REmap
A Renewable Energy Roadmap

IRENA
International Renewable Energy Agency

Renewables Readiness Assessment and REmap Analysis for Thailand

#REmap

A REMAP ANALYSIS

23-24 February 2017, 2nd Technical Workshop, Bangkok

Time	Programme
Thursday, 23 Feb.	
Morning	**Renewables Readiness Assessment Review** Yong Chen, IRENA; Bright Management Consulting
Afternoon	**Part 1: REmap Programme Introduction; Overview of REmap Approach, methodology** **Part 2: Presentation of preliminary findings for power sector** *Nicholas Wagner, IRENA* ***Discussion*** **Part 3: : Presentation of preliminary findings for end-sectors (heating, cooking, transport fuels)** *Nicholas Wagner, Yong Chen, IRENA* ***Discussion***
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	Part 5: Deep-dives: Bioenergy and Regional Cooperation and Synergies *Yong Chen, Nicholas Wagner, IRENA* ***Discussion*** ***Wrap-up of REmap discussion***
Afternoon	**Report finalization, perspectives on potentials discussed, messaging and next steps** *Yong Chen, IRENA; DEDE* ***Discussion*** ***Closing remarks***

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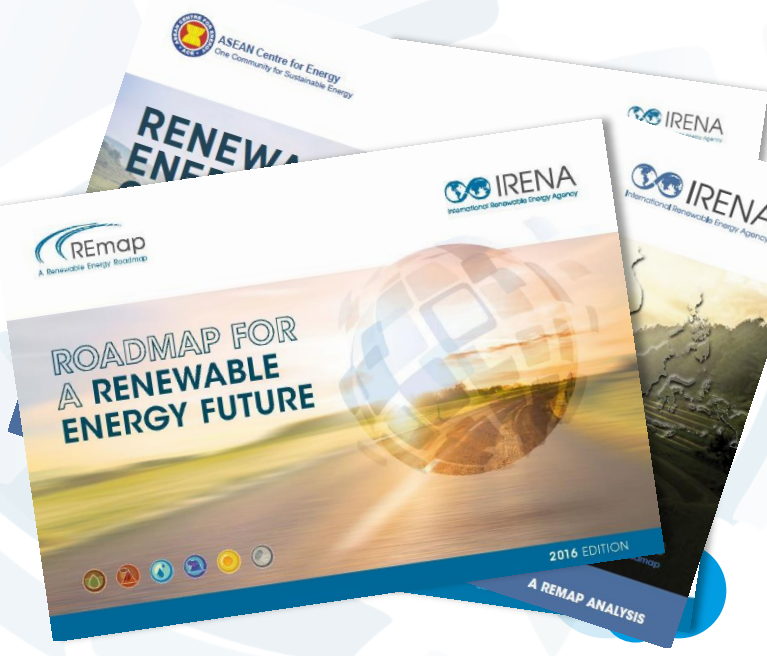
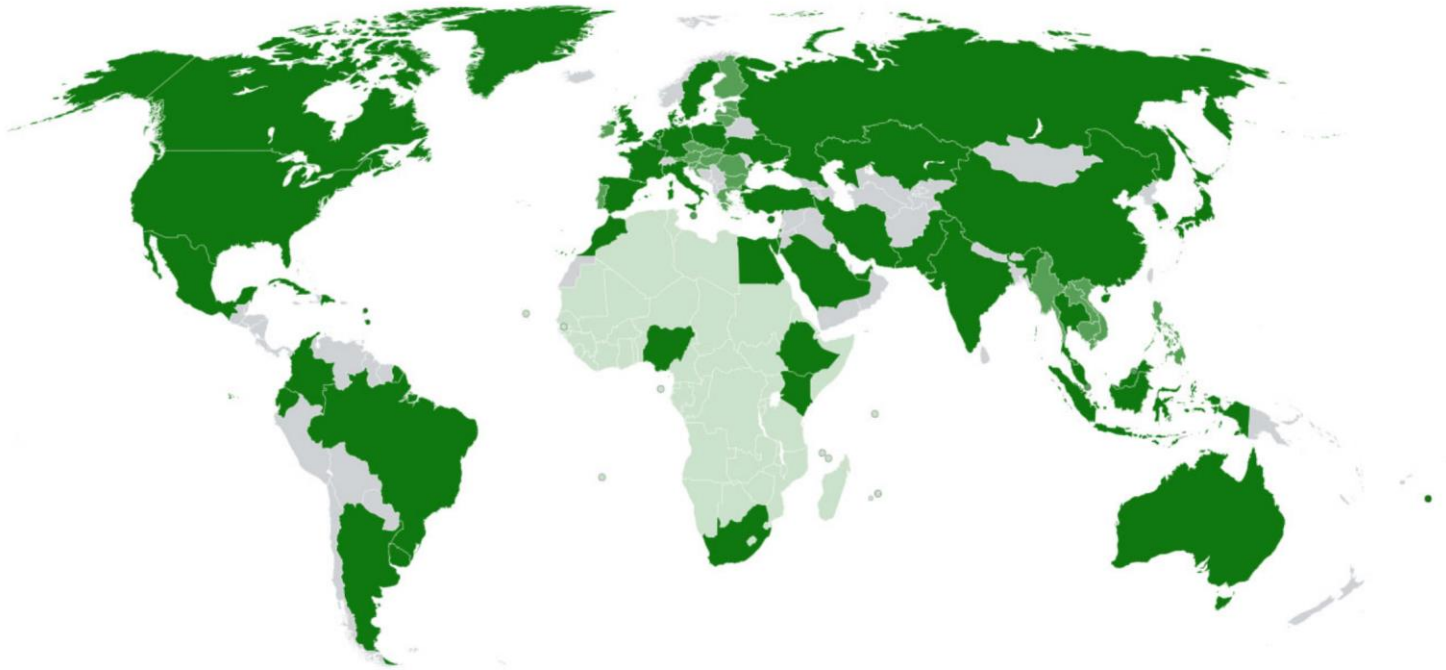
- IRENA's **Global Renewable Energy Roadmap**
- Shows feasible, cost-effective ways to **increase renewable energy deployment** in world's energy mix by 2030 **in line with SDG7**
- **Support the G20** in determining pathways for operationalising Paris Agreement with decarbonisation scenarios analysis to 2050, report release in March 2017
- **REmap 3.0 report** coming in early 2018
- Identifies concrete **technology options** for countries and sectors
- Assesses policy and investment **implications**
- Outlines **benefits** (economic, social, environmental)
- In cooperation with 70 countries
- 30 publications to date and datasets

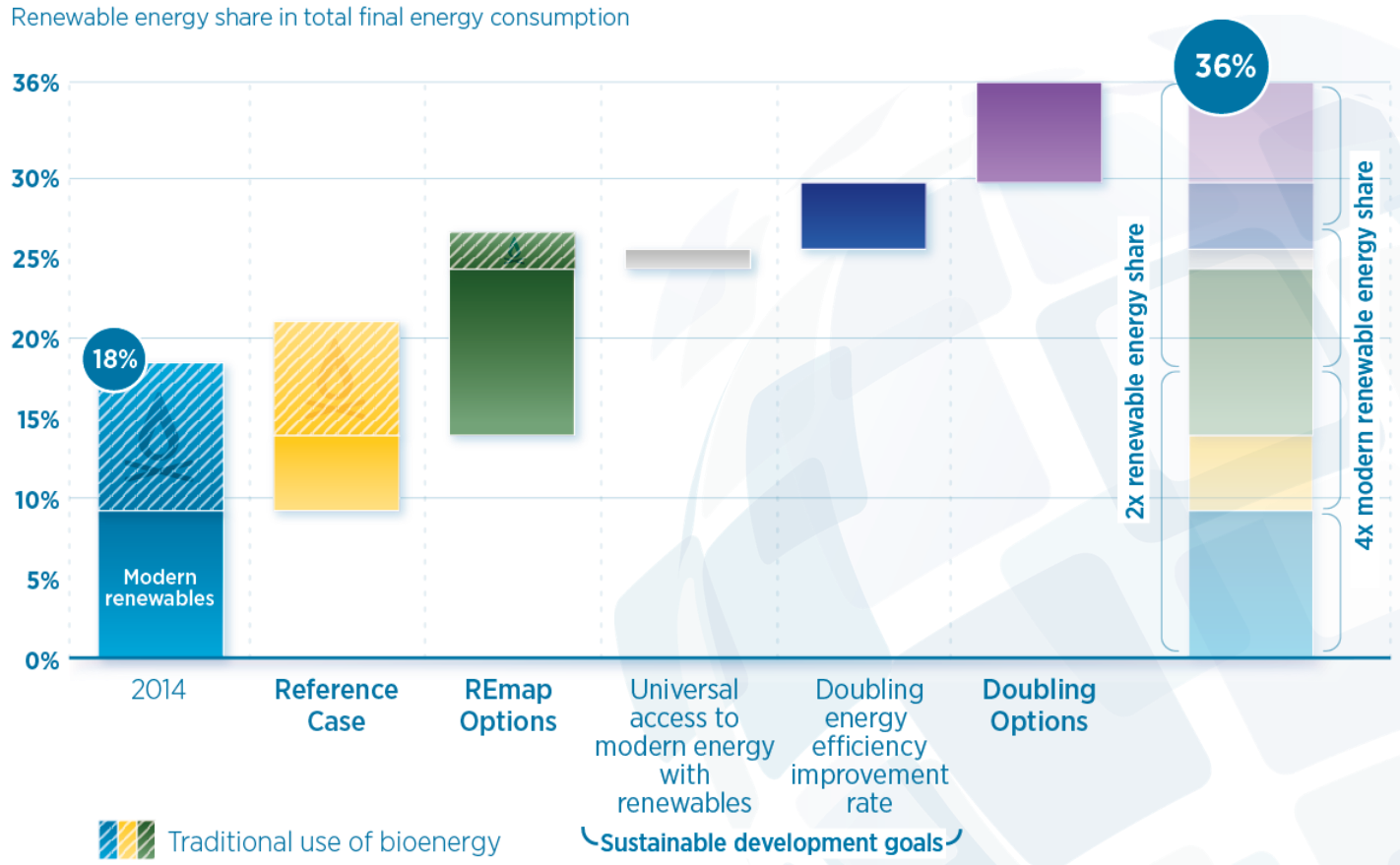


REmap Countries and regional efforts



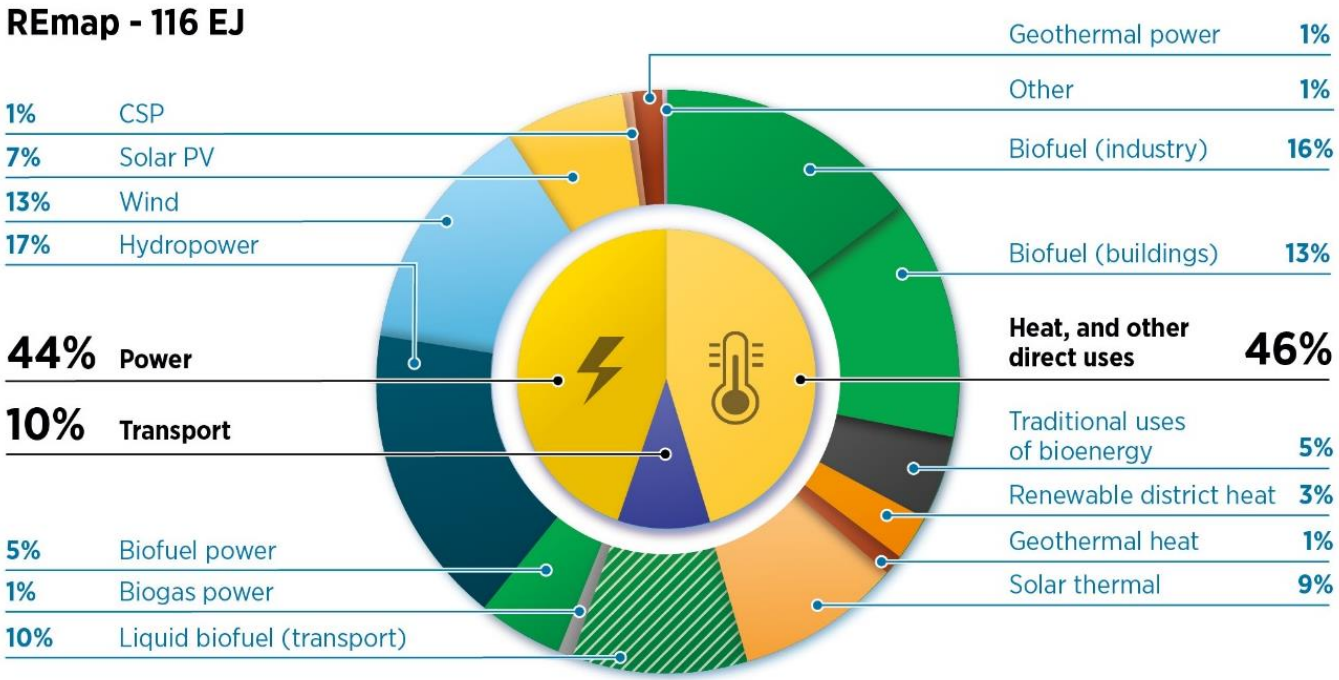
Dark green: REmap countries
Middle green: Countries covered under the REmap regional analyses for the EU and ASEAN
Light green: Countries covered under the REmap regional analysis and IRENA power pools projects for Africa

