IRENA
International Renewable Energy Agency

IRENA FlexTool

TRAINING FOR ASEAN

SESSION 3: Applying IRENA FlexTool to a real case study – the case of Thailand

Introduction

กระทรวงพลังงาน
MINISTRY OF ENERGY

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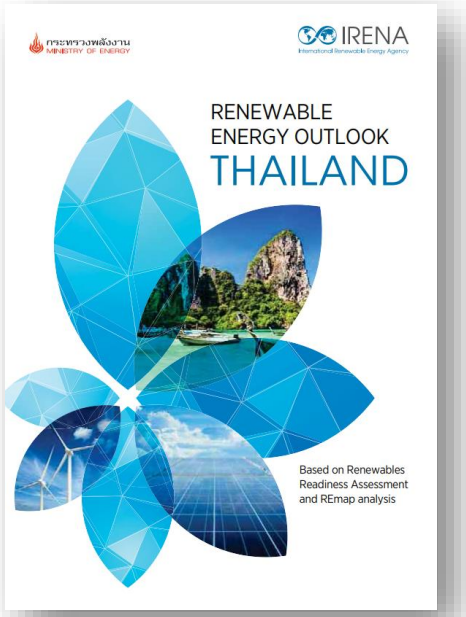

Thailand Renewable Energy Outlook

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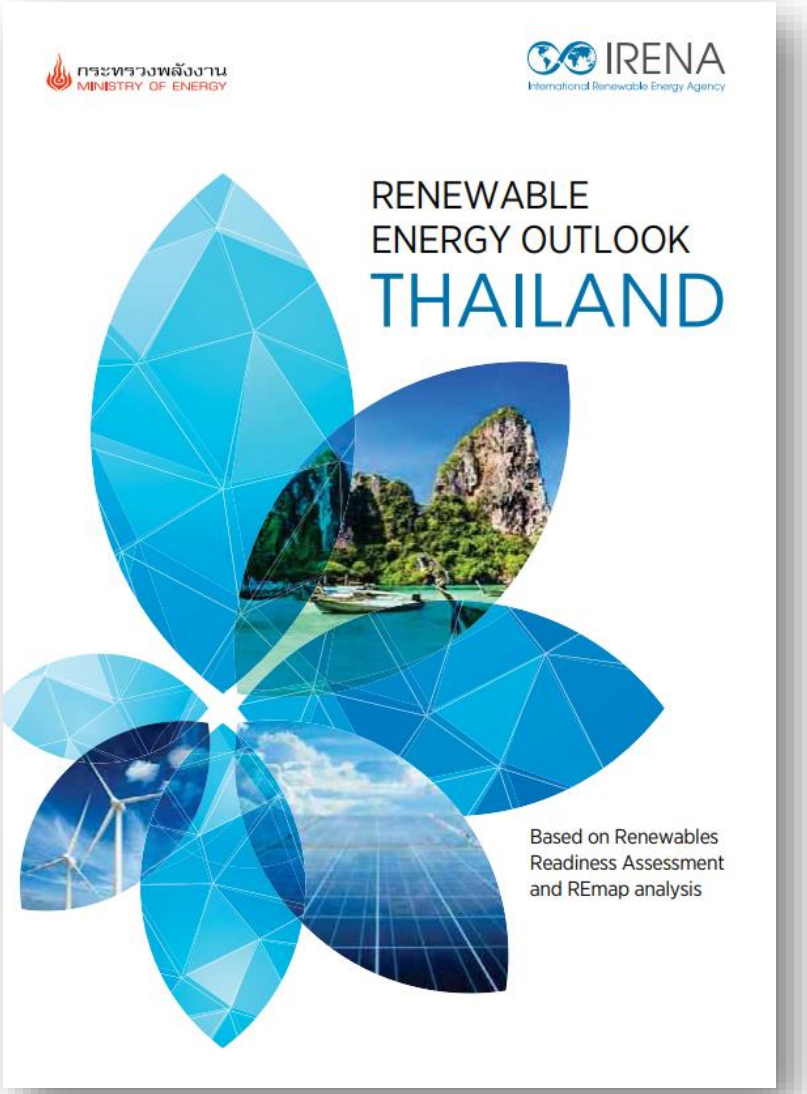
- IRENA together with the Ministry of Energy of Thailand published in 2017 the Thailand Renewable Energy Outlook
- Thailand set a target whereby 30% of the country's total energy consumption would come from renewable sources by the year 2036
- This study highlights the actions needed to meet or even exceed the country's target of 30% renewables in the energy mix by 2036 and presents the REmap scenario – 37% RE share
- In the power sector:
  - Reference Scenario (based on Thai plans) – 18% RE share
  - REmap Scenario – 25% RE share with increase of solar PV and wind
- IRENA FlexTool to analyze the feasibility of both proposed power sector scenarios



