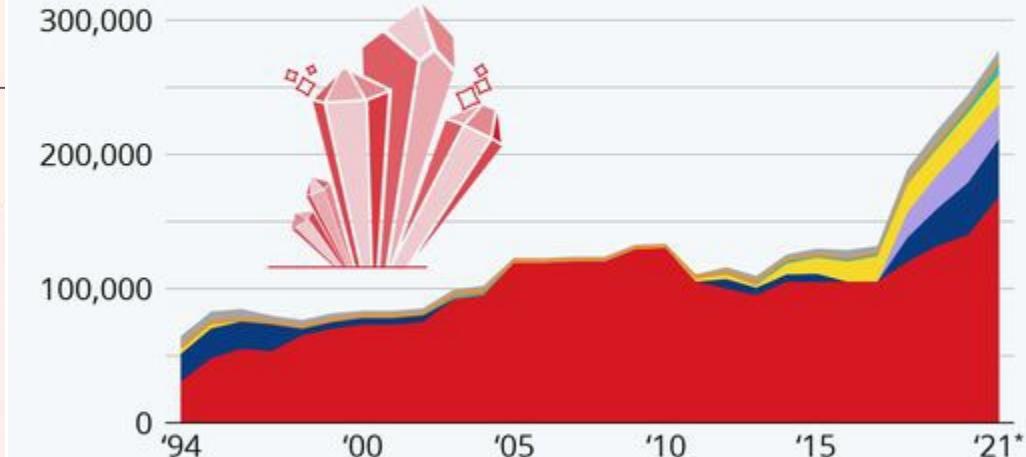
2060



China's Rare Earth Monopoly is Diminishing

Global mine production of rare earths (in tons)

■ China ■ United States ■ Myanmar ■ Australia
■ Thailand ■ India ■ Others



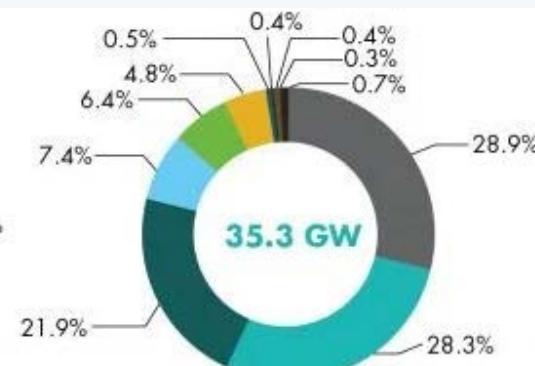
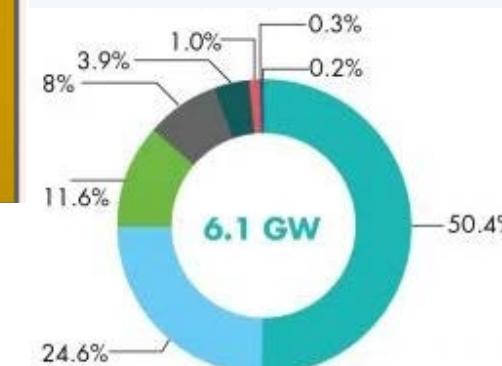
Documented production only, some estimations

* estimated

Source: United States Geological Survey



statista



SOLAR + WIND



2018
1 TW
global generation capacity

2023
2 TW
global generation capacity
This second TW will cost 45% less than the first.

Metals Needed:



Silver Copper REEs

EVS



2017
3.1 million EVs

2030
125 million EVs
Ownership of EVs will increase by 40x in the next 13 years.

Metals Needed:



Lithium Graphite Copper Nickel
Cobalt REEs Manganese

ENERGY STORAGE



2017
\$194 billion
global market

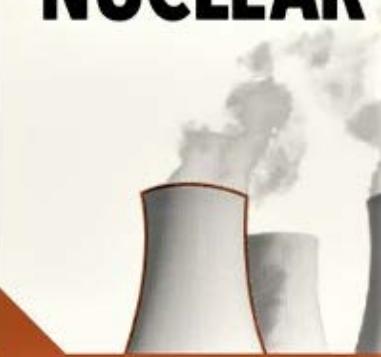
2024
\$296 billion
global market

Metals Needed:



Lithium Graphite Copper Nickel
Cobalt Vanadium Zinc Manganese

NUCLEAR



150 reactors with a total gross capacity of ~160,000 MW are planned

An additional **300 reactors** are proposed for the future, mostly in Asia.

Metals Needed:



Uranium



LITHIUM

Used in EV batteries



COPPER

The electrification of everything



URANIUM

Nuclear is a necessary component of green movement



TIN

The "glue" of metals, used to bind things together



GOLD

Increasing scarcity, and the rarity of large deposits



ZINC

Used in autos, electronics, and infrastructure



REES

Used in EVs, and in green power applications



Demand will need to increase 12x by 2050 to reach emissions targets set by the Paris Agreement



Zinc supply stocks are at their lowest point since 2008



China has a near monopoly on global supply, producing about 80% of all rare earths



Exhibit 5: Energy readiness across Southeast Asia

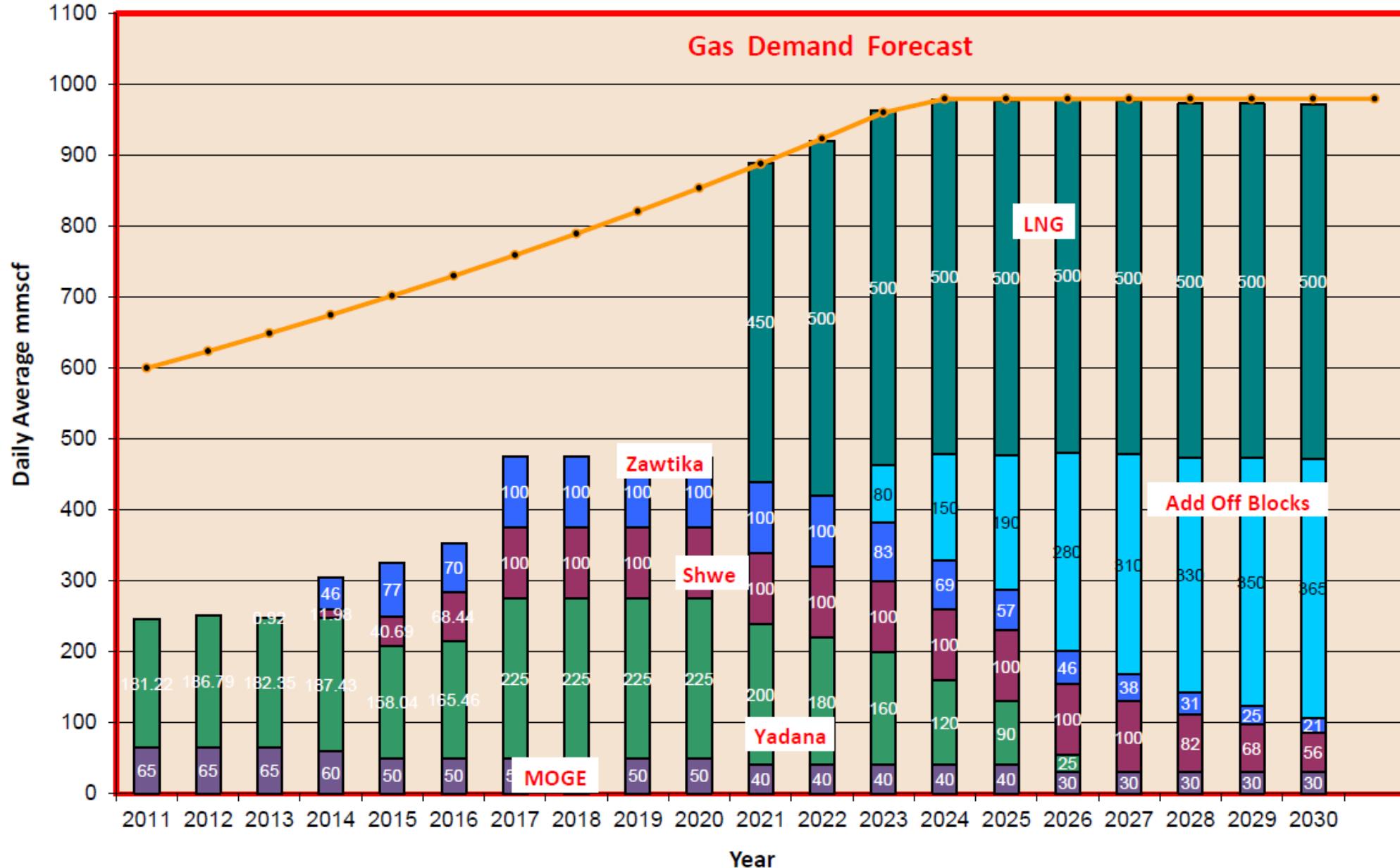
Scale:  Developing  In Progress  Established  Mature

