

# Country Presentation: Singapore

Current status and plans regarding  
nuclear safety regulation and nuclear energy

Presented by: Energy Market Authority (EMA) and  
National Environment Agency (NEA)

IAEA-KINS Basic Professional Training Course on Nuclear Safety  
29 Sep 2022



Smart Energy, Sustainable Future



# Presentation Outline

---

1. Overview of Singapore, EMA, and NEA
2. Radiation Protection and Nuclear Science in Singapore
3. Nuclear Energy Outlook

# 1 Overview of Singapore, EMA, and NEA

# Overview of Singapore

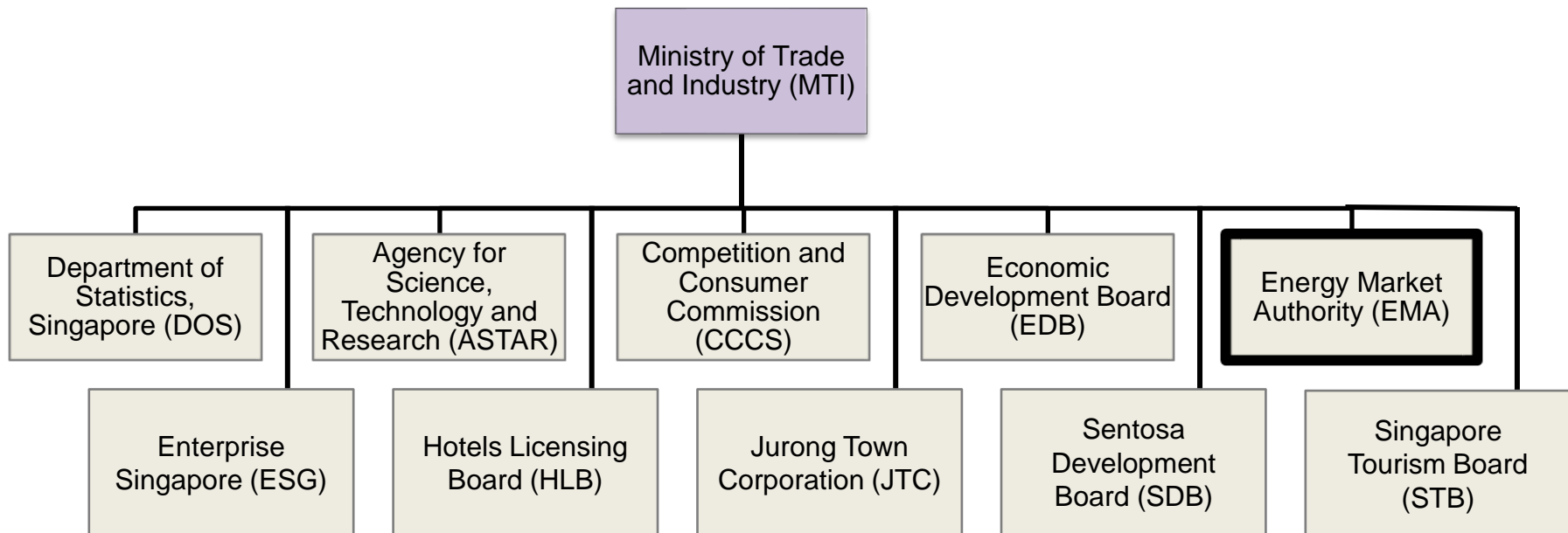
---

- Population: 5.95 million
- Population density: 8,358 per km<sup>2</sup>
- Land area: 729 km<sup>2</sup>
- Located on the southern tip of the Malay Peninsula in Southeast Asia, between the Indian Ocean and the South China Sea