THAILAND POWER SYSTEM FLEXIBILITY ASSESSMENT

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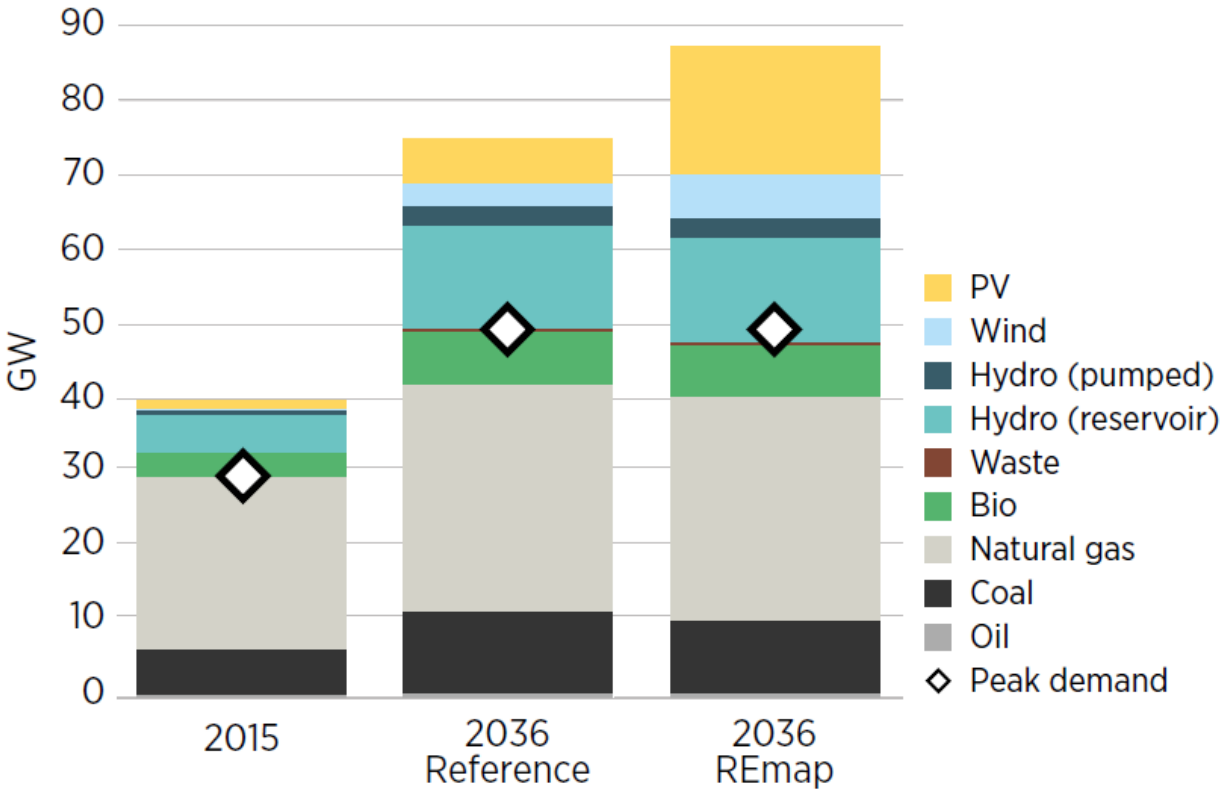
Overview of Thailand's power system