Energy accessibility Energy reliability Energy affordability Energy sustainability Energy smartness Energy trading



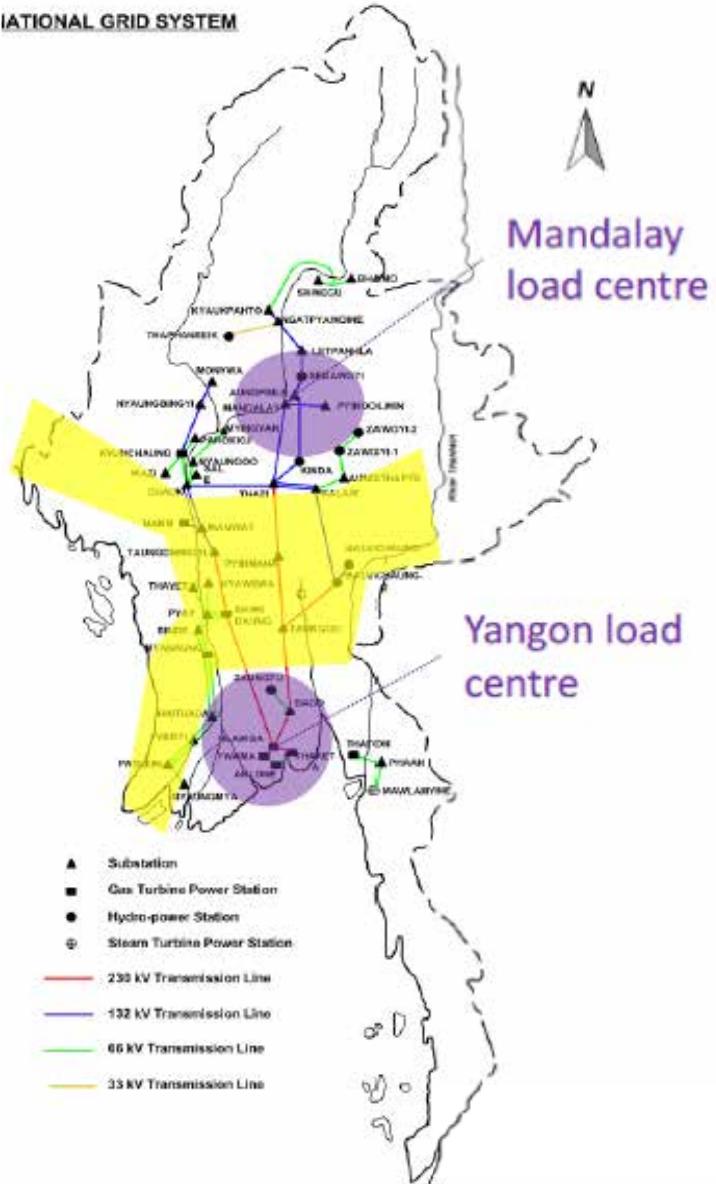
Brunei							
Cambodia							
Indonesia							
Lao PDR							
Malaysia							
Myanmar							
Philippines							
Singapore							
Thailand							
Vietnam							