FIGURE 2 The renewable share in global energy mix between today and 2030



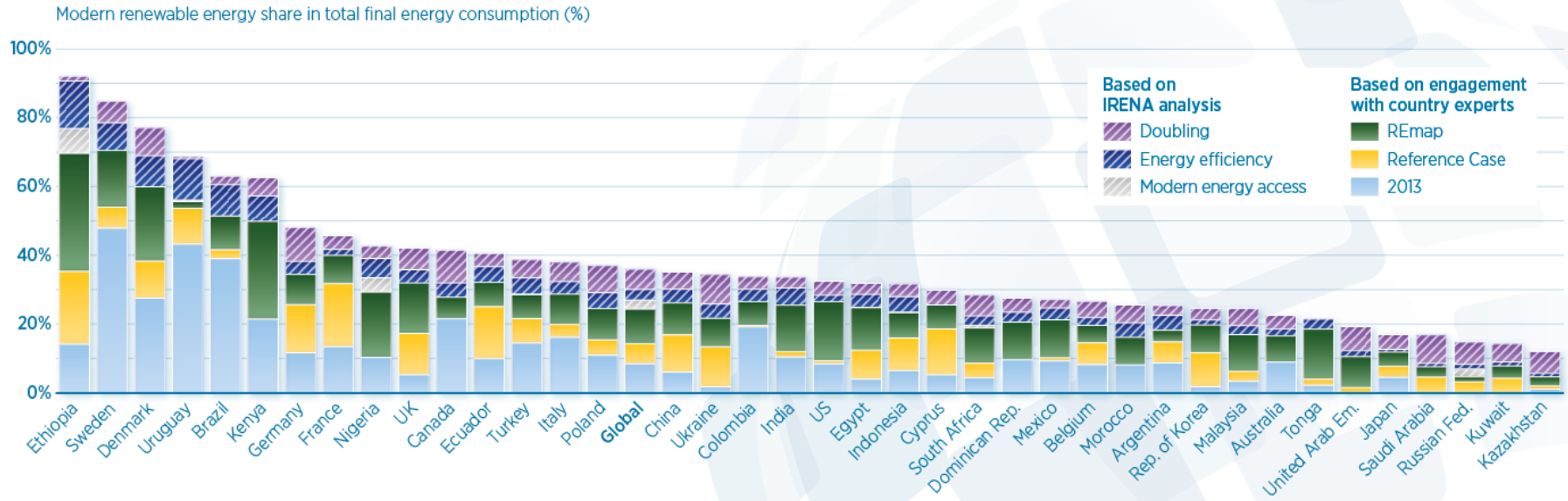
A doubling would mean a quadrupling of the modern renewable energy share in the same time frame. This requires action in multiple areas, not only in renewables.

FIGURE 14 Renewable energy use in 2030 with REmap Options and with modern energy access with renewables.



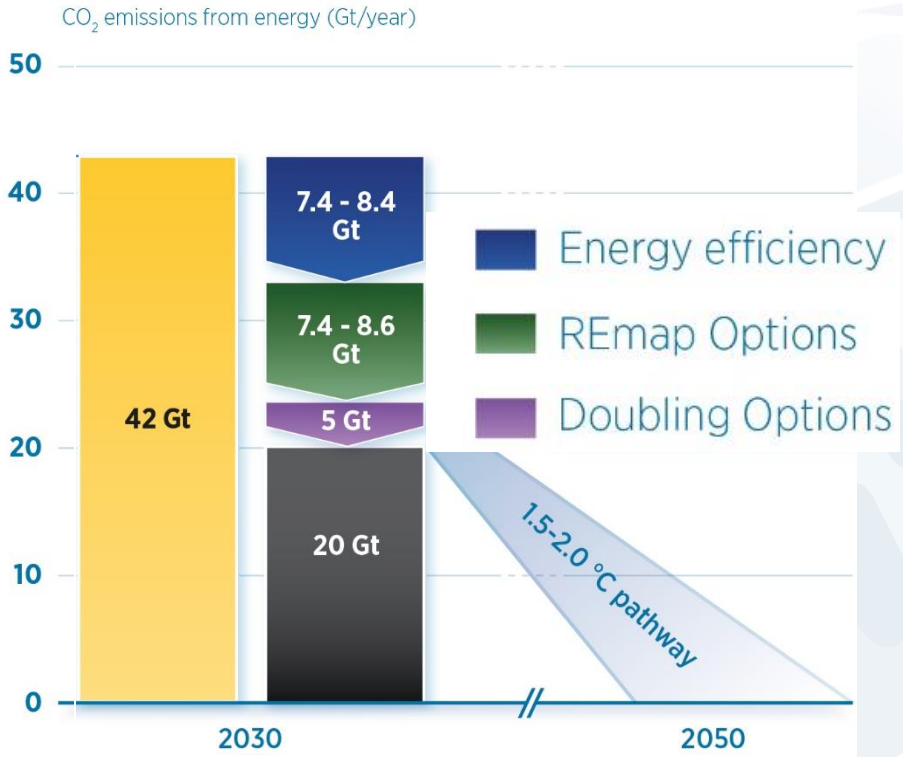
In REmap, renewables use in buildings, industry and transport as well as renewables-based district heating, would account for nearly 60% of modern renewable energy use in 2030.

FIGURE 21 Share of modern renewables in energy use of REmap countries, 2013-2030



Each country will contribute to a doubling of the global renewable energy share.

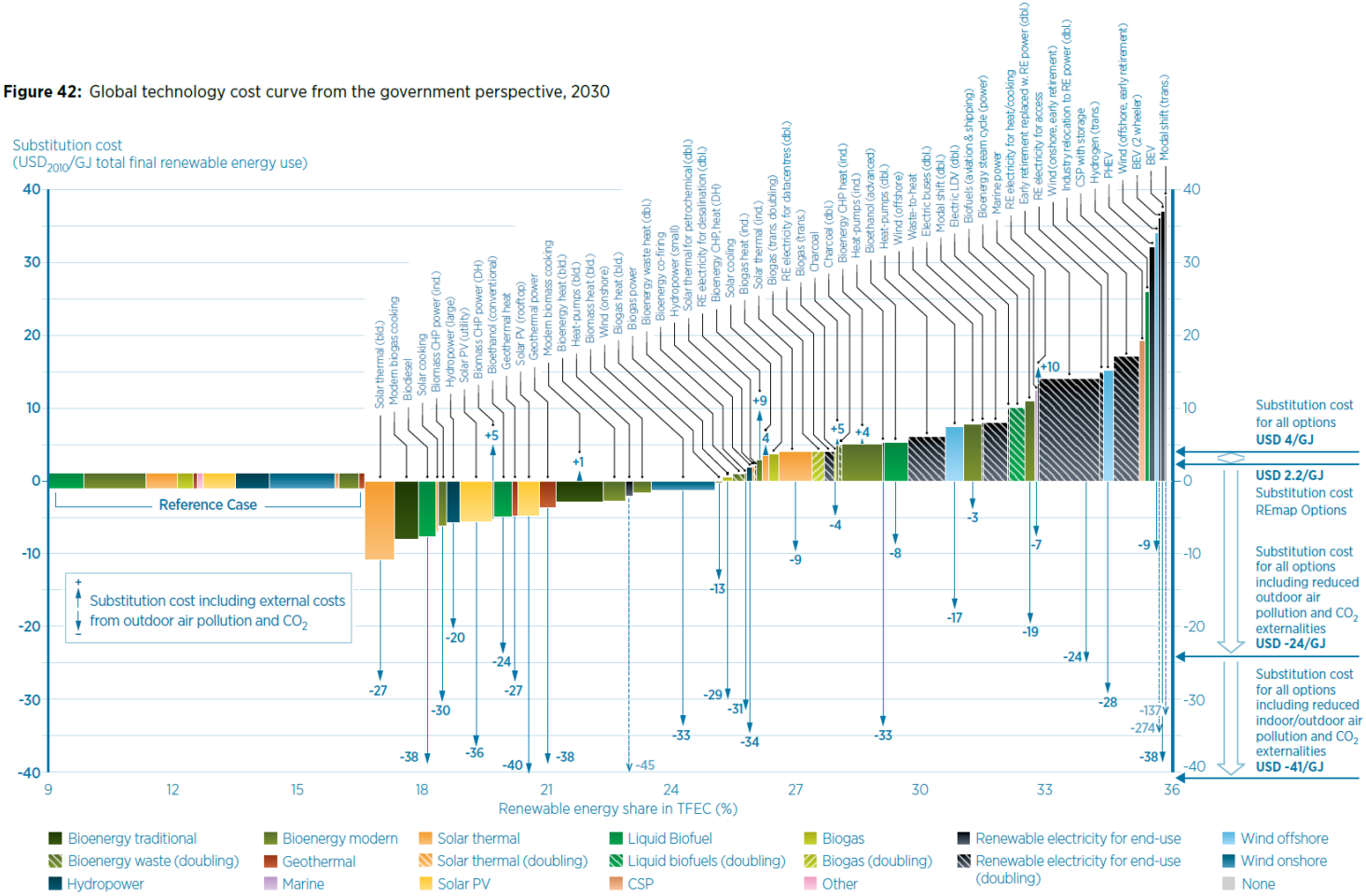
Doubling renewables is critical for meeting climate objectives



Doubling the share of renewables by 2030 would put the world on a pathway to limiting global warming to 1.5-2.0 degrees

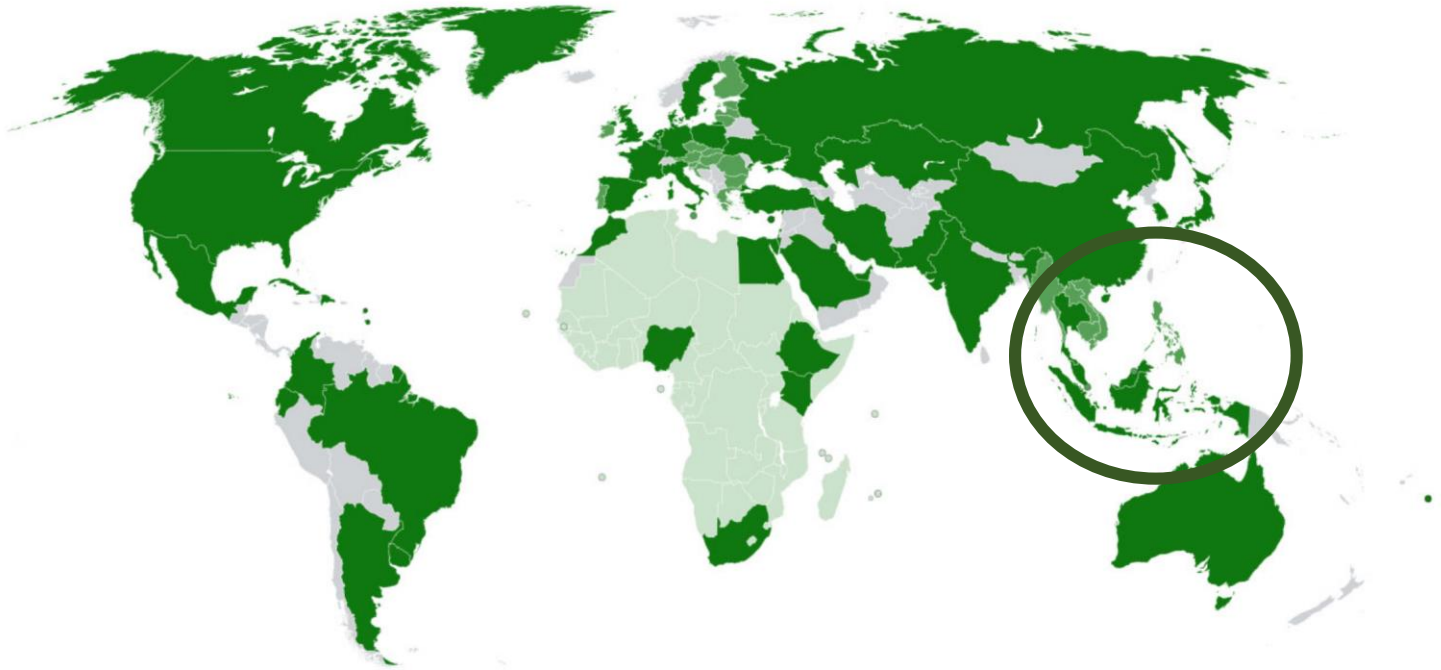
Renewable energy reduction potential on par with efficiency potential

FIGURE 42 Global technology cost curve from the government perspective, 2030



The cost of doubling modern renewable energy in the energy mix is negligible, at USD 4 per GJ or just over USD 1.4 cent per kWh.

REmap Countries and regional efforts



REmap ASEAN report released in October 2016, at Singapore International Energy Week

Project partners for REmap ASEAN regional analysis

- IRENA - the global voice, advisory resource and knowledge hub for 176 Governments for renewable energy
- ASEAN Centre for Energy (ACE) - a regional intergovernmental organisation, leading energy think tank assisting ASEAN Member States identify innovative solutions for the region's energy challenges and a catalyst to unify and strengthen ASEAN energy cooperation
- The GIZ Renewable Energy Support Programme "ASEAN RESP" is a jointly implemented project by ACE and GIZ, on behalf of the German Federal Ministry for Economic Cooperation and Development enabling regional exchange; and a partial financial supporter of the *Renewable Energy Outlook for ASEAN – a REmap 2030 analysis*.