- Main focal point: Department of Alternative Energy Development and Efficiency (DEDE)
- Process facilitated by engagement with Thailand Renewable Energy Outlook

- Thailand's power system is characterized by:
  - Large share of natural gas-fired capacity (60%) hydropower generation with storage and some pumping capabilities
  - VRE capacity is just 4% of the total generation share
  - 30 GW peak demand and 40 GW installed capacity
  - Hydro power plants in Lao People's Democratic Republic and Myanmar
- By 2036
  - Reference: Adds 7.5 GW of VRE (mostly solar PV)
  - REmap: Adds 21.7 GW of VRE (mostly solar PV)
  - Peak demand will grow to 51.5 GW in 2036



Flexibility analysis for Thailand's 2036 power system

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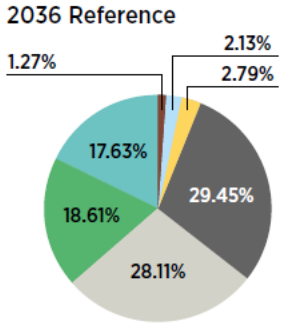
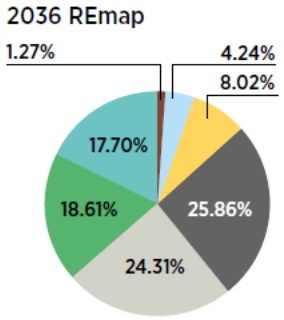
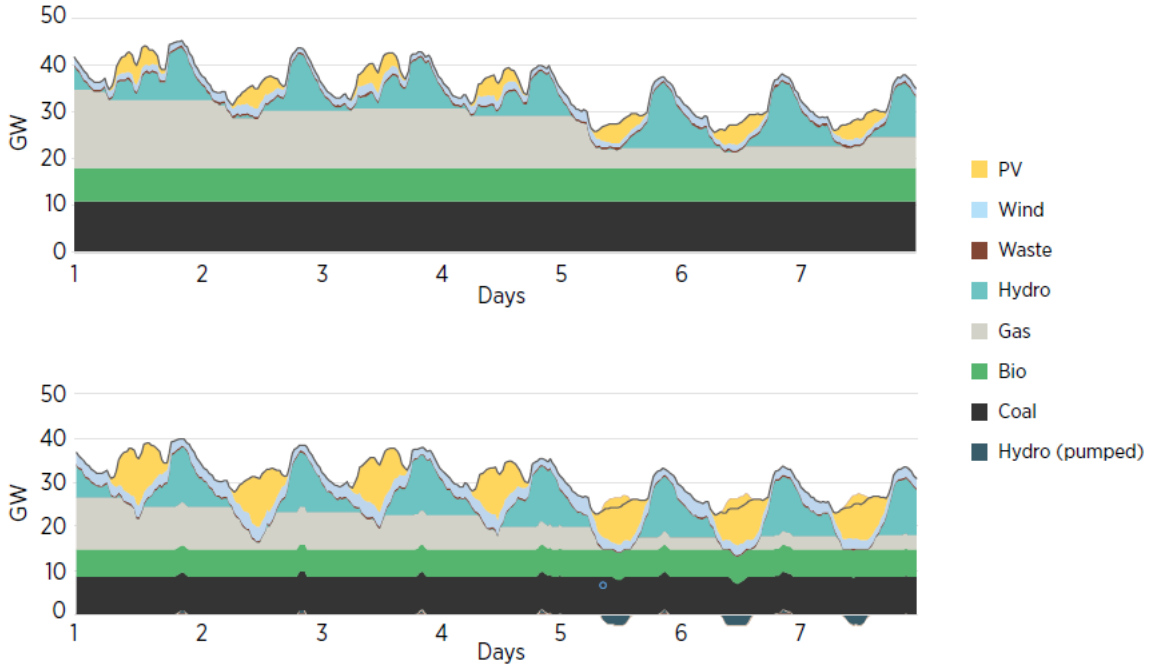
- No flexibility issues identified in 2036 even in the REmap scenario
- RE share is 41 % in the reference scenario and 49% in the REmap
- REmap scenario has 700 USD millions lower generation costs and 12% lower CO2 emissions than the reference scenario
- Flexibility provided by
  - 2.1 GW additional pumped hydro capacity
  - Additional hydro in Lao PDR (2 GW) and Myanmar (6.3 GW)
  - 7 GW of natural gas-fired capacity