GAS DEMAND AND SUPPLY FORECAST IN MYANMAR

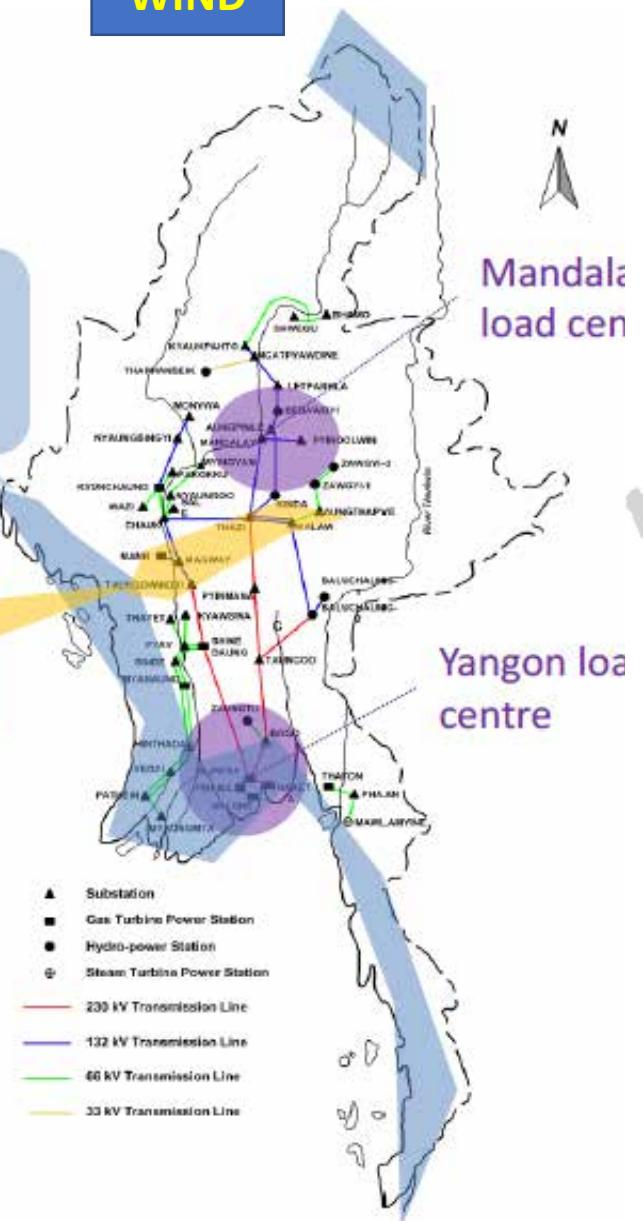


Potential Areas for Renewable Energy

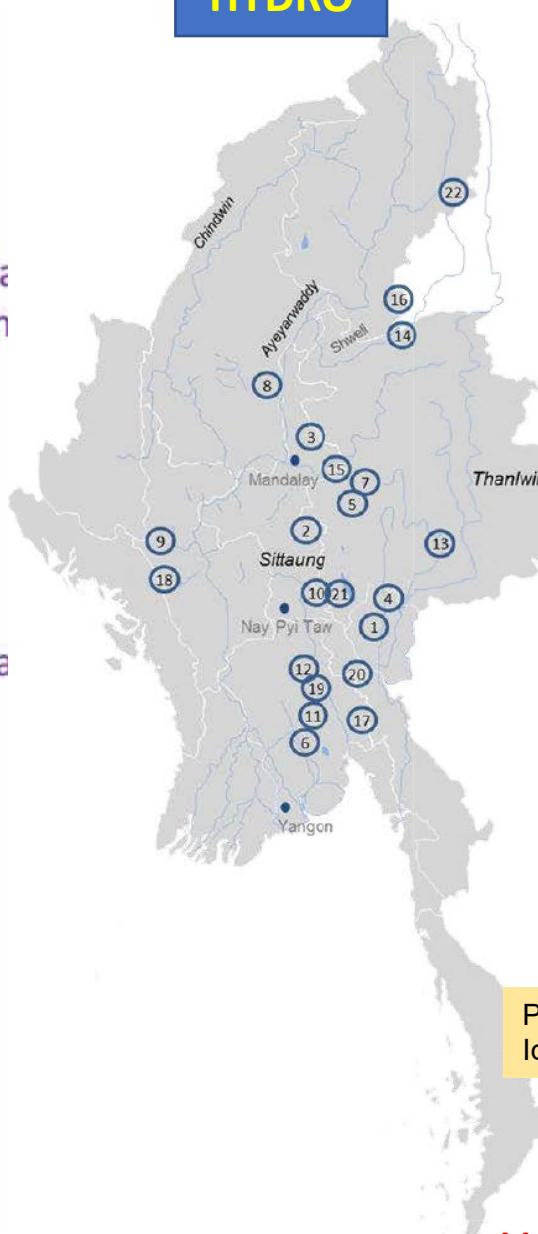
SOLAR



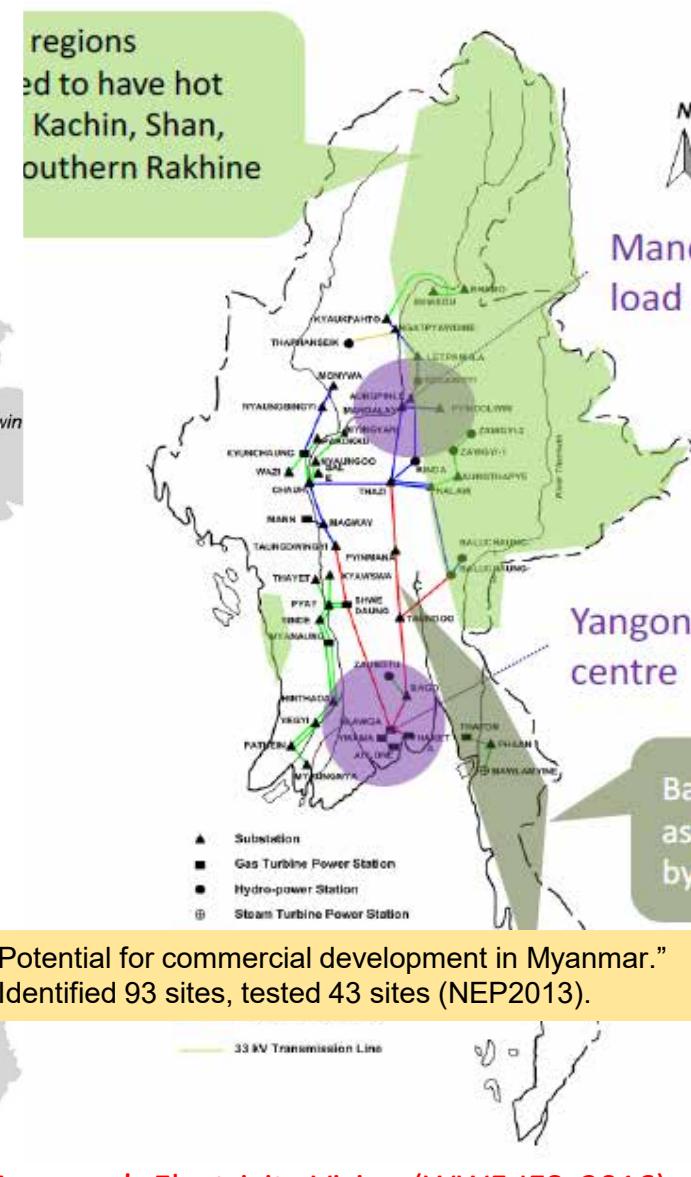
WIND



HYDRO



GEOTHERMAL



1Site selection
and feasibility**2**Scoping and
consultation**3**Planning
application and
consenting**4**