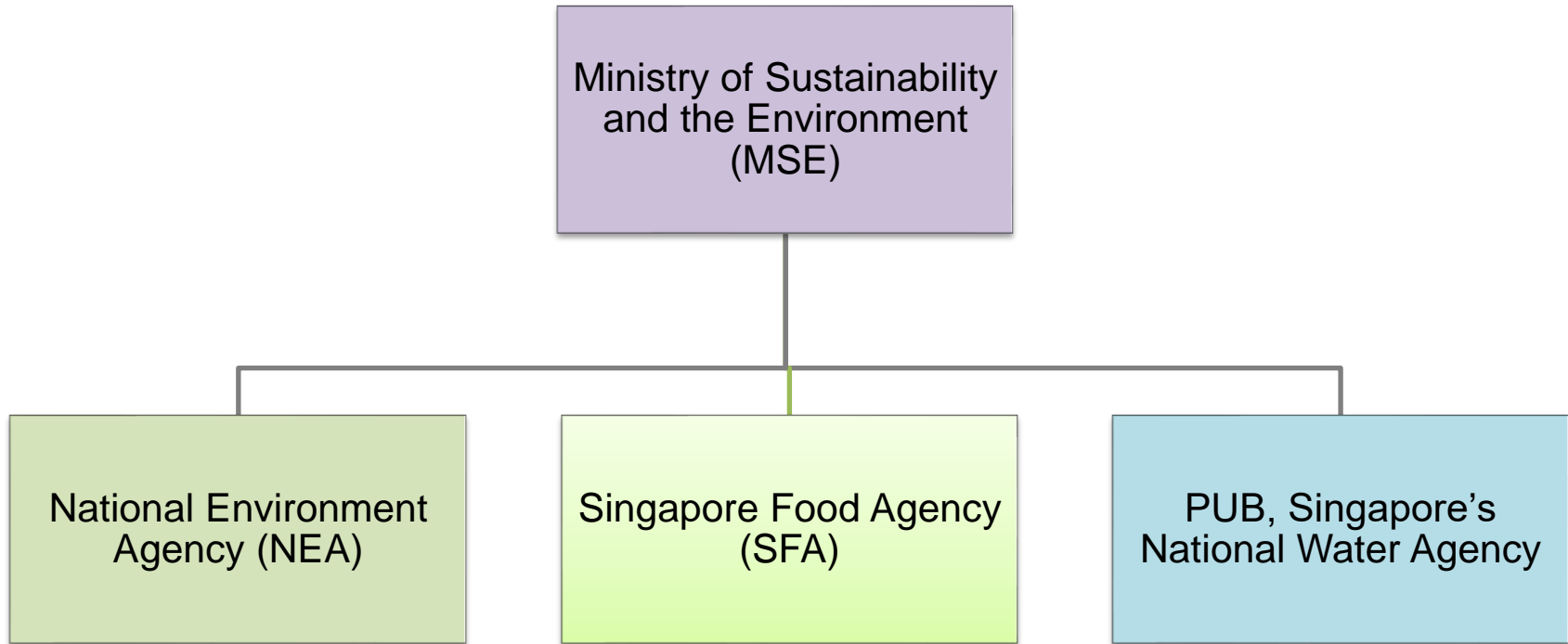
# Overview of EMA

---



# Overview of National Environment Agency (NEA)

---



# Key Programmes that Underpin NEA's Mission

---



**Pollution Control**  
(Air Quality, Water Quality, Chemical Safety, Noise Control)



**Public Hygiene and Cleanliness**  
(Public Toilet Cleanliness, Anti-Littering, Cleaning of Public Areas)



**Radiation Protection and Nuclear Safety**



**Prevention and Control of Vector-Borne Diseases**



**Solid Waste Management**



**Management of Hawker Centres**



**Energy Efficiency**



**Smoking Prohibition**



**Meteorological Services**



**Care for the Dead Facilities**



**Environmental Training**



**3P (People, Public and Private) Partnership**

# 2 Radiation Protection and Nuclear Science in Singapore



# Background on Singapore's Nuclear Landscape

---

- Singapore does not have any nuclear power plant or research reactor
- Applications of radiation and nuclear science are in following areas:
  - **Medical:** nuclear medicine, diagnostic and therapeutic radiology, and radiation sterilisation of blood
  - **Industrial:** material analysis (e.g. x-ray fluorescence, x-ray diffraction), gauging (to measure thickness, level, density), industrial radiography