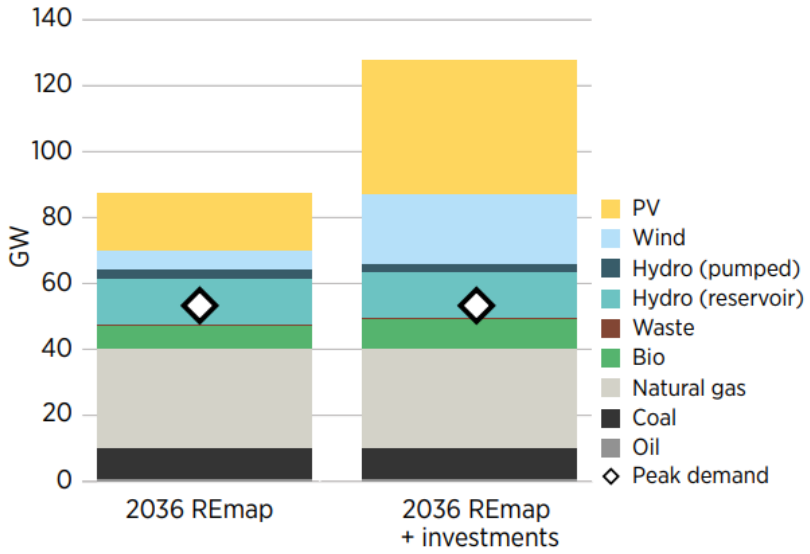




	2036 Reference		2036 REmap	
	Total (GWh)	Peak (MW)	Total (GWh)	Peak (MW)
Curtailment	0	0	0	0
Loss of load	0	0	0	0
Spillage	0	0	0	0
Reserves inadequacy	0	0	0	0

Note: These flexibility indicators are defined in IRENA (2018b). GWH = gigawatt-hours; MW = megawatts.

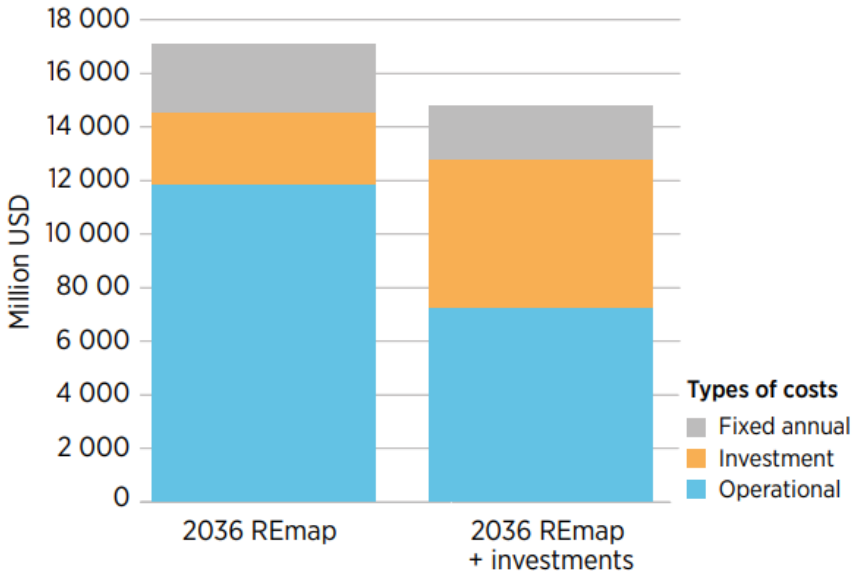
Optimizing investments with IRENA FlexTool