Construction

5Operation and
maintenance

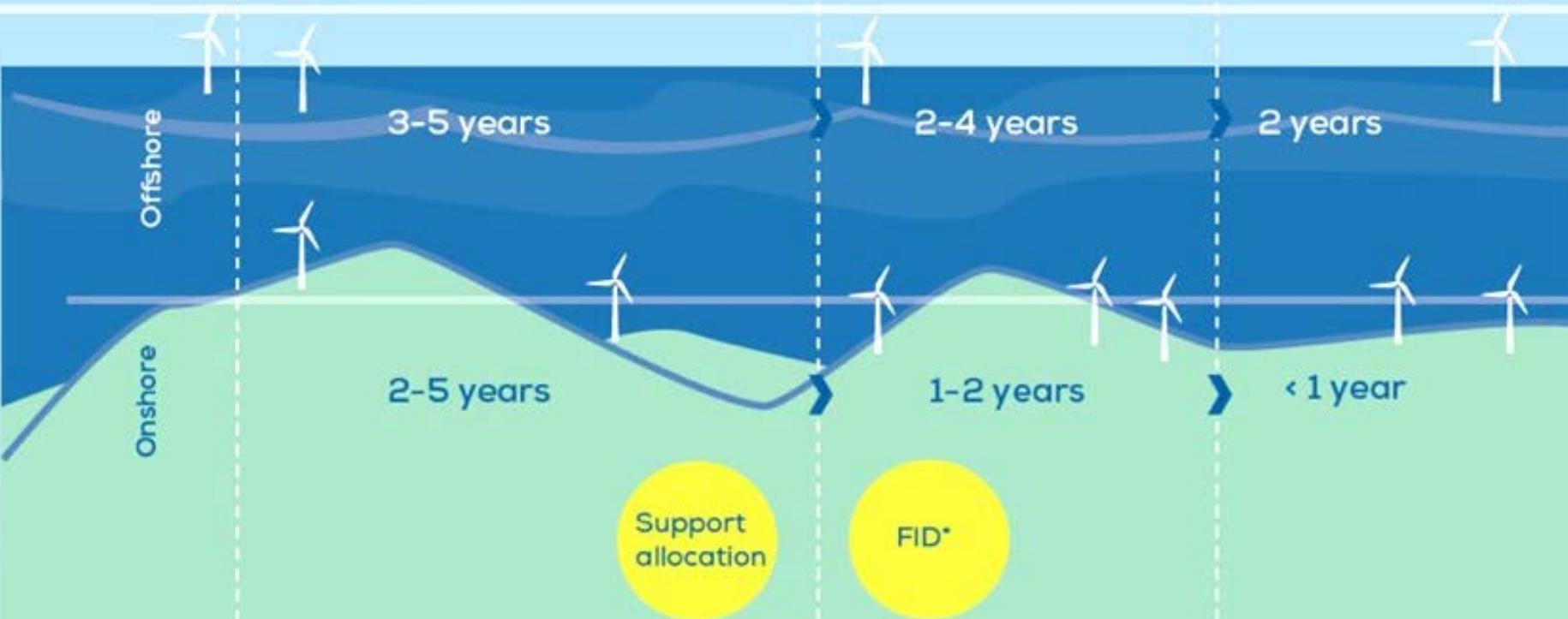
Phase

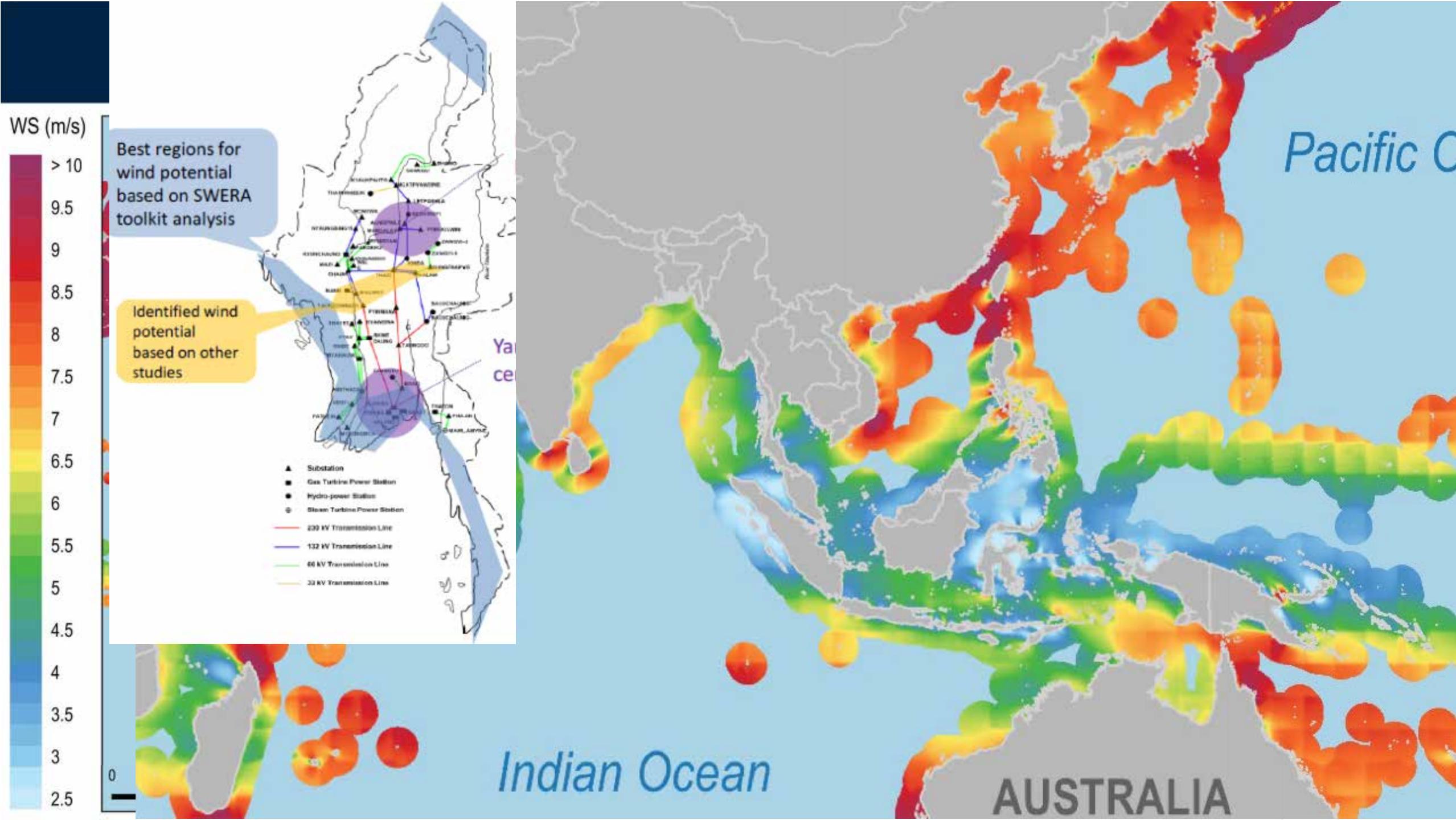
Activity

Timing

DEVELOPMENT**PRE-CONSTRUCTION**

Leasing
2 years
<ul style="list-style-type: none"> Determine wind farm locations Environmental and spatial planning Early site layout
Permitting
3 years
<ul style="list-style-type: none"> Early site surveys Grid and building permits Site layout Front-end engineering design
Detailed design and financial close
2 years
<ul style="list-style-type: none"> Detailed design Supplier selection Final decision on construction through competitive auctions or PPAs
Installation
2 years
<ul style="list-style-type: none"> Manufacture and pre-assembly of components Onshore and offshore construction Wind farm commissioning
Operations
25+ years
<ul style="list-style-type: none"> Planned maintenance and service Unplanned maintenance Logistics Asset management
Decommissioning
2 years
<ul style="list-style-type: none"> Removal of assets





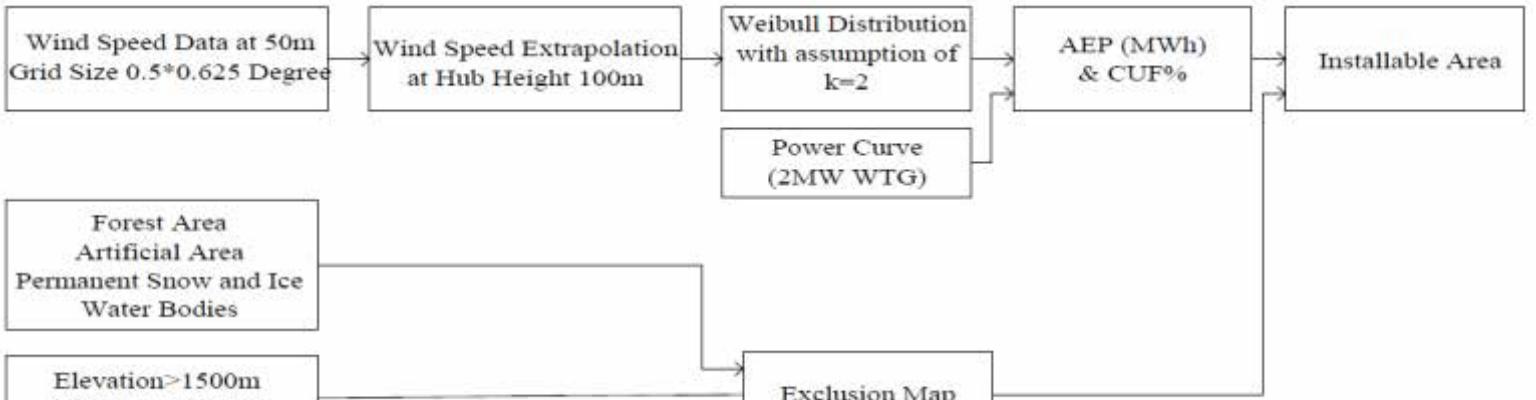
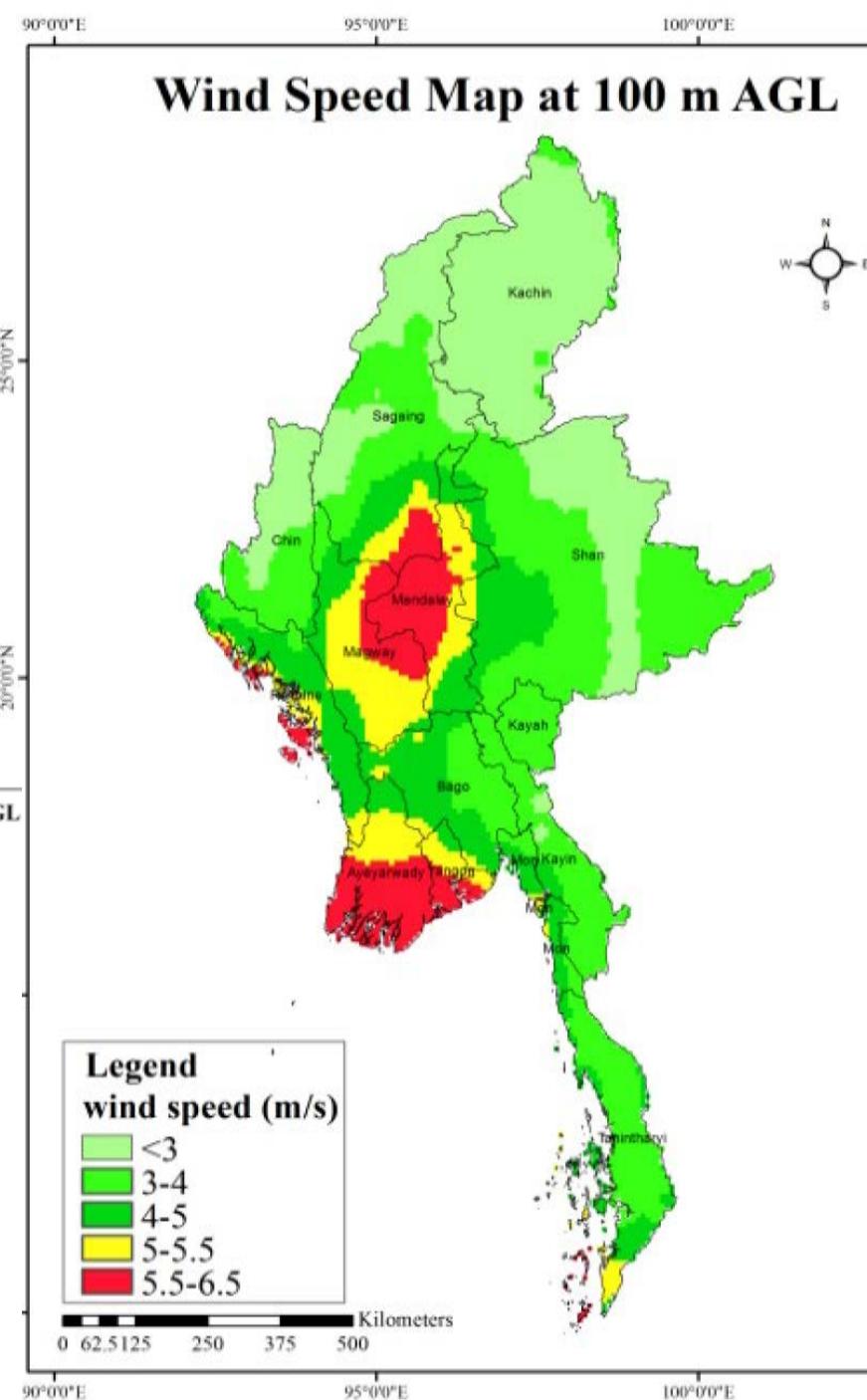
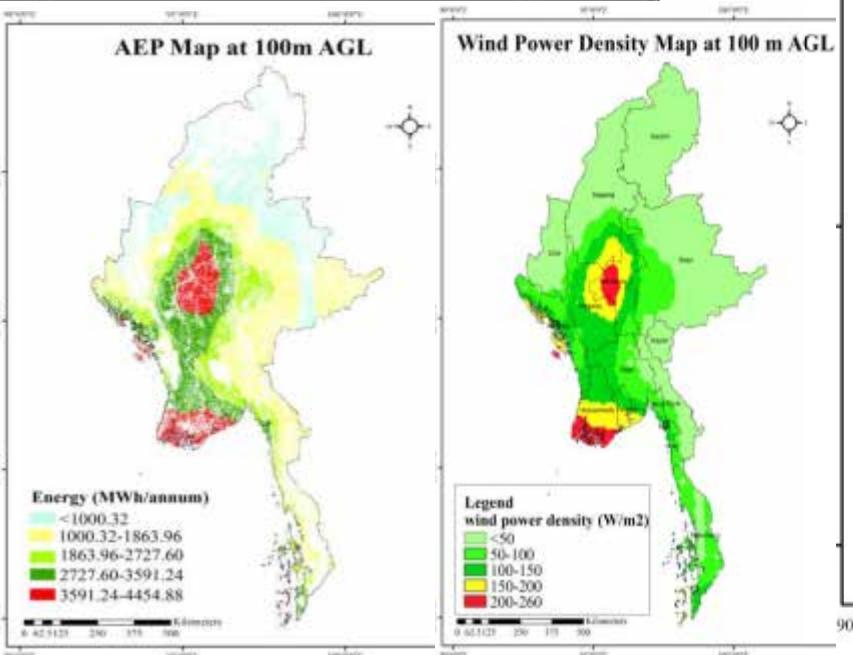