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ASEAN Centre for Energy
One Community for Sustainable Energy

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Approach and country engagement

- IRENA's REmap renewable energy technology assessment tool and approach
- ACE's close working relationship with the 10 ASEAN Member States

Country engagement as the cornerstone of REmap

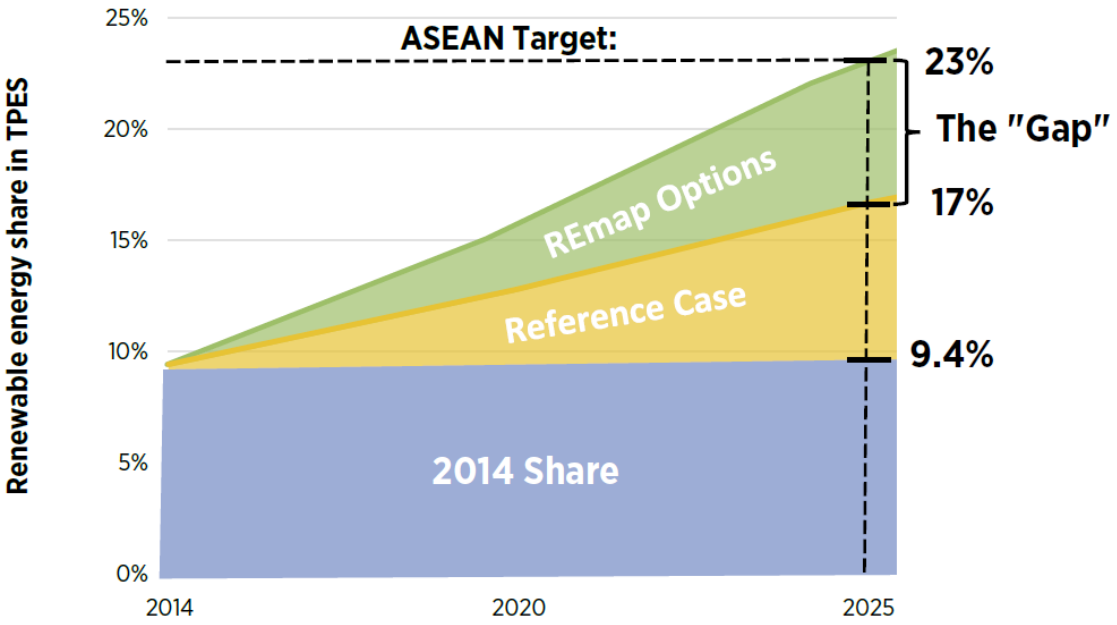
IRENA and ACE have engaged all ASEAN countries and +60 experts throughout 2016

- Two in-depth **technical workshops**:
  - March workshop in Manila
  - June workshop in Bangkok
- Three review **webinars** (April, May, September)
- 34th AMEM final **Ministerial consultative meeting**
- SIEW launch in October 2016

ASEAN's 23% aspirational renewables target

Set forth in October 2015 as part of ASEAN Plan of Action for Energy Cooperatio

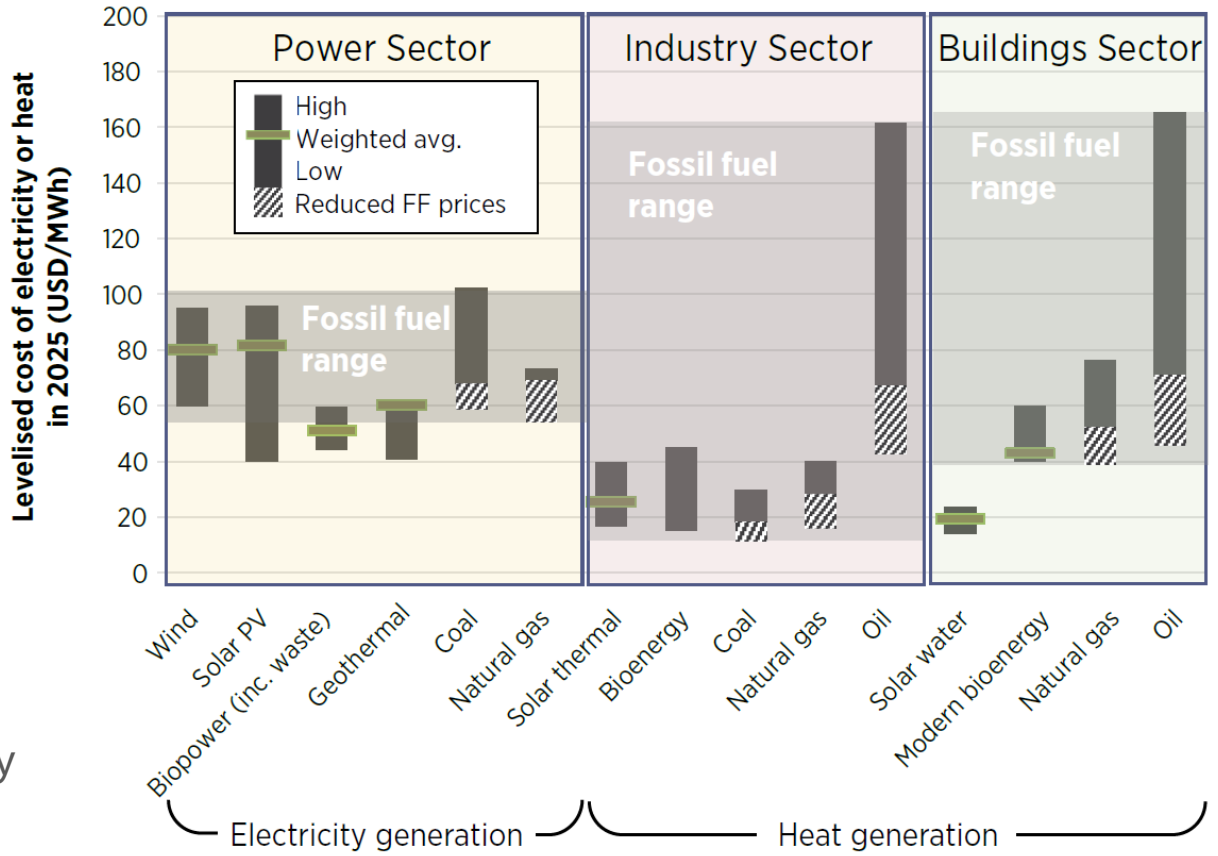
- 23% renewable energy share[1)] in total primary energy supply (TPES) by 2025
- ACE Energy Outlook (2015):
  - **2014 – 9.4%**
  - 2025 BAU – 10%
  - 2025 Advanced Policy Scenario (APS) – 15.4%
- IRENA Reference Case – **16.9%** (APS + latest country updates)
- **6%** point gap to the 23% target



1) excluding traditional uses of bioenergy, including all hydropower

Drivers for a renewable revolution in the region

- The region has some of the best renewable energy resources in the world
- Renewable energy is becoming increasingly cost-competitive:
  - Declines in the costs of renewable energy technologies
  - Increasing costs from import price volatility
- Health benefits, improved wealth distribution, especially in rural areas
- Renewable energy drives economic activity & creates employment

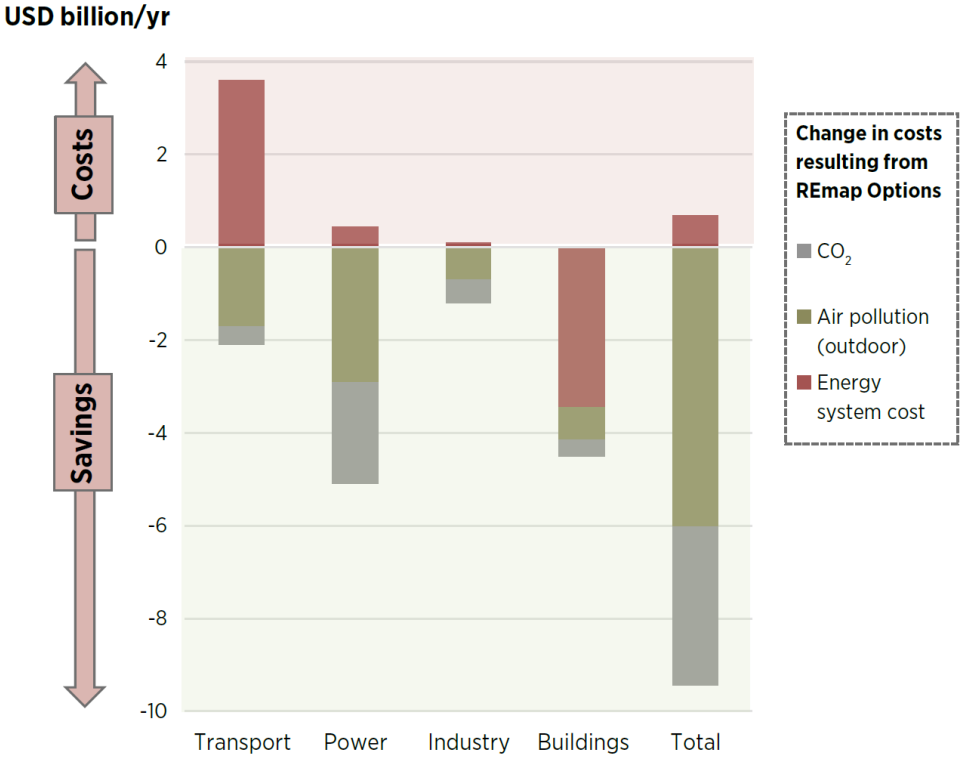


Note: reduced fossil fuel (FF) prices assumes lower average commodity prices for fossil fuels for coal (-10%), natural gas (-20%) and oil (-30%)

Costs and savings of closing the gap

The REmap Options for closing the gap to 23% are represented by an incremental cost of USD 1.9 per MWh by 2025

- The REmap Options would result in slight incremental costs of USD 1.9/MWh or USD 0.7 billion per year in absolute terms
- Reduced externalities would outweigh costs. Savings exceed the cost:
  - 10x for outdoor air pollution
  - 6x for climate change
  - 38x for indoor air pollution (not shown in figure)
- ASEAN's fossil fuel expenditures would be lowered by USD 40 billion per year by 2025

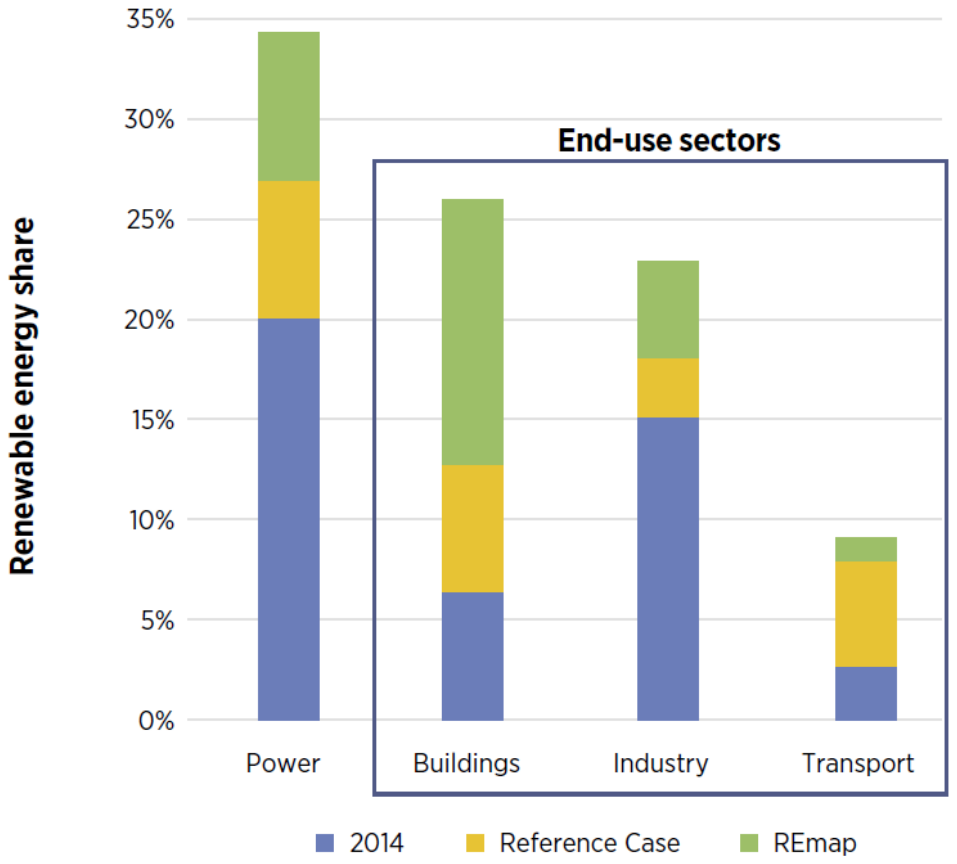


Note: Assumes low-end estimates for externalities for outdoor air pollution and CO2, indoor air pollution excluded from figure

Renewable energy share by sector 2014-2025

Renewable shares increase in all sectors, but mostly in end-use sectors

- Power sector – highest share of renewable energy
- Buildings –largest increase in share due to the substitution of traditional uses of bioenergy
- Industry – large untapped potential compared to the Reference Case
- Transport – largest growth in renewable energy use according to the Reference Case



Note: End-use sectors include the consumption of electricity sourced from renewables. Shares presented in figure exclude traditional uses of bioenergy.

High-level action areas

ACTION AREAS FOR ENABLING ASEAN'S RENEWABLE ENERGY POTENTIAL

Accelerating the deployment of renewable energy technologies must take national circumstances into account. There is therefore no single set of solutions suited to the needs of the entire ASEAN region. Suggestions can, however, be grouped broadly into four areas:

1 **Action area 1:** increase power system flexibility in the ASEAN region while using renewables to provide modern energy access for all

2 **Action area 2:** expand efforts for renewable energy uptake for the power sector and for heating, cooking and transport sectors

3 **Action area 3:** create a sustainable, affordable and reliable regional bioenergy market

4 **Action area 4:** address the information challenge by increasing the availability of up-to-date renewable energy data and the sharing of best practice for renewable energy technologies

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REmap publications

RECENT REMAP-RELATED PUBLICATIONS, BACKGROUND DATA AND METHODOLOGY

First edition of IRENA's global roadmap (2014)

The first study of worldwide renewable energy potential assembled from country plans and data, outlining how the world can double the share of renewables in the energy mix.