# NEA's Role in Radiation Protection and Nuclear Science

---

1. Administer and enforce the Radiation Protection Act and Regulations
  - License import, export, sale, possession, use and transport of radioactive materials and irradiating apparatus
  - Monitor radiation dose exposure for radiation workers



2. Provide radiation-related services (e.g. calibration of survey meters)



3. Establish baseline and monitor radiation and radioactivity levels in the ambient environment and in food



4. Implement international conventions that Singapore is a party to, on nuclear safety, security and safeguards



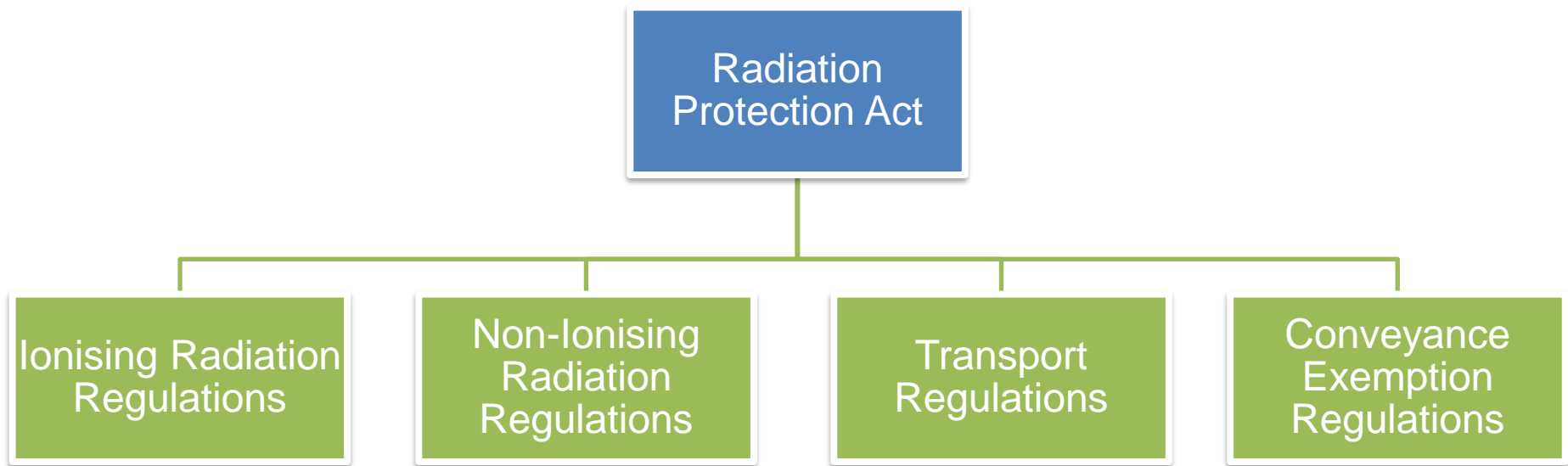
5. Jointly respond with relevant agencies to radiological emergencies



# Regulatory Framework for Radiation Protection

---

Radiation protection and use of irradiating apparatus and radioactive material (including nuclear material) are regulated under the Radiation Protection Act (RPA) and its subsidiary legislation, administered by NEA



# Key Infrastructure Projects

---

National  
Radiochemistry  
Laboratory (NRL)  
(commenced  
operations in Apr  
2018)

Ambient Radiation  
Monitoring  
Network (ARMNet)  
(commissioned in  
Jan 2020)

To establish baseline background radiation and  
radioactivity levels found in Singapore's environment

# International Conventions and Agreements with the IAEA

NEA implements various international instruments relating to radiological and nuclear matters which Singapore has ratified/ supported.