Table 1. Data Sources

No.	Data set	Source
1.	Wind Parameters	MERRA 2 (2005-2015)
2.	Land Use Land Cover Data Set	ESA Globcover 2009 (300m)
3.	Elevation and Slope information	SRTM (90 m)
4.	Road, Railway lines, Administration boundary, River details	MIMU (Myanmar Information Management Unit)
5.	Airports	Google Earth/ Online Sources
6.	Protected area	WDPA (World Database on Protected areas)

- Preliminary wind resources assessment & pre-estimation of the wind power density
- Starting point in understanding the wind resources
- Need of onsite high quality land surface measurements

(Thi Thi Soe et al., 2017)



Bangladesh

Wind Resource Map

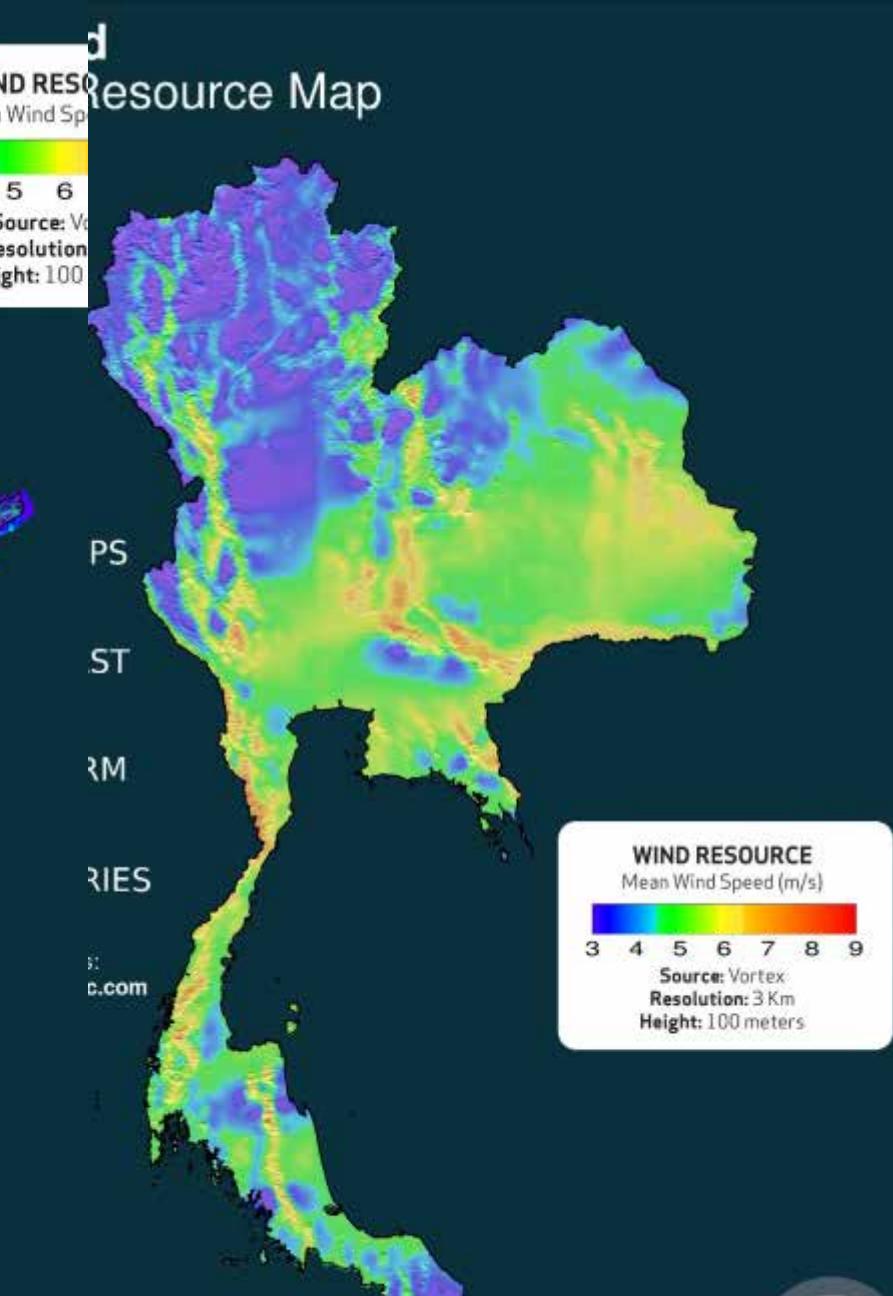
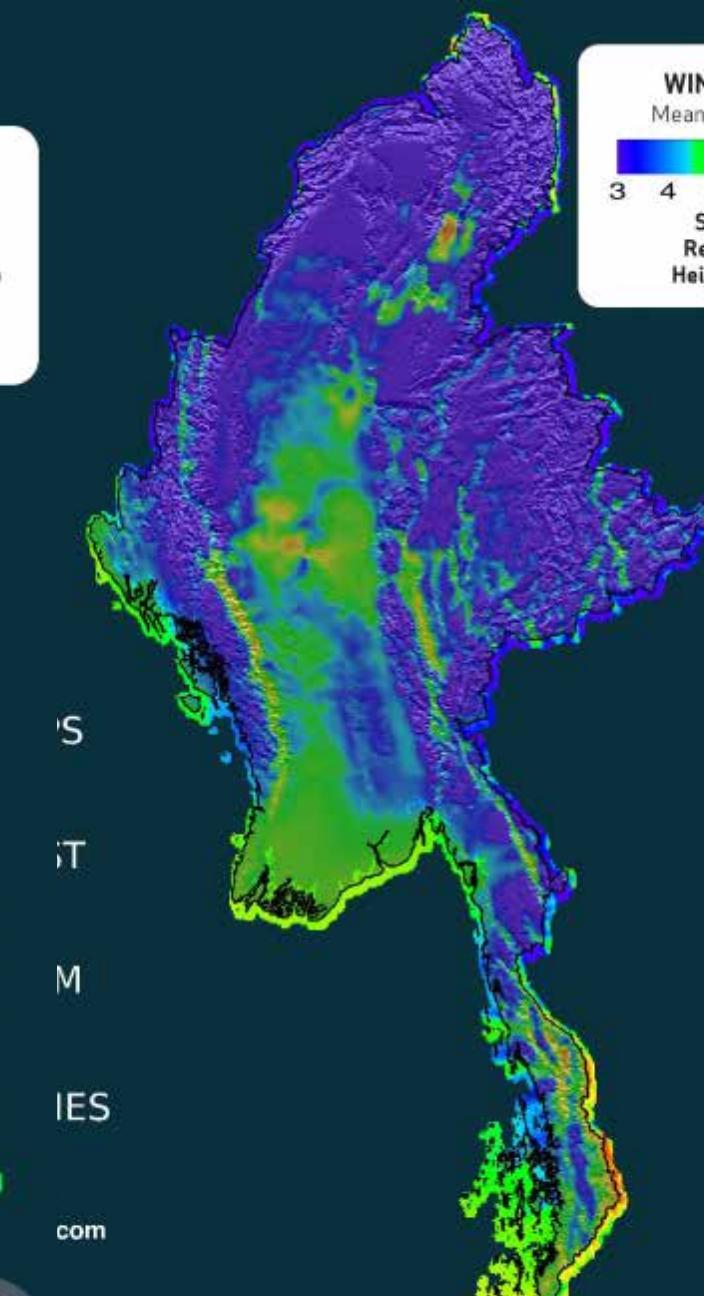
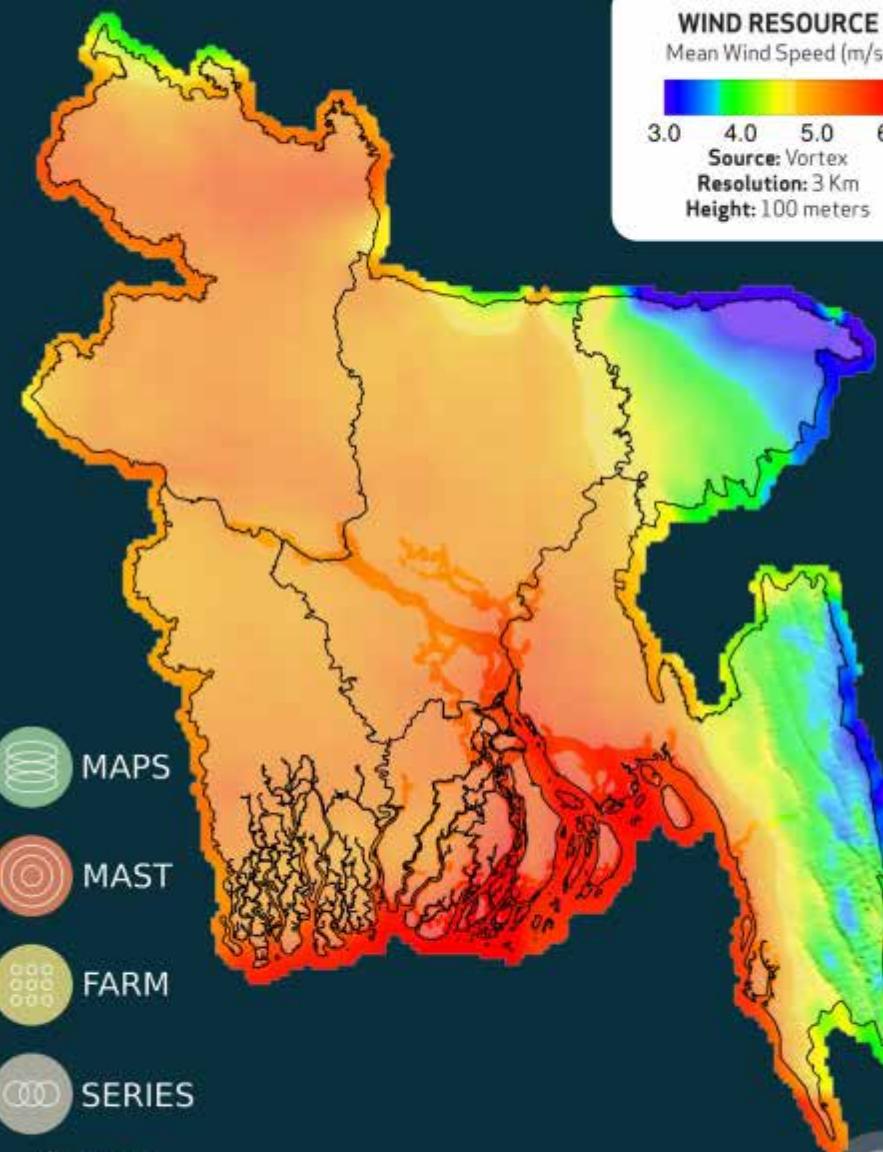
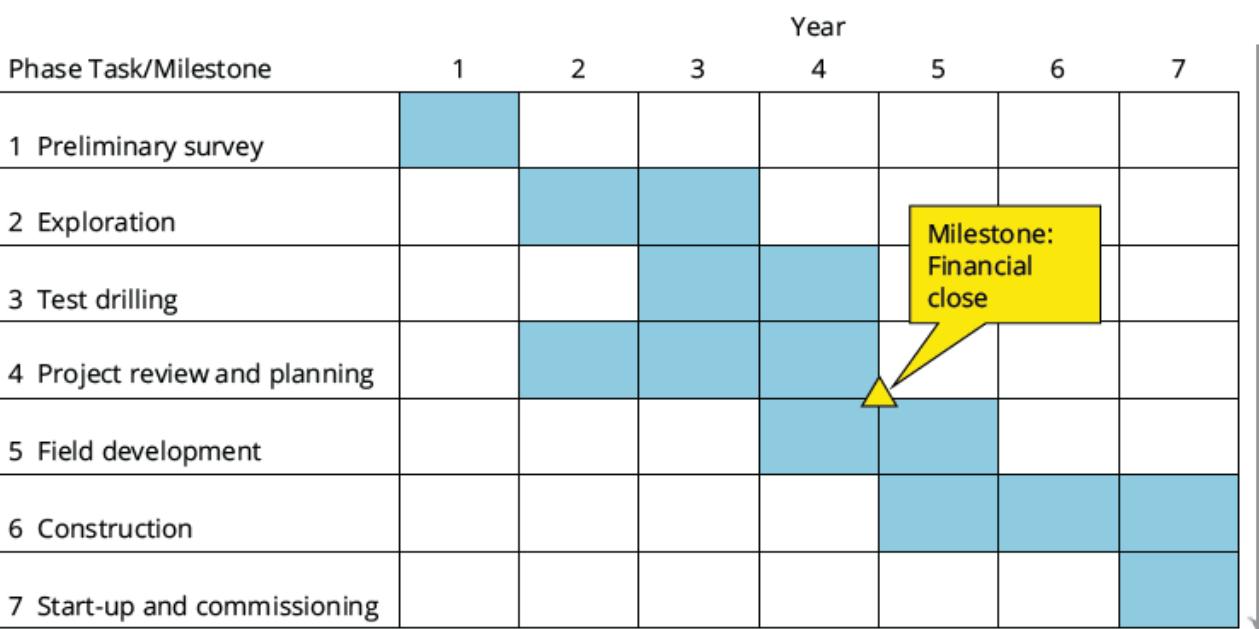


FIGURE 1.1: THE DEVELOPMENT PHASES OF A GEOTHERMAL PROJECT

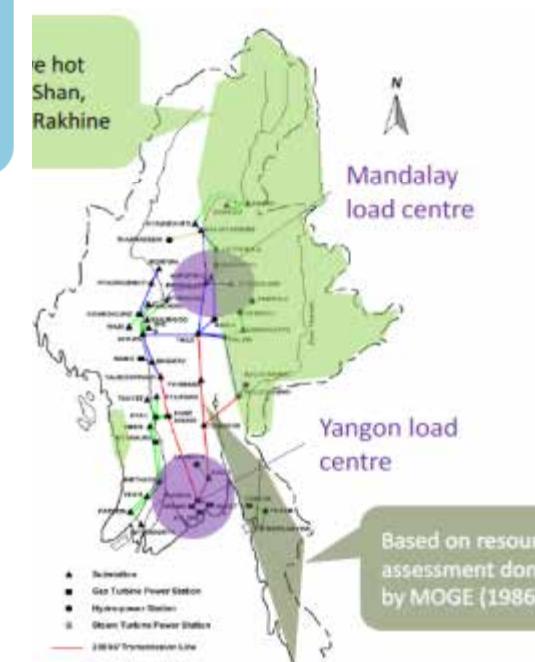


Source: ESMAP 2012.

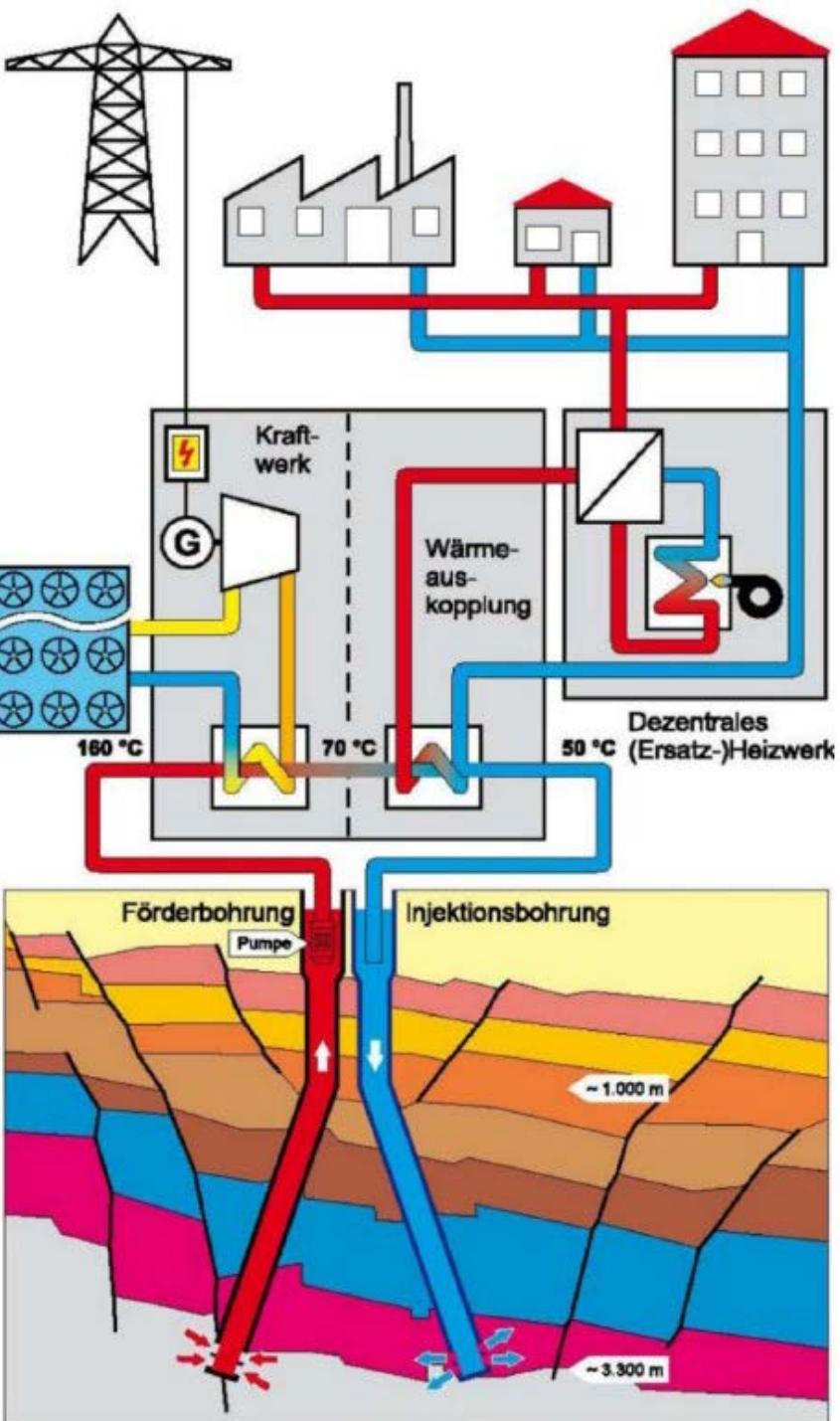
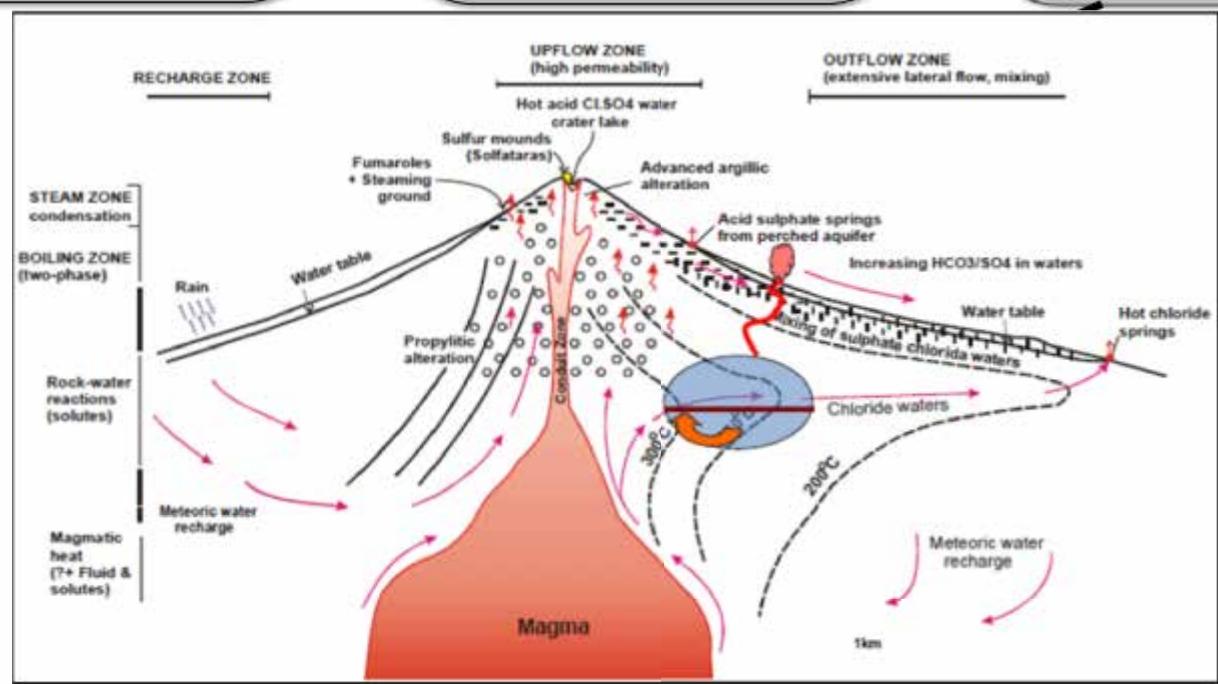
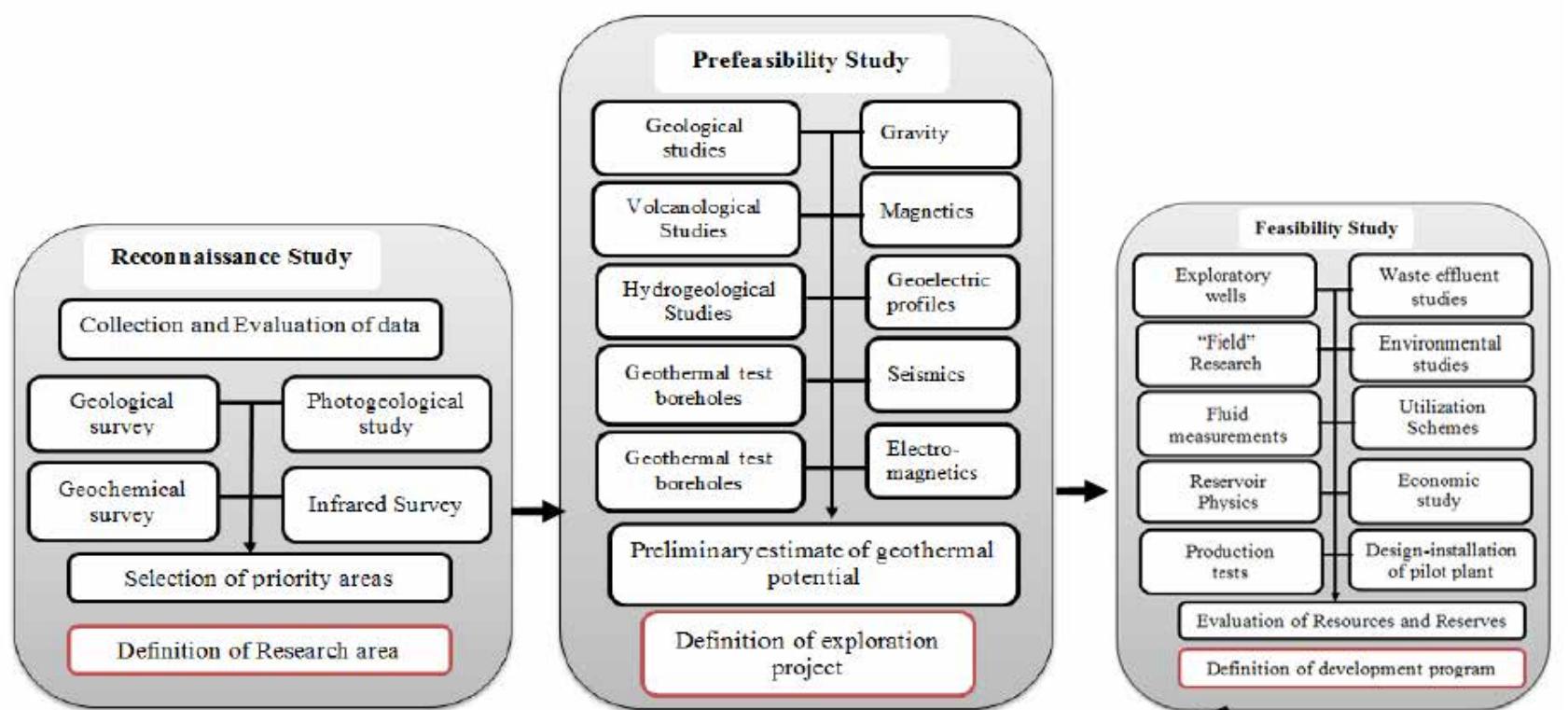
FIGURE 1.3: CONTENTS OF GEOTHERMAL FEASIBILITY STUDIES



CASH FLOW OVER A TYPICAL 30-YEAR FINANCIAL PLANNING HORIZON



Potential for commercial development in Myanmar." Identified 93 sites, tested 43 sites (NEP2013).



(JAPAN's) ASIA Energy Transition Initiative (AETI)

2021 May

1. Support Drawing Roadmaps for energy transitions

2. Asian version of Transition Finance

3. US\$10 billion finance support

(e.g.) renewable energy, energy efficiency, LNG etc.

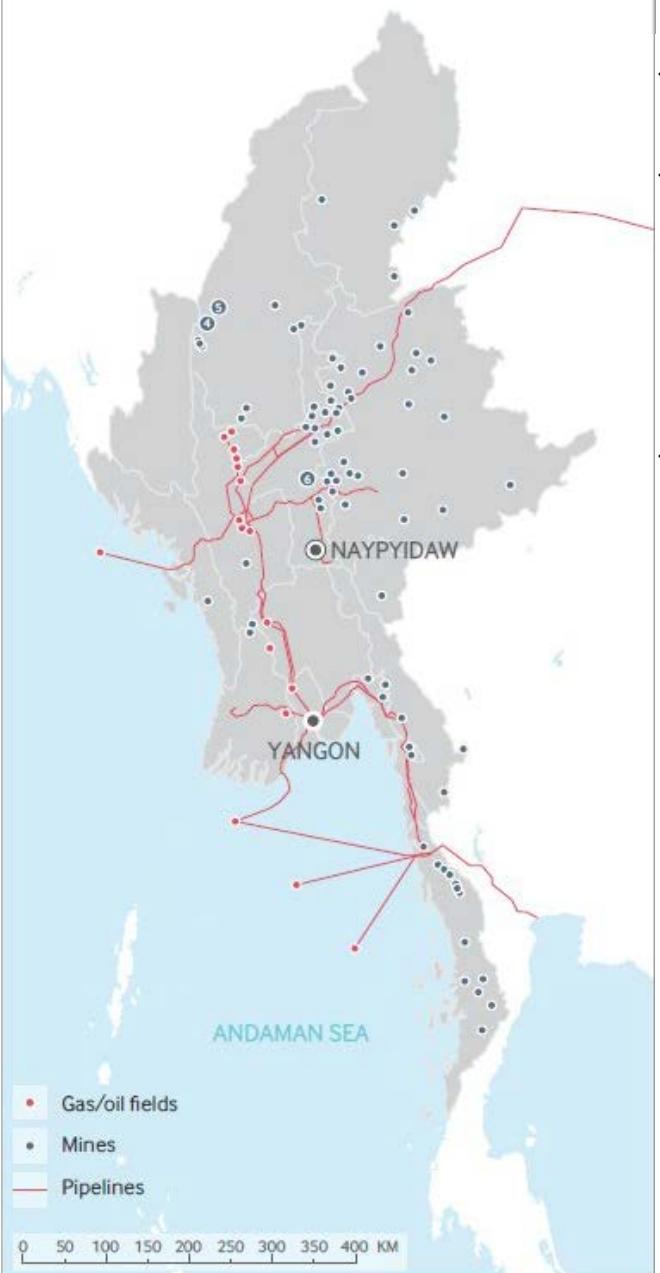
4. Technology development and deployment, utilizing the achievement of 2 trillion yen fund

(e.g.) Offshore wind power generation, Fuel-ammonia, Hydrogen etc.

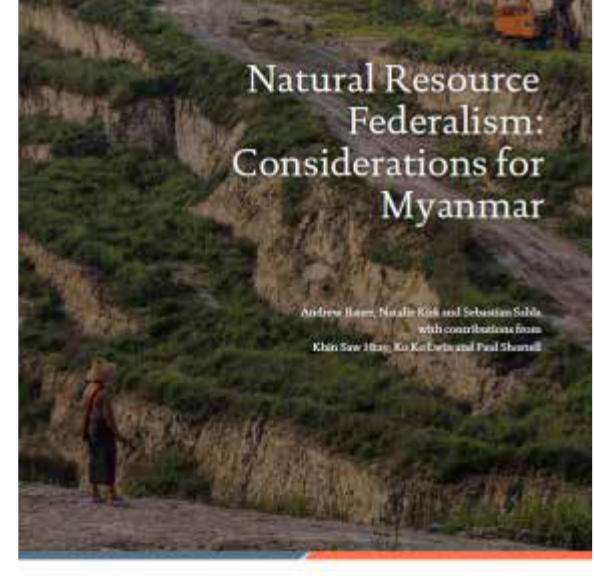
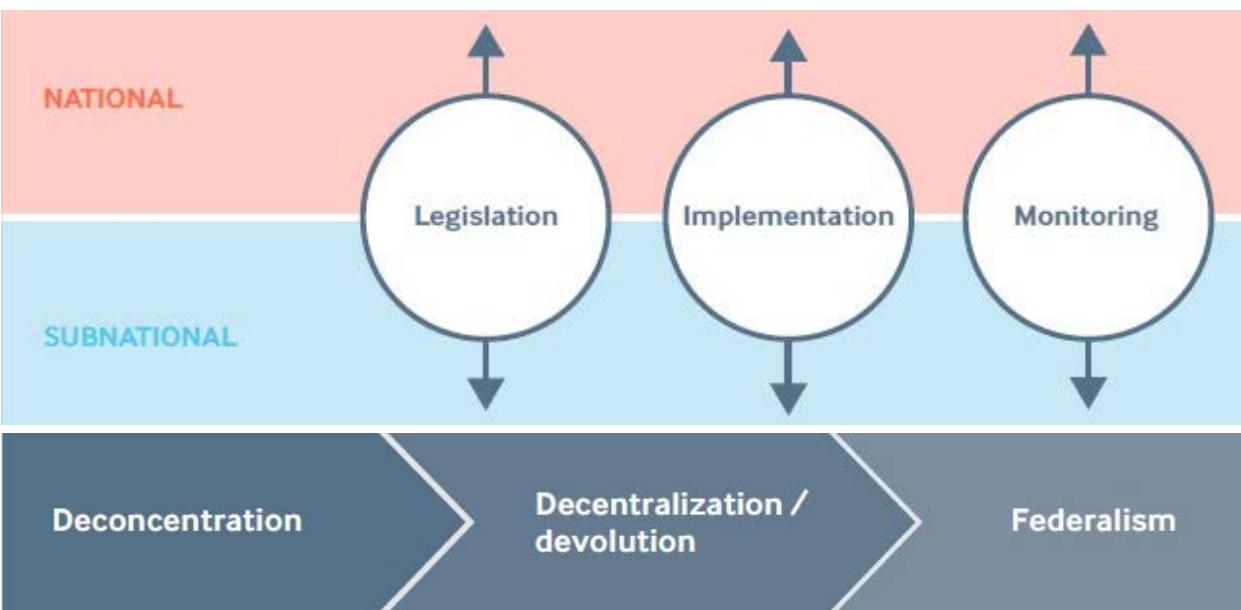
5. Capacity building of Decarbonisation Technologies, and Knowledge Sharing through Asia CCUS Network

- Capacity building of decarbonisation technologies for 1,000 people in Asian countries
- Workshops and Seminars on energy transitions

Dawn of Resources Federalism



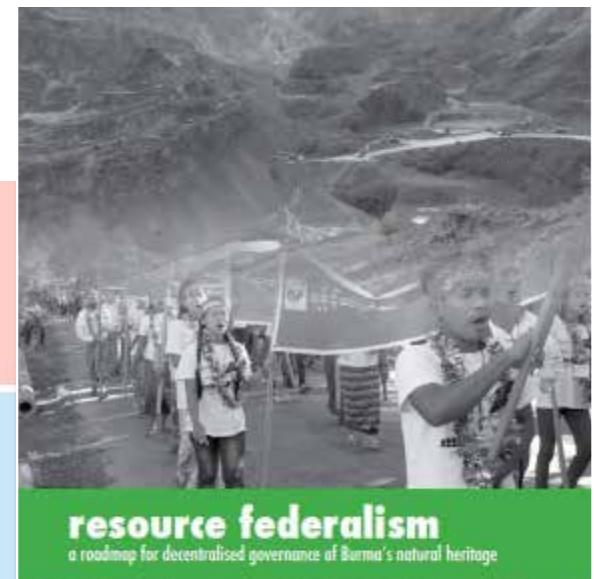
- ❖ Forest, Land, Water, Coal, Jade, Oil & Gas
- ❖ Extend the new laws and regulations to implementation and monitoring in transparent way as well as sharing the benefits & responsibilities to subnational level
- ❖ Extend mapping and studies in war zones and offshore (first time in history)



Natural Resource
Federalism:
Considerations for
Myanmar

Andrew Baum, Nuala Kirk and Sebastian Salas,
with contributions from
Khin Saw Htun, Ko Ko Lwin and Paul Sturzell

JANUARY 2018



resource federalism
a roadmap for decentralised governance of Burma's natural heritage