Comprehensive country repo (2014—)

Detailed studies – done in collabo ith countr outlining REmap analysis, the potentia applicable policy frameworks, with sugg recommendations to accele

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Ac n team working papers 5—)

ap action teams explore
g RE/EE*
renewable
energy efficiency

Further studies and tools

REmap has provided the analytical basis for IRENA's REthinking Energy and Renewable Energy Benefits reports, as well as Sustainable Energy for All Global Tracking Framework and G7, G20 and UNFCCC frameworks.

New product: RRA-REmap report

Regional analyses (2015—)

Detailed regional perspectives based on REmap findings.

Country background papers (2015—)

Concise analysis of specific issues, sectors and technologies in REmap countries.

Technology roadmaps for manufacturing, bioenergy and electricity storage (2014—)

In-depth technology and sector-based roadmaps featuring the technologies needed to enable the global energy transition.

REmap country analyses
Collaboration of IRENA and country experts

What is the RE outlook in government plans?

- Overall energy demand forecast
- Sectoral breakdowns
- Government targets for RE
- Share of RE in energy mix (in SE4ALL definition)

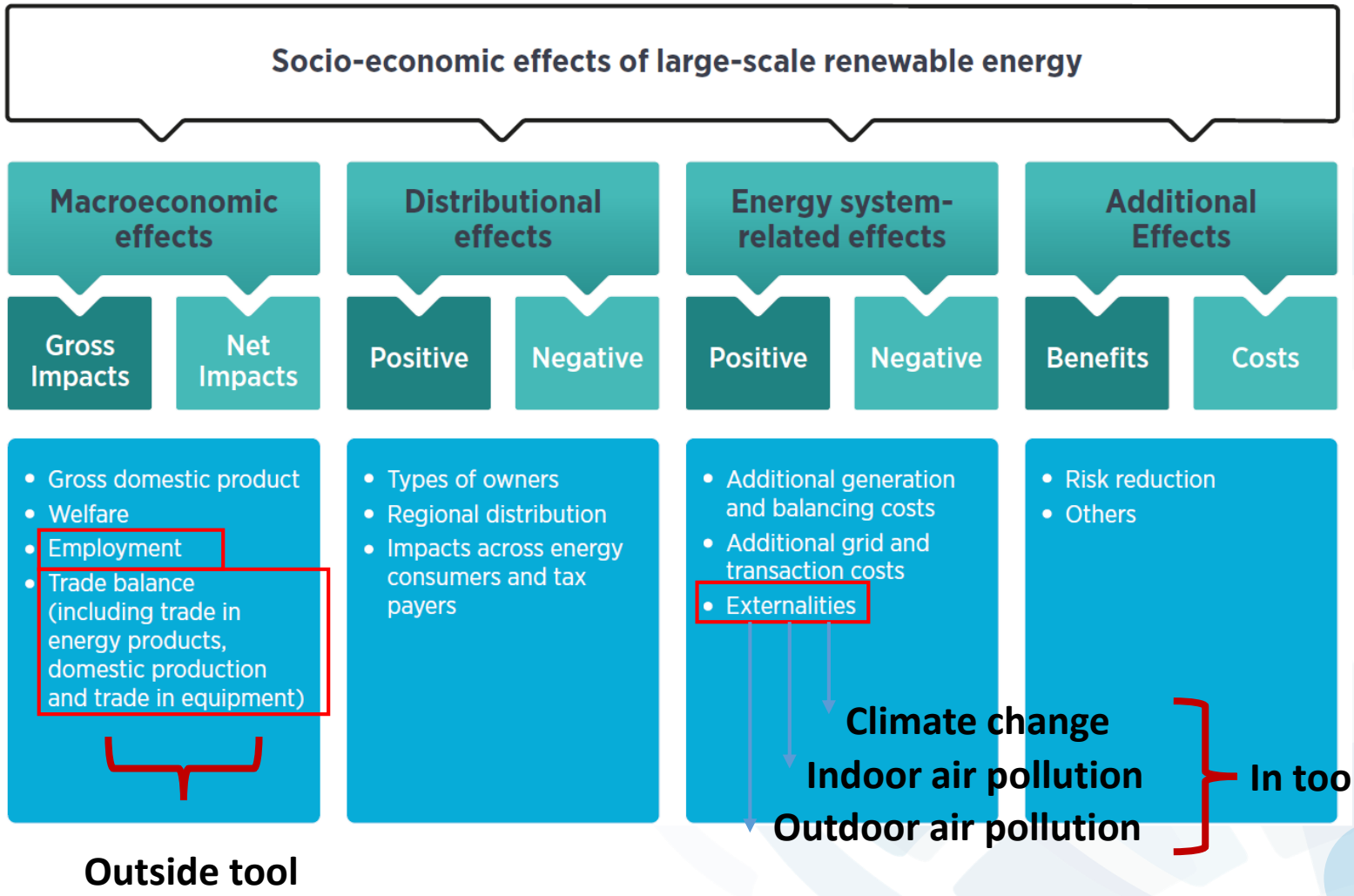
What are the costs and benefits of the RE options?

- Accounting for forecast energy prices, discount rates, technology costs
- Derive set of metrics, e.g. investment needs, substitution cost (per technology), net system costs

What are the additional RE deployment options?

- Accounting for RE resources in the country; realistic deployment potential
- Includes large number of technology options across sectors (power, DH, buildings, industry, transport)

Renewables have various socio-economic benefits



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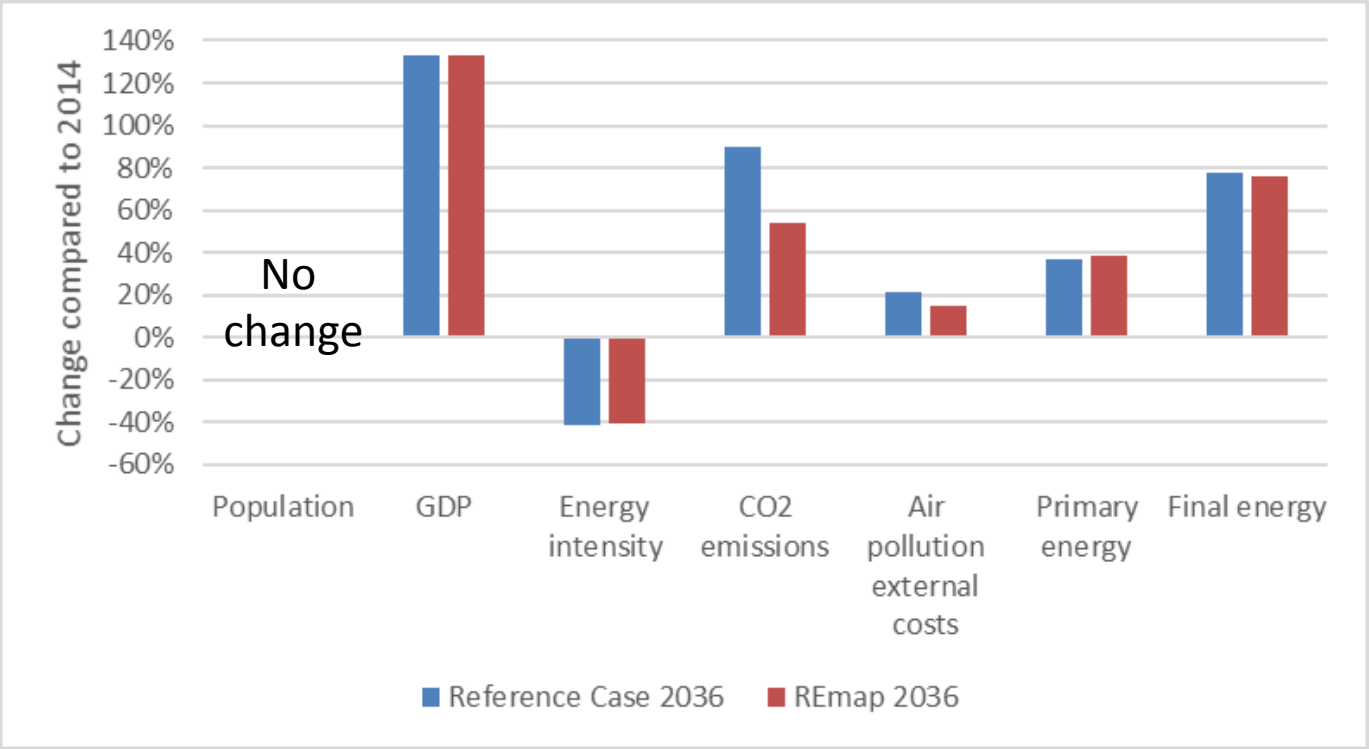
Key indicator changes between today and 2036

Growth in GDP coincides with growth in energy demand, CO2 emissions and air pollution

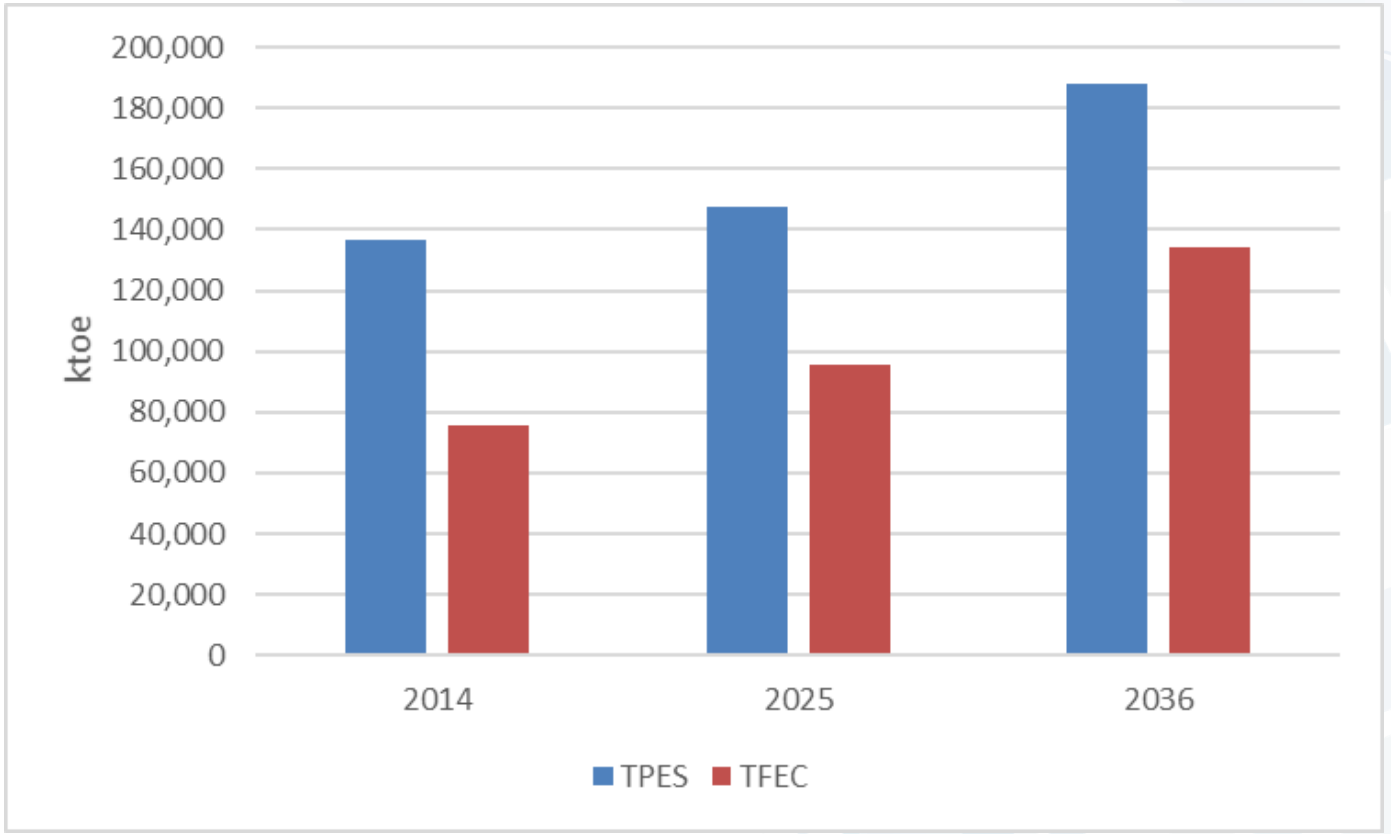


- Energy intensity does decline but overall GDP and energy growth outpaces improvements in energy efficiency

→ Additional improvements in energy efficiency are not considered in the analysis this is on reason why there is no change in energy demand between cases