## Nuclear Safety

- Convention on Nuclear Safety (1998)
- Convention on Early Notification of a Nuclear Accident (1998)
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (1998)
- Code of Conduct on the Safety and Security of Radioactive Sources (2016)



## Nuclear Security & Safeguards

### Nuclear Security

- Incident and Trafficking Database (2012)
- Convention on the Physical Protection of Nuclear Material (CPPNM) and its 2005 Amendment (2014)

### Nuclear Safeguards

- Comprehensive Safeguards Agreement (1977)
- Modified Small Quantities Protocol (2008)
- Additional Protocol (2008)



## Technical Cooperation

- Regional Co-operative Agreement (RCA) for Research, Development and Training in Nuclear Science and Technology for the Asia and Pacific region (1972)
- Memorandum of Understanding (MOU) on the Singapore-IAEA Third Country Training Programme (TCTP) (2015)
- Country Programme Framework (2021-2025)

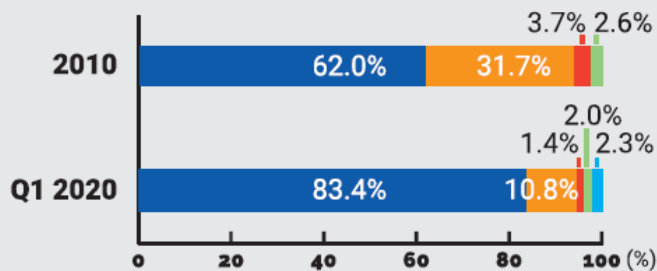
# 3 Nuclear Energy Outlook

# Background: Existing Energy Landscape

- Singapore is an energy **importer** that is **highly dependent** on fossil fuels.
- In 2020 1H, Singapore's fuel mix consists of **95% natural gas**, of which about **33%** is from LNG.
- Other generation sources include: **1.3% coal**, **0.2% petroleum products**, and **3.3% others** (including municipal waste, biomass and solar).