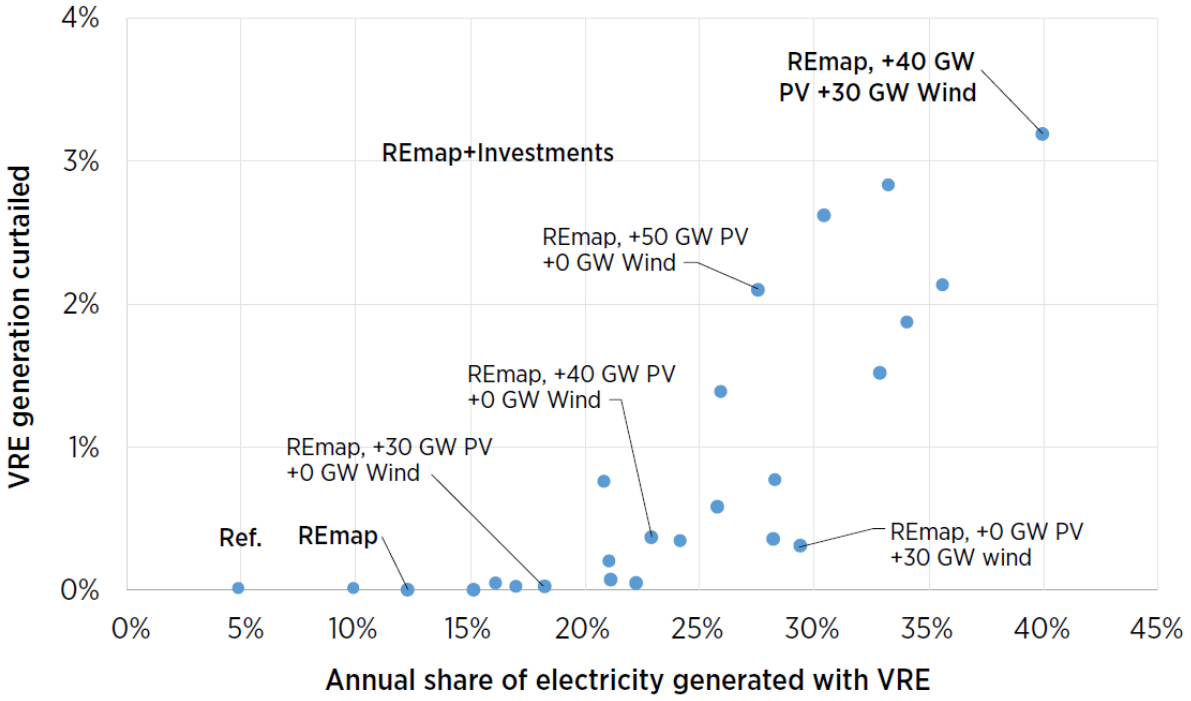
- Investment mode of FlexTool identified that minimum costs are achieved when investing in:
  - 15 GW of wind power
  - 23.8 GW of solar PV
  - 2 GW of biomass
- VRE share increases from 12.3% to 33.4% and renewable energy share from 49% to 74%

- Increase in investment costs is compensated by reduction in operational and curtailment costs

- Total savings in the Investments scenario is about 2000 million USD



Gradually integrating more VRE into the system



- Sensitivity analysis adding solar PV and wind until significant curtailment levels emerge
- In the 2036 reference scenario the VRE share is 5% and RE share 41%, while in the renewables scenario the share is 49%. No VRE curtailment
- If solar PV capacity is 41 GW and wind is 21 GW
  - Excess of VRE reaches 1.9% with a 33% VRE share and 74% RE share. From this point VRE curtailment increases
- Integration of VRE can be facilitated by increasing pumped hydro storage capacity or exploring sector coupling options

Conclusions and Impact

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- Thailand is characterised by a high share of natural gas-fired capacity and low VRE share (4%)
- In 2036, Thailand's power system will be flexible enough to cope with the increasing penetration of VRE in both reference and REmap scenarios
- The IRENA FlexTool suggests that is could be cost-efficient to invest in additional solar PV and wind to reduce system costs and carbon emissions
- Thailand could also explore other alternatives such as sector coupling or investing in pumped hydro storage
- **"DEDE, which forms part of Thailand's Ministry of Energy, affirms the usefulness of the FlexTool for assessing the system's readiness for higher shares of variable renewables"**

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