Energy demand growth

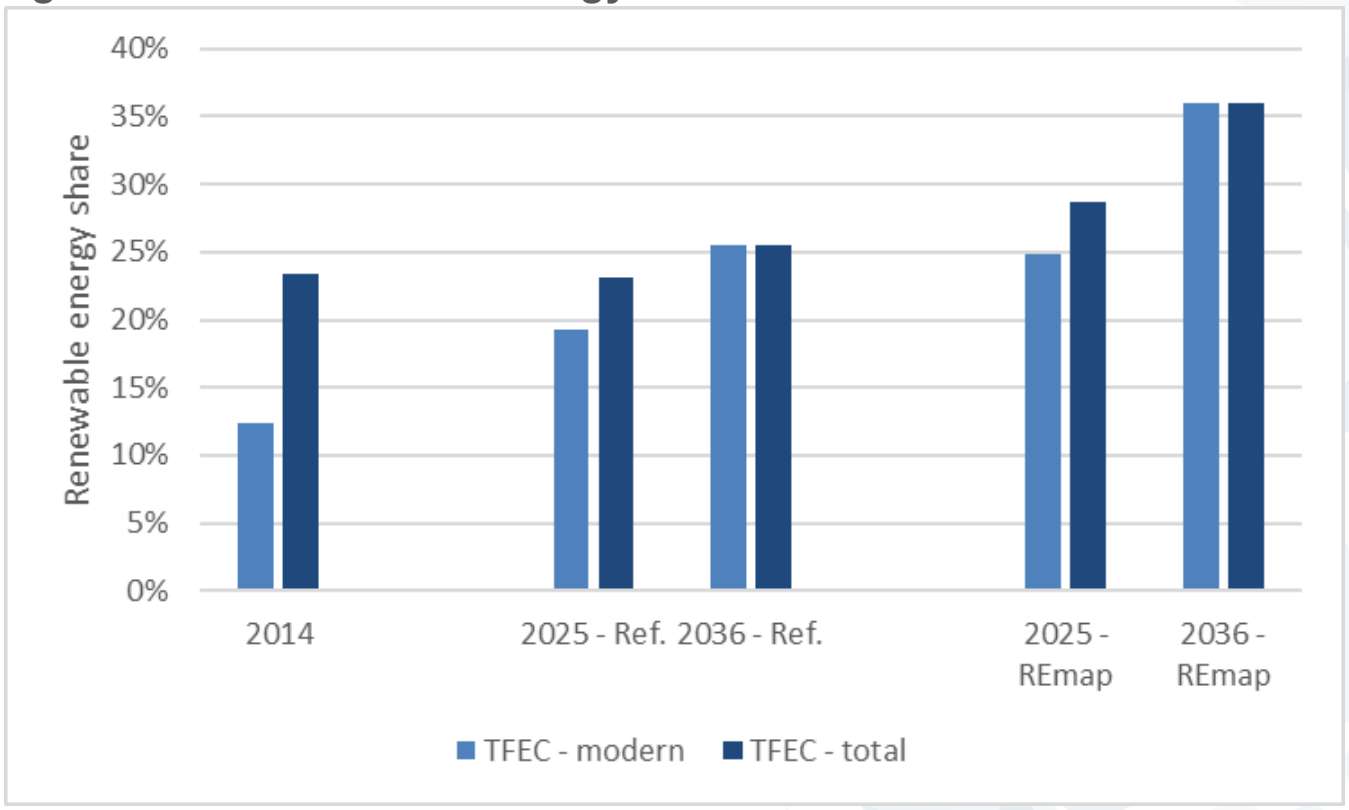
Strong growth in energy demand in both primary and final terms



- In TFEC largest growth in Industry (150%), followed by buildings (100%) and transport (30%)

Renewable energy shares in TPES and TFEC

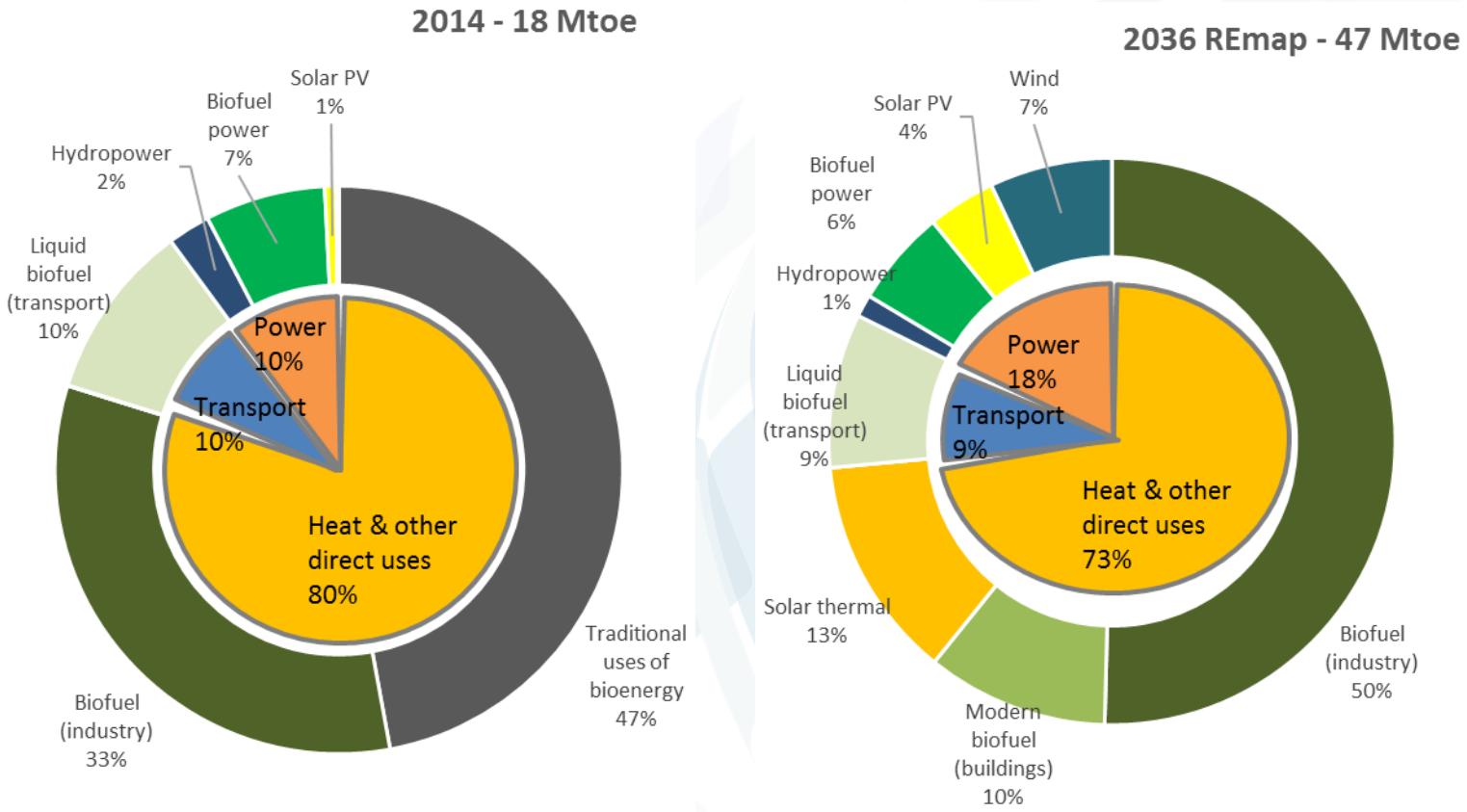
Renewable energy shares increase despite growing energy demand and falling use of traditional bioenergy



- Modern renewables share could increase to around one-third of energy demand by 2036, around a tripling over today's levels
- Shares in TFEC and TPES show similar trends and shares

Renewable energy consumption in TFEC

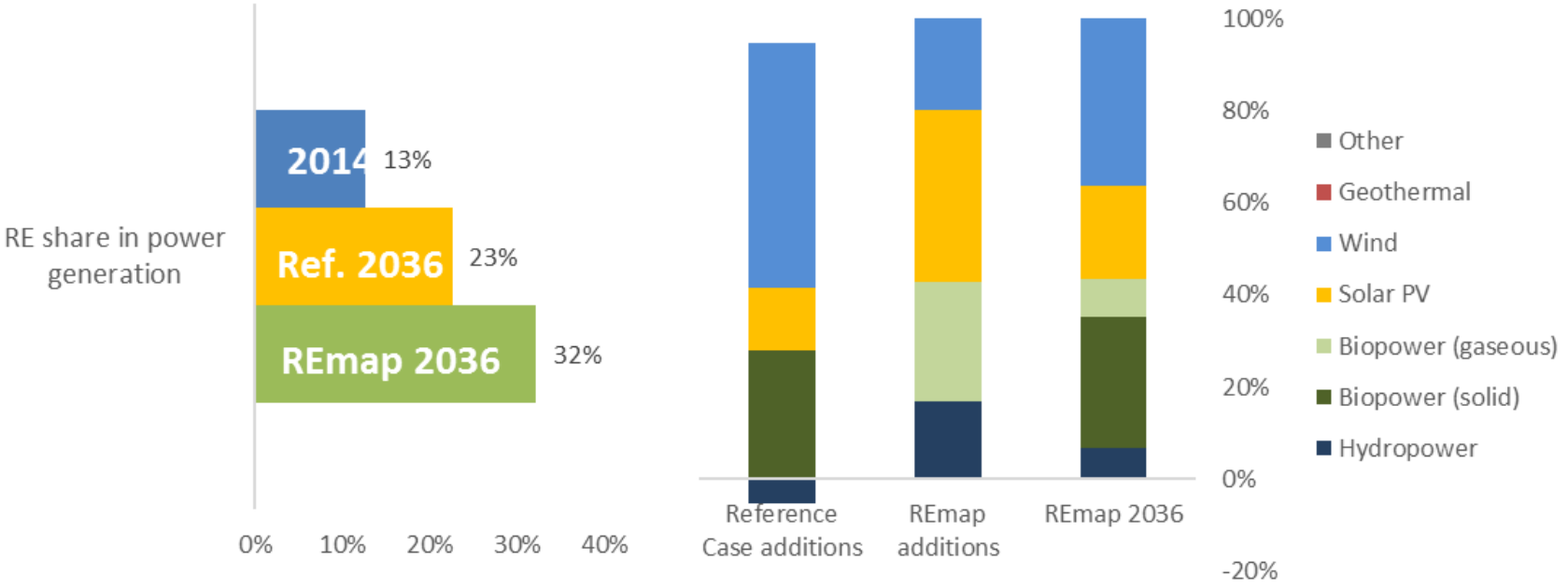
Fuel use for heat and other direct uses remains largest source of renewables, but relative importance of power sector increases



- Traditional uses of bioenergy see significant decline, and overall renewable energy consumption increases 2.5 fold

Power sector generation and shares

The renewable share increases 2.5 fold to almost one-third. Power generation increases from 175 TWh to over 350 TWh by 2036



- Solar PV, bioenergy based power, and wind all see similar increases in generation; hydropower generation declines in Reference Case

Discussion items

- The REmap 2036 power capacity deployments are more ambitions what are your perspectives on this?
- What is the main drivers for renewable power generation, is it costs, energy security, air pollution?
- How important are regional interconnections, what is their share of Thailand's installed capacity?
- Given these shares of variable renewable power generation of 20% and in capacity of 28% are there power system related concerns regarding adequacy and flexibility?
- Bioenergy
  - What are the main areas for growth for the significant increase in generation, what role does growth in bioenergy demand for industry and transport have in providing residues for power generation
  - Has most of the potential in large-scale industries like starch and palm oil been already exploited?

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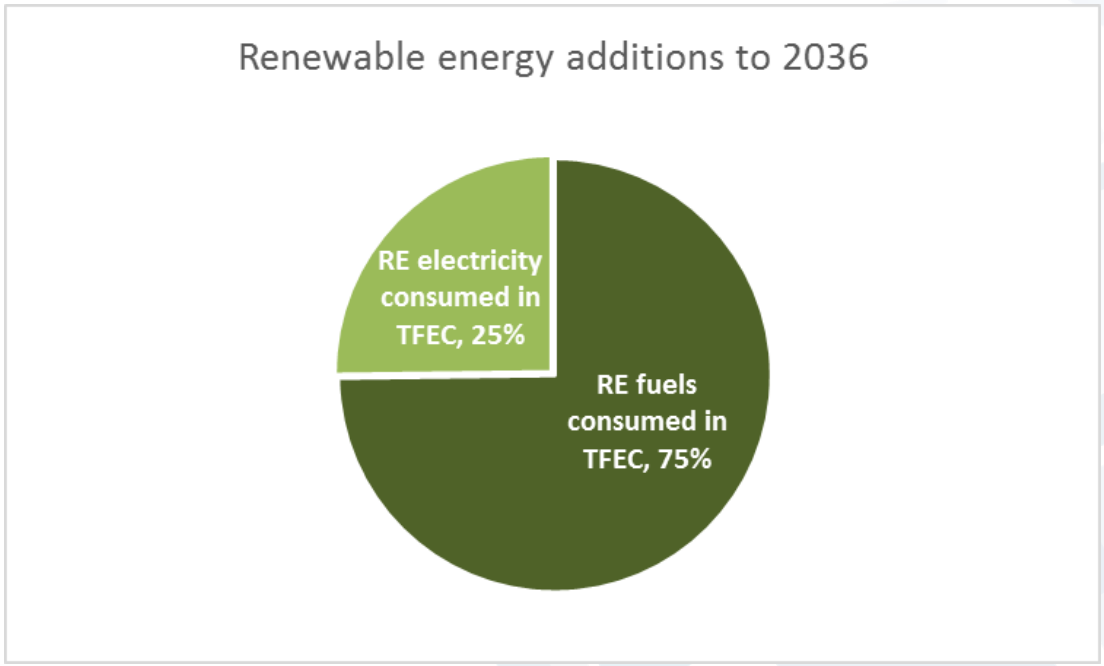
Importance of end-uses

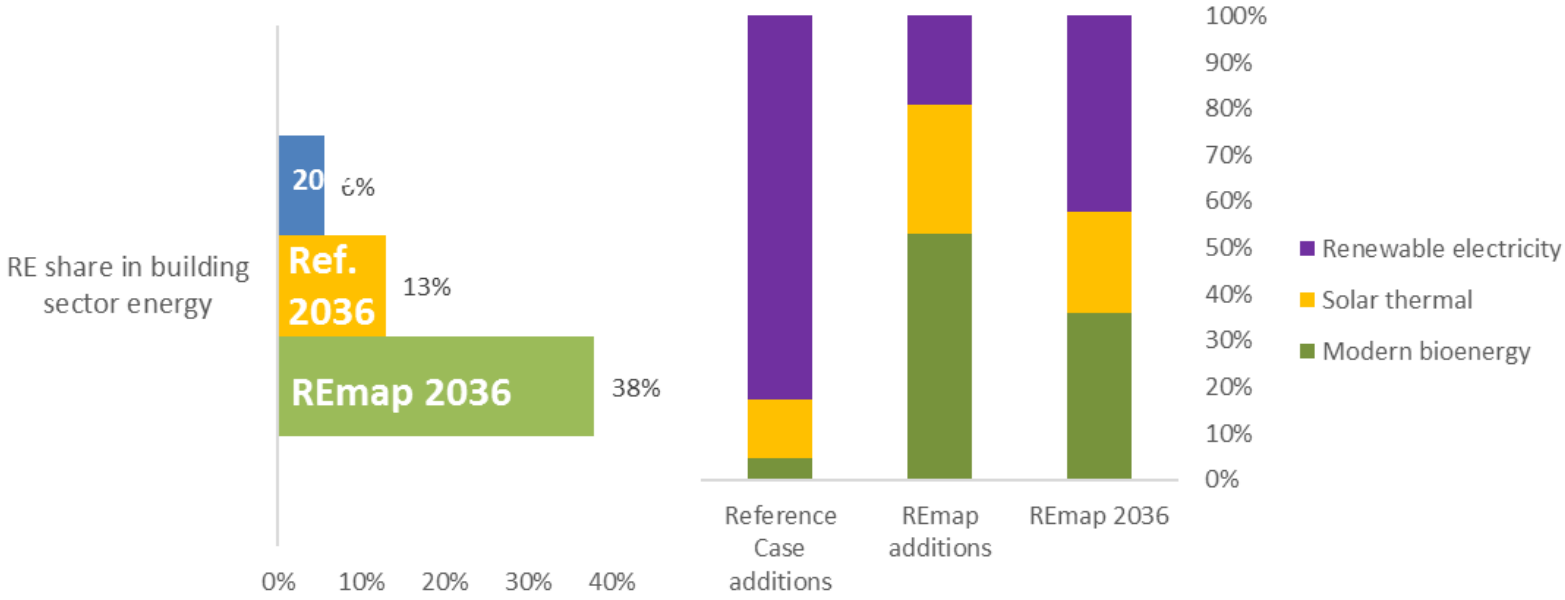
The end-use sectors are defined as buildings, industry and transport. They consume electricity, but also fuels and other direct uses of energy



- In both the Reference and REmap cases around three-quarters of the additions in renewable energy in TFEC was in the end-use sectors (fuels for heating, cooking, transport)
- TFEC emphasis fuels used in end-use as opposed to electricity
- These end-use additions are largely bioenergy, with some solar thermal

Building sector

The building sector sees the largest jump in renewable shares, largely due to replacement of traditional biomass but also growth in bioenergy and solar thermal



- Demand in the sector doubles
- Significant growth in electricity and oil products in the Reference Case
- REmap slows the growth in oil product with emphasis with bioenergy and solar thermal

Building sector – traditional uses of bioenergy

- The buildings sector account for a significant share of the bioenergy use in Thailand (over 40% in 2014)
- Solid biomass and charcoal for cooking in the residential sector prevail
- Estimates are unreliable though:

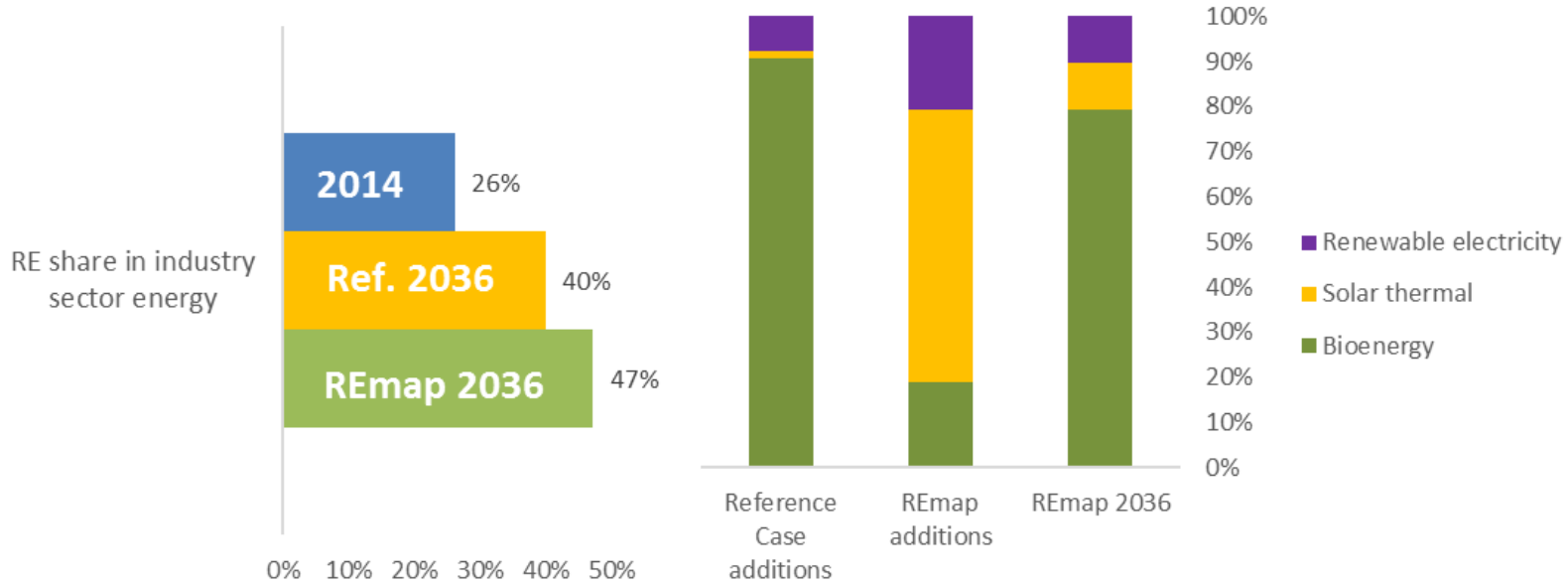
Source	Solid Biomass and Charcoal in the Residential Sector (PJ) in 2014
IRENA value (based on questionnaire)	348
DEDE	321 (2015)
IEA	280
FAO	141
IRENA Analysis based on WHO	289 – 323
IRENA Analysis based on GACC	250 – 441

Building sector discussion items

- A fair assessment of bioenergy use is essential, based on household surveys, in order to orient policy-making
- Alternatives to traditional uses include modern fuels, such as LPG, but importantly also electricity, biogas and clean cook stoves – longer term LPG is expensive and has price risks
- The use of clean cook stoves can significantly reduce indoor air pollution and there is a strong health argument for its adoption alone
- Solar thermal can provide 10% of sector energy demand, but this is significant growth over the Reference Case of around five times
- How to promote more sustainable cooling?

Industry sector

The industry sector sees the largest renewable share largely due to bioenergy use



- Demand in the sector growth the most – it more than doubles
- Significant growth bioenergy use in Reference Case (4x) and Coal (3x)

Industry sector

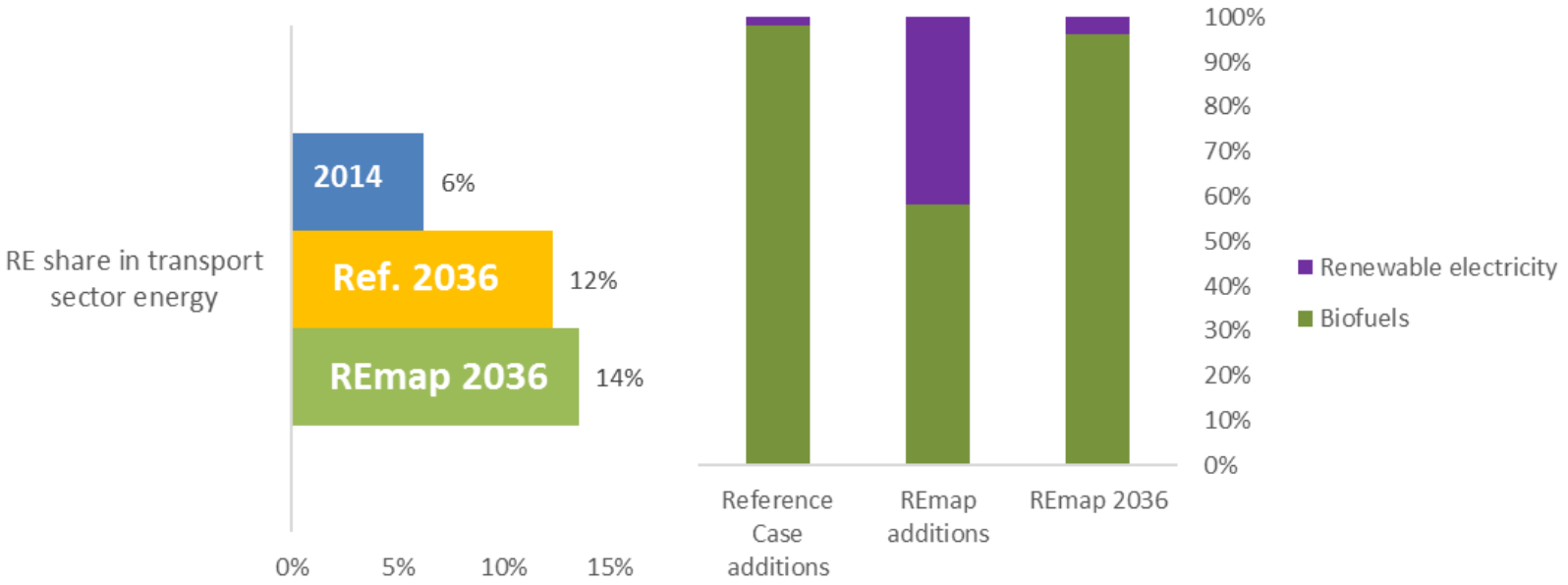
- Strong biomass-based industries, such as sugarcane (4th largest producer worldwide), cassava and oil palm, lead the way in tapping biomass resources
- Biomass is used to produce heat and power:
  - Resources include: process wastes and wastewaters;
  - Technologies include: steam cycle cogeneration, biogas production, boilers, biogas engines, etc.
    - Improving efficiency combustion of CHP also important, moving residues to centralized, efficiency, grid systems
- IRENA roadmap shows that solar thermal can provide low to medium-temperature heat in sub-sectors such as food processing but also pulp/paper and some chemical processes
  - In REmap around 5% of sector energy demand by 2036
  - Solar cooling also option, notably food (where duel use of heat possible as well)

Industry sector discussion items

- What are the low-hanging fruits and how much additional potential is there?
- Other biomass-based industries: Rice, maize, coconut, cashew nuts, rubber, etc.
  - Is there room for expansion in biomass deployment based on existing resources?
- Industries like cement, brick, ceramics, iron and steel, pulp and paper, etc. offer significant technical potential for biomass deployment, these sub-sectors have high temperature heat requirements that bioenergy or electricity can provide
- How are solar thermal solutions for low/medium grade heat developing?
- What about electrification, are there opportunities to use heat-pumps for lower temperature applications?

Transport sector

The transport sector has the lowest renewable energy share but a significant jump in share in the Reference Case



- Energy demand increases in the sector is modest, only around 30% increase, due in part to significant efficiency improvements
- The main driver is growth in liquid biofuels, but REmap starts to see increases in electric mobility

Transport sector – biofuels (1)

- The use of biofuels for transport has been promoted since the early 2000s and the AEDP intends to significantly increase that effort
- Two main biofuels for transport use have traditional been:
  - Bioethanol produced from sugarcane molasses (most important feedstock) and cassava starch
    - Molasses is a residue from sugar production, whereas cassava starch and palm oil are derived from dedicated crops. Supply of molasses may be limited by sugar output
  - Biodiesel produced from palm oil
    - existing oil palm area will need to be expanded
- The expansion of biofuel in the AEDP will require robust feedstock supply and expansion of production capacity

Transport sector – biofuels (2)

- Efficiency improvements in biomass conversion should be explored and promoted to ease the pressure on resource demand and capacity expansion
- The expansion of bioethanol and biodiesel also hinges upon increasing demand for biofuels in transport avoiding the "blend wall"
  - Bioethanol – 10-15% is the limit for blending with gasoline, Thailand E20 – that can be increased to 100% ethanol if adequate measures are taken (fully flex vehicles allow for market to determine blend rate)
  - Biodiesel – blending rates up to 20% are achievable, Thailand lower B8, but higher rates (up to 100%) are possible
- A key pathway is the promotion of lignocellulosic biofuels or other advanced biofuels that would ease pressure on resource demand – investments in R&D necessary to drive down cost

→IRENA has key innovation outlook for these advanced fuels

Transport sector - biomethane

- The AEDP is also promoting the use of compressed biomethane (Bio-CNG) in transport
- That is a new pathway that poses interesting opportunities, such as the displacement of diesel in trucks and machinery e.g. in agriculture; buses and fleet vehicles
- Some of the challenges include:
  - Feedstock supply and scale – Energy crops? Residues? Landfills?
  - Expansion of biogas upgrading capacity
  - Ensuring adequate distribution and retail networks, pipeline specs
  - Ensuring adequate market demand

Transport sector – electric mobility

- Electric vehicles are an emerging technology that provides an important link with the power system when coupled with variable renewables like solar PV or wind
- EVs are also a means to drive down levels of air pollution in urban areas
- The Reference Case sees 470,000 EVs (including BEV and PHEV) on the road by 2036
- REmap increases total EVs to 1,450,000 by 2036, representing just under 10% of the car stock, providing 15 GWh of storage capacity
- Electric two and three wheelers are also important in urban areas
  - Over 1,000,000 in the Reference Case, and 3,500,000 million in REmap

Transport sector discussion items

- The expansion of biofuel in the AEDP alone will require robust feedstock supply and expansion of refining capacity
- Consideration of creating flexible vehicles fleets to accommodate higher biofuel shares; how do blend rates and efficiency goals inter-relate
- Are biomass residues used in industry and power contingent upon significant increases in liquid biofuels in transport
- Advanced forms such as lignocellulosic biofuels are necessary
- Is biomethane a viable alternative, is there a use case in buses or fleet vehicles
- Electric mobility, will it happen in Thailand
  - Is the substantial automobile manufacturing industry interested
  - Does it provide a service to the power sector
  - How can charging and infrastructure issues be overcome

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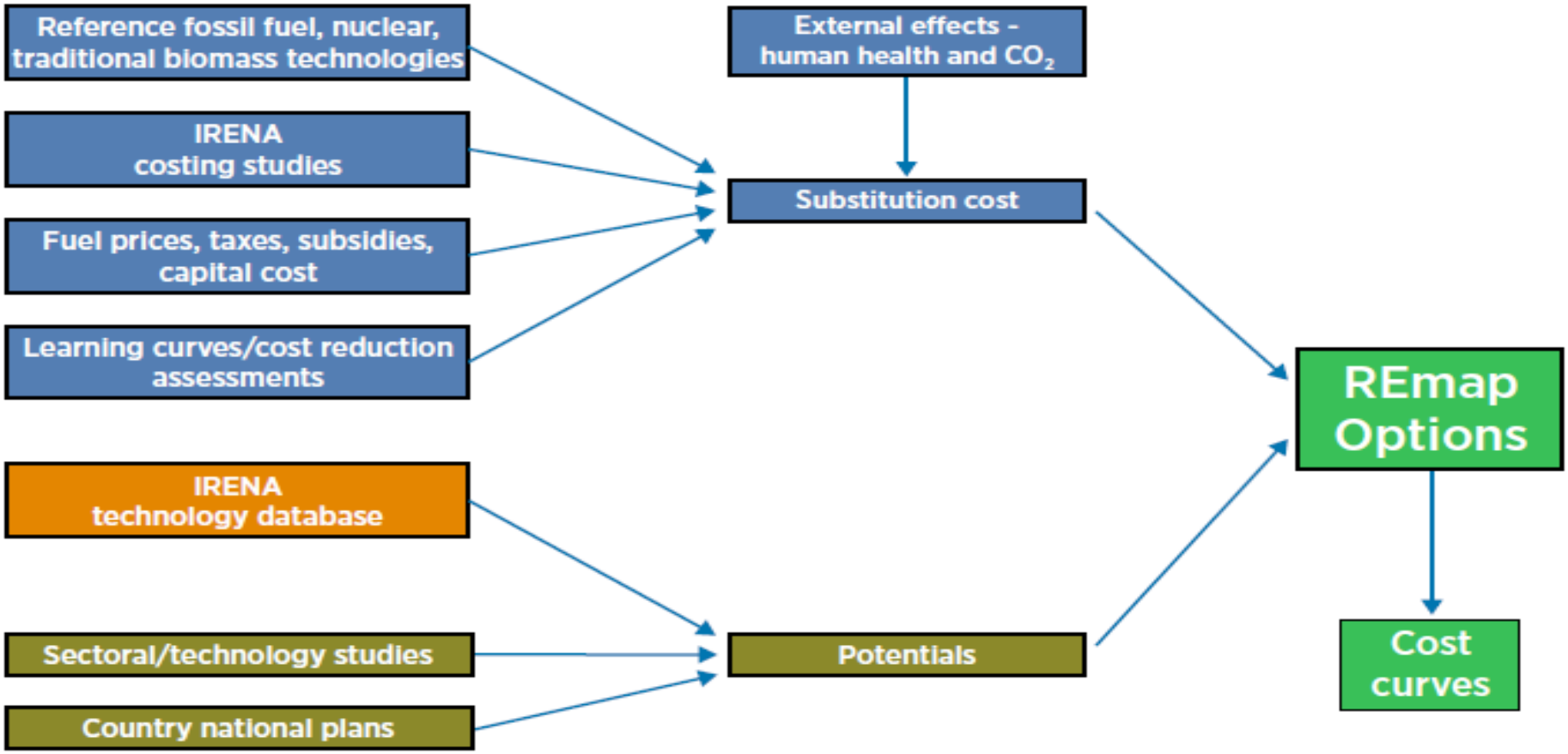
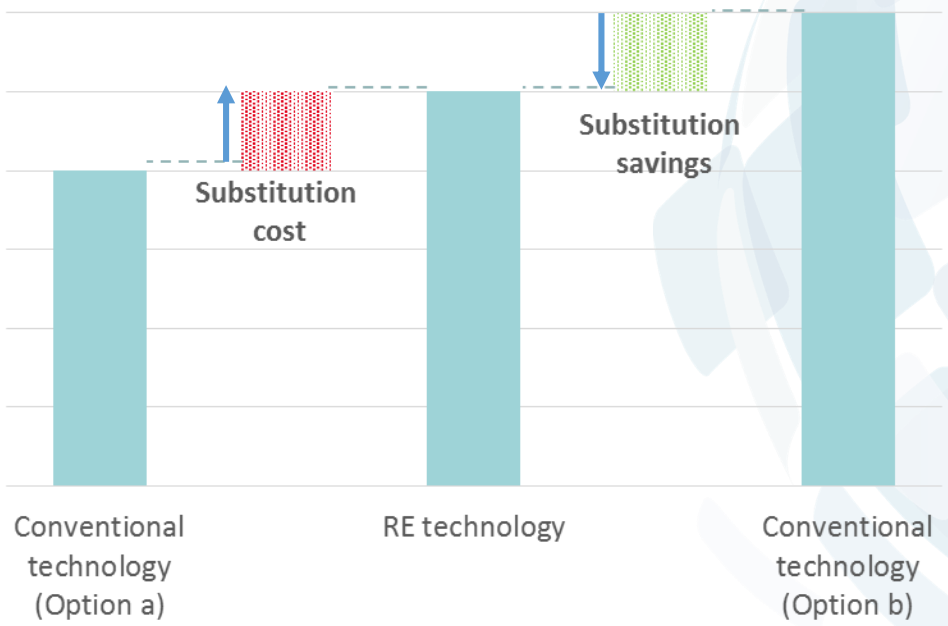
Inputs


Reference fossil fuel, nuclear, traditional biomass technologies
IRENA costing studies
Fuel prices, taxes, subsidies, capital cost
Learning curves/cost reduction assessments
IRENA technology database
Sectoral/technology studies
Country national plans
External effects – human health and CO_2
Substitution cost
Potentials
REmap Options
Cost curves

Substitution costs

- **Costs**
  - Based on levelised cost of heat, electricity generation and transport
  - For each REmap Option relative non-RE counterpart

REmap Option substitution and costs



1. **REmap Option**: energy contribution of selected RE technology
2. Substitution of equivalent energy consumption from a conventional technology

Costs/Benefits of REmap Options

- **Costs/Benefits and Investments**
  - Compares costs to benefits
  - Shows investment needs overall, by sector and technology

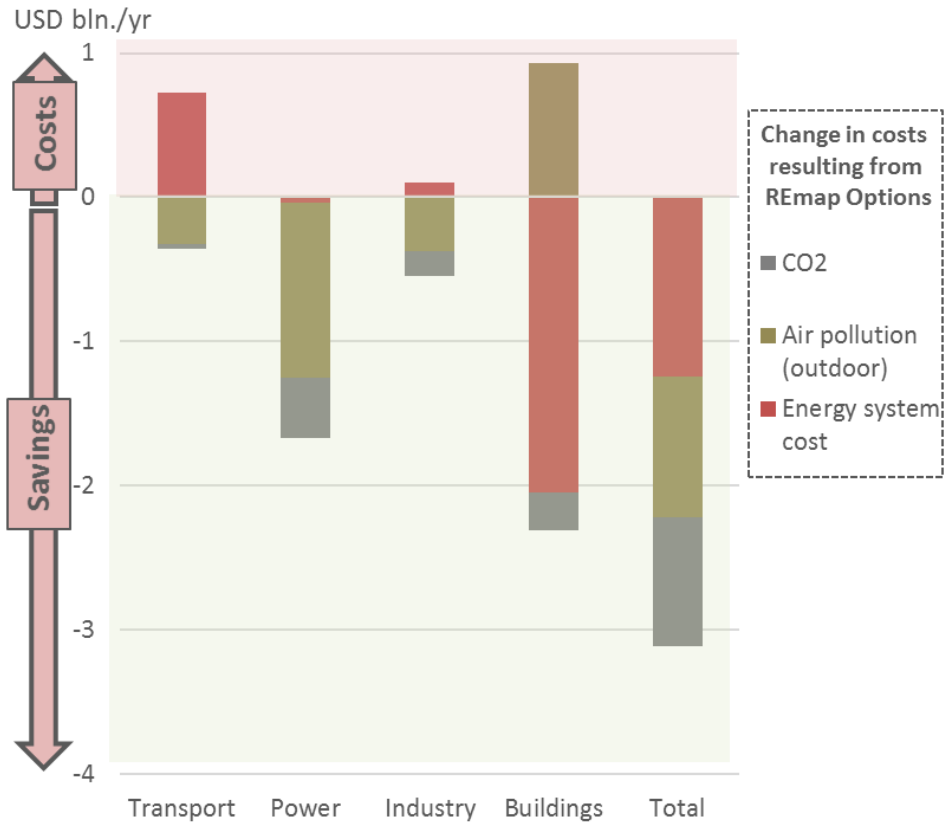
- **Climate change**
  - For carbon dioxide (CO_2) emissions only
  - Assuming a carbon price in 2030 of USD 17-80 per tonne CO_2

- **Air pollution assessed**
  - Five pollutants (SO_2, NO_x, VOC, NH_3, $PM_{2.5}$)
  - Indoor air pollution (traditional uses of biomass)
  - Outdoor air pollution (power generation, transport, industry, buildings)
  - Emissions from each sector by technology assessed
  - Damages of each pollutant by region based on ExternE adjusted by GDP for each country
  - Unit external costs (USD per tonne of pollutant) applied to fuel mix

Sector level costs

Overall the REmap Options result in a reduction of system costs in 2036 of USD -1.24 billion

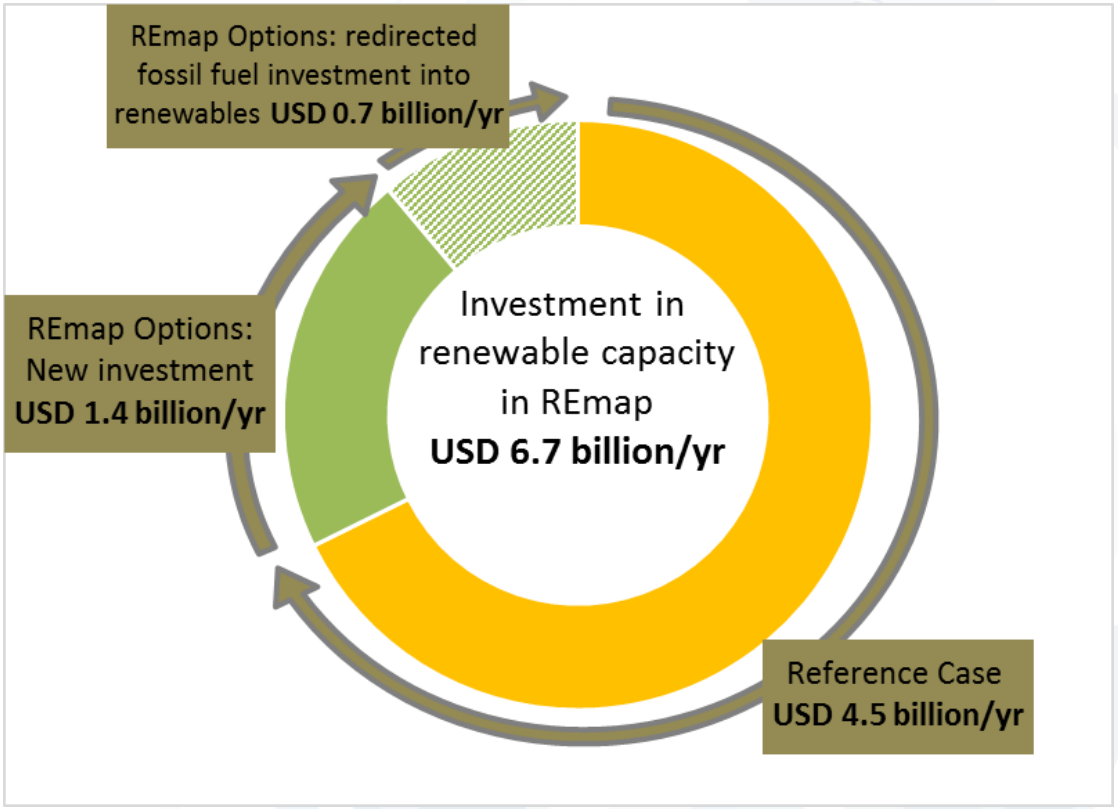
- Transport and industry have slightly positive system costs
- Reduction in air pollution results in significant health savings except in the building sector*
- Up to USD 3 billion in energy and external cost savings annually due to REmap options



Investments

Investment in renewable energy capacity would need to average USD 6.7 billion per year to 2036 to reach the renewable energy level identified in REmap

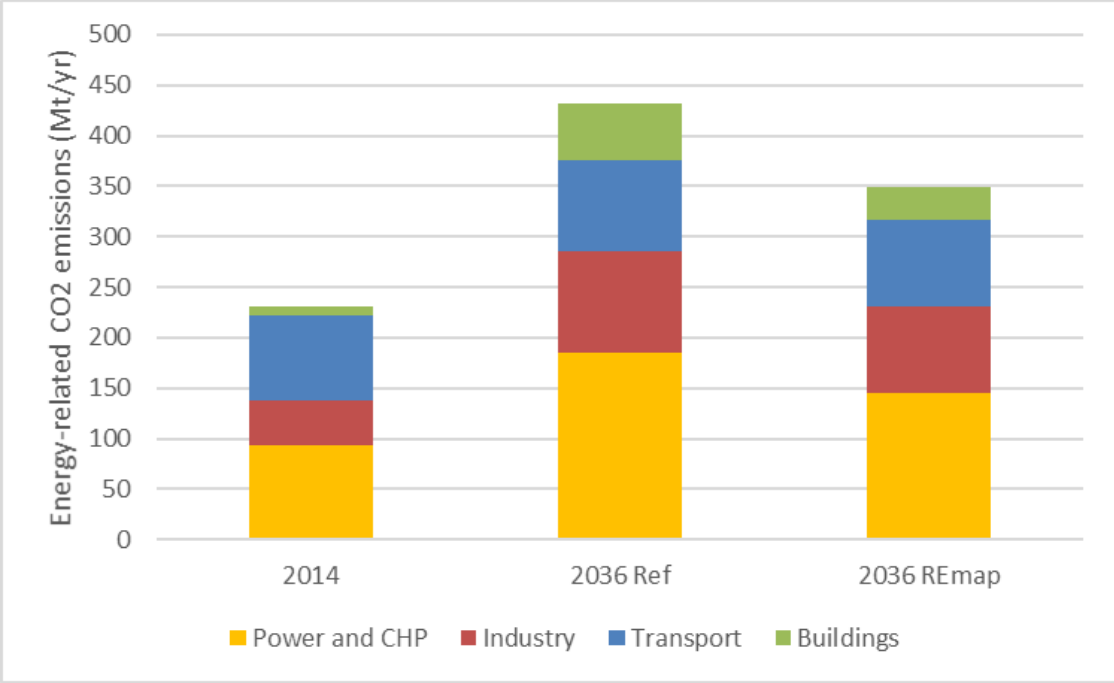
- Significant investment in renewable capacity already takes place in the Reference Case
- REmap Options would increase investment in renewable by about 50%, a third of which would be redirected investment from fossil and two-thirds new investment



CO2 Emissions

Energy-related CO2 emissions increase 90% in the Reference Case to almost 450 Mt/yr

- The REmap Options result in a decline of emissions by around 20% from the Reference Case
- Largest increases by sector include power and industry



For discussion

- Overall package of renewables result in savings, but on sector level there are differences
- How useful is a detailed cost-supply curve?
- Does the external cost assessment increase the case for deploying more renewables?
- What level of detail is helpful to understand investment needs?
- How important is mitigating CO2 as an argument?

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Bioenergy Uses – Four Main Pillars

2014 [PJ]	Buildings	Industry	Power	Transport	Total	Share
Solid Biomass	174	215	151	0	541	66%
Charcoal	174	0	0	0	174	21%
Biodiesel	0	0	0	46	46	6%
Biogas	0	22	8	0	30	4%
Bioethanol	0	0	0	28	28	3%
MSW	0	4	0	0	4	0%
Total	348	242	159	75	823	
Share	42%	29%	19%	9%		

Buildings – Biomass for Cooking

- A fair assessment of bioenergy use is essential, based on household surveys, in order to orient policy-making.
- Alternatives to traditional uses include modern fuels, such as LPG, but importantly also electricity, biogas and clean cook stoves – longer term LPG is expensive and has price risks.
- The use of clean cook stoves can significantly reduce indoor air pollution and there is a strong health argument for its adoption alone.

Transport – Liquid Biofuels

- The cost of biomass normally represents a high share of the total cost of liquid biofuel production, it could be as high as 80%. How to ensure that biomass resources will be available at affordable prices?

- Lignocellulosic biofuels are still an aspiration worldwide due to still high costs. Nevertheless short-term strategies could be pursued by using feedstocks already available in industry and building upon existing production capacity.

- Drop-in biofuels are also an aspiration, so the role of flex-fuel vehicles should be emphasized as opposed to blending mandates – avoiding the “blend wall” should be a central part of the policy.

Power / Industry – Solid Biomass Residues

- In both power and industry, the main challenge is to develop biomass supply chains that ensure reliable access to biomass at affordable prices – if the fuel is available at the right price and quality, industry will naturally shift.

- Clearly the highest potentials are in biomass-based industries, but most of that potential seem to have been explored. Is there room for further improvements efficiencies that could be promoted?

- If the low-hanging fruit has been picked, the next step is to tap biomass residues currently left in the field after harvest – What are the main barriers to make that happen? In particular, what can be done with sugarcane tops and leaves and rice straw?

Biogas and Biomethane

- Biogas is a versatile fuel that can be used to produce heat, power and, if upgraded, mixed with natural gas or used in transport.

- The use for heat and power is consolidated, but there may be further opportunities to be explored:
  - Expand to other substrates, such as vinasse in bioethanol distilleries.
  - Promote the improvement of conversion efficiencies of existing plants.

- The use biomethane is new – experiences in other countries show that biomethane is more likely to be successful in two cases:
  - When biomethane can be mixed with natural gas – which requires existing natural gas infrastructure
  - When biomethane is used in captive fleets – a new and promising field would be to use biomethane in agricultural operations in replacement of diesel in flex-fuel diesel engines

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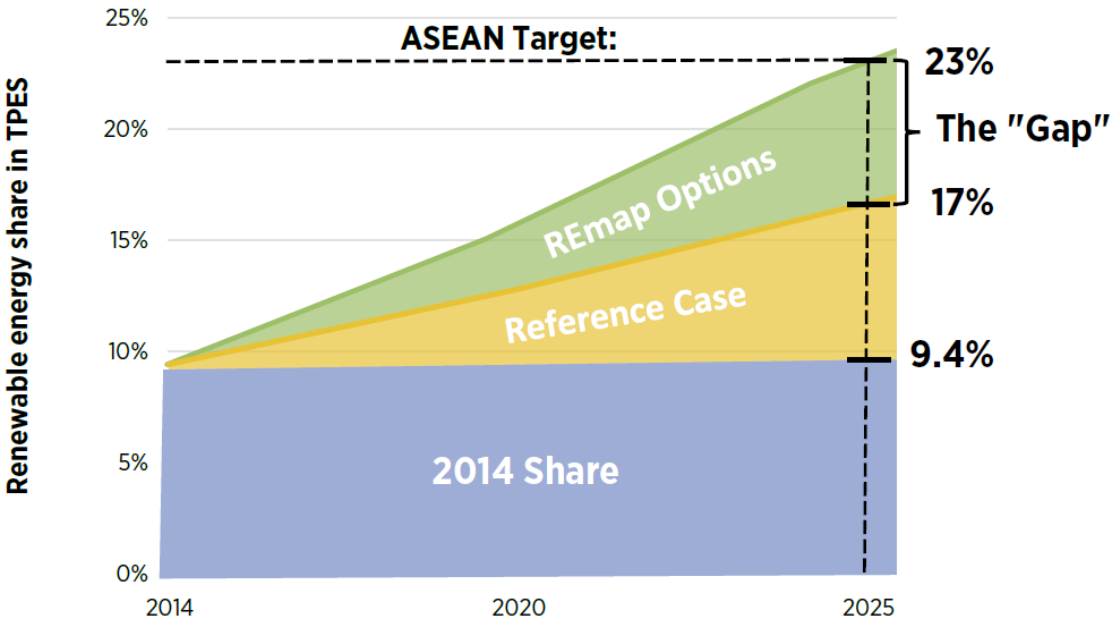
ASEAN's 23% aspirational renewables target

Set forth in October 2015 as part of ASEAN Plan of Action for Energy

Cooperation

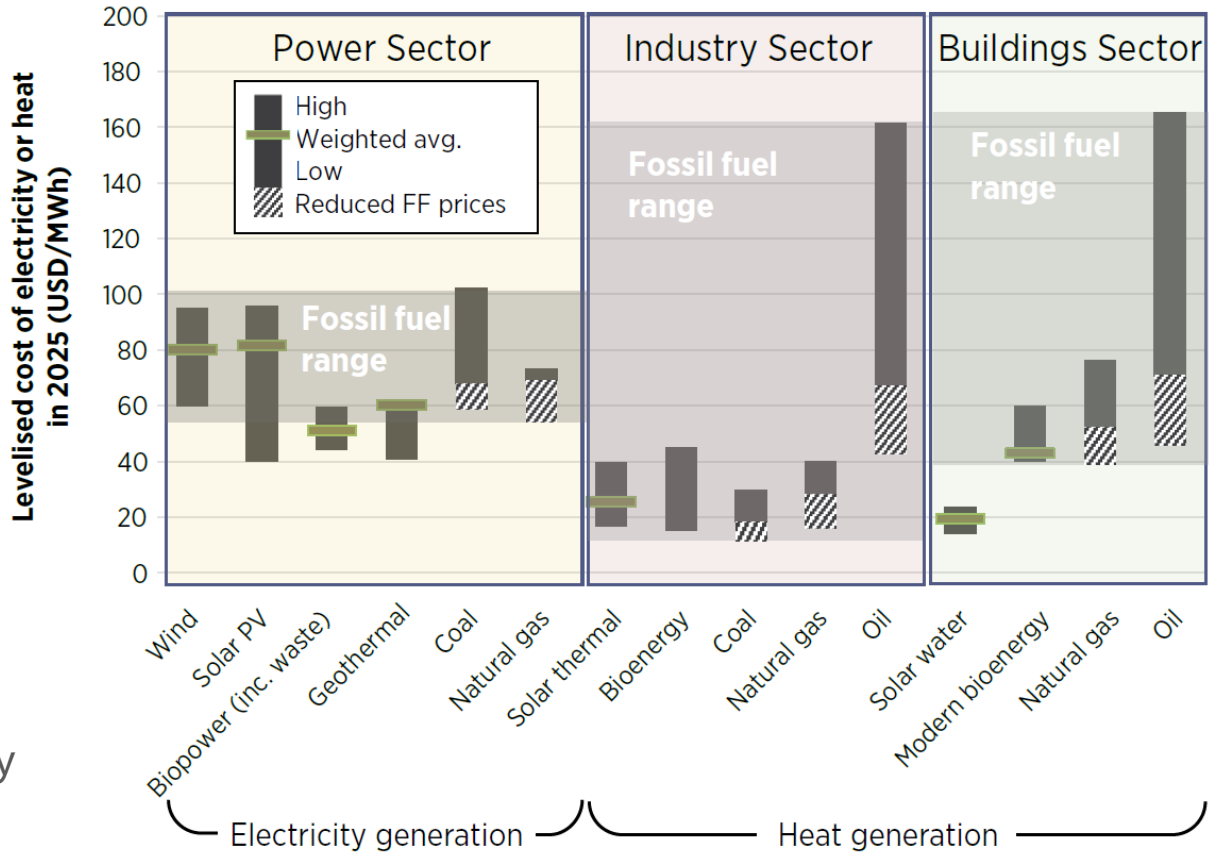
- 23% renewable energy share[1)] in total primary energy supply (TPES) by 2025
- ACE Energy Outlook (2015):
  - **2014 – 9.4%**
  - 2025 BAU – 10%
  - 2025 Advanced Policy Scenario (APS) – 15.4%
- IRENA Reference Case – **16.9%** (APS + latest country updates)
- **6%** point gap to the 23% target



1) excluding traditional uses of bioenergy, including all hydropower

Drivers for a renewable revolution in the region

- The region has some of the best renewable energy resources in the world
- Renewable energy is becoming increasingly cost-competitive:
  - Declines in the costs of renewable energy technologies
  - Increasing costs from import price volatility
- Health benefits, improved wealth distribution, especially in rural areas
- Renewable energy drives economic activity & creates employment



Note: reduced fossil fuel (FF) prices assumes lower average commodity prices for fossil fuels for coal (-10%), natural gas (-20%) and oil (-30%)

High-level action areas

ACTION AREAS FOR ENABLING ASEAN'S RENEWABLE ENERGY POTENTIAL

Accelerating the deployment of renewable energy technologies must take national circumstances into account. There is therefore no single set of solutions suited to the needs of the entire ASEAN region. Suggestions can, however, be grouped broadly into four areas:

1 **Action area 1:** increase power system flexibility in the ASEAN region while using renewables to provide modern energy access for all

2 **Action area 2:** expand efforts for renewable energy uptake for the power sector and for heating, cooking and transport sectors

3 **Action area 3:** create a sustainable, affordable and reliable regional bioenergy market

4 **Action area 4:** address the information challenge by increasing the availability of up-to-date renewable energy data and the sharing of best practice for renewable energy technologies