## Electricity Generation Capacity

by Technology Type

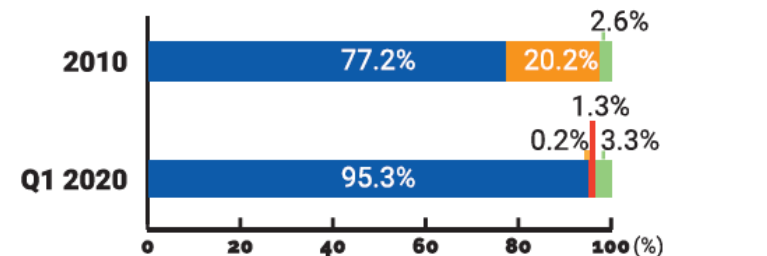


## Energy Flows for Electricity Generation

Fuel Mix for Electricity Generation by Energy Product

**9.8 Mtoe** Total Energy Inputs into Generation Companies

**4.7 Mtoe (54,142 GWh)** Total Gross Electricity Generated by the Generation Companies



Legend for Fuel Mix: Natural Gas, Petroleum Products, Coal, Others

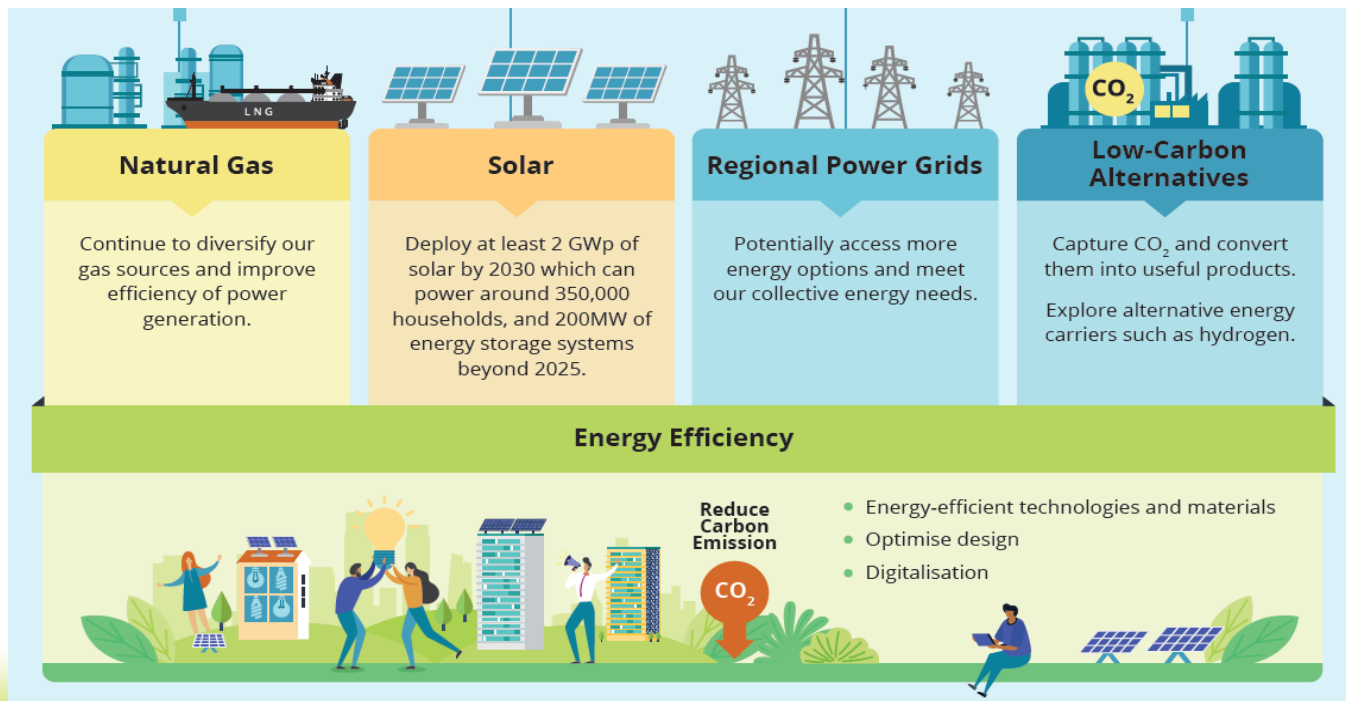
1 Mtoe = 11,630 GWh



Figures taken from Singapore Energy Statistics 2020: [https://www.ema.gov.sg/singapore\\_energy\\_statistics.aspx](https://www.ema.gov.sg/singapore_energy_statistics.aspx)

# Advancing Singapore's energy transition

- Globally, there is increasing urgency to achieve net zero carbon.
- To play our part, Singapore has raised our climate ambition to achieve net zero emissions by or around mid-century.
- EMA introduced the “4 Switches” to guide our transition to a sustainable energy future for Singapore.
- Even as we transit towards a low-carbon energy future, we will need to manage competing demands of security and affordability.

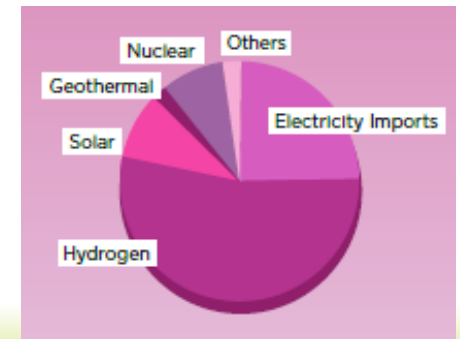




# Nuclear Energy and Singapore

---

- Advanced nuclear technologies and SMRs, if proven to be safe, could potentially help meet our climate change targets in the future.
- In 2010, Singapore did a pre-feasibility study on nuclear energy, which concluded that large conventional nuclear reactor technologies are not suitable for domestic deployment in Singapore.
- However, we note that advanced nuclear fission technologies, small modular reactors, and fusion technologies that are being developed today have the potential to be much safer than many of the plants in operation today.
- EMA commissioned the Energy 2050 Committee, an independent panel of experts, which released a report with findings and recommendations on how Singapore can decarbonise the power sector and capture the economic opportunities arising from the energy transition.
- To keep our energy options open for the future, we will continue to strengthen our capabilities to:
  - Understand nuclear science and technology, and track these newer technologies as they develop; and
  - Assess the implications of evolving nuclear energy technologies for Singapore.



Thank you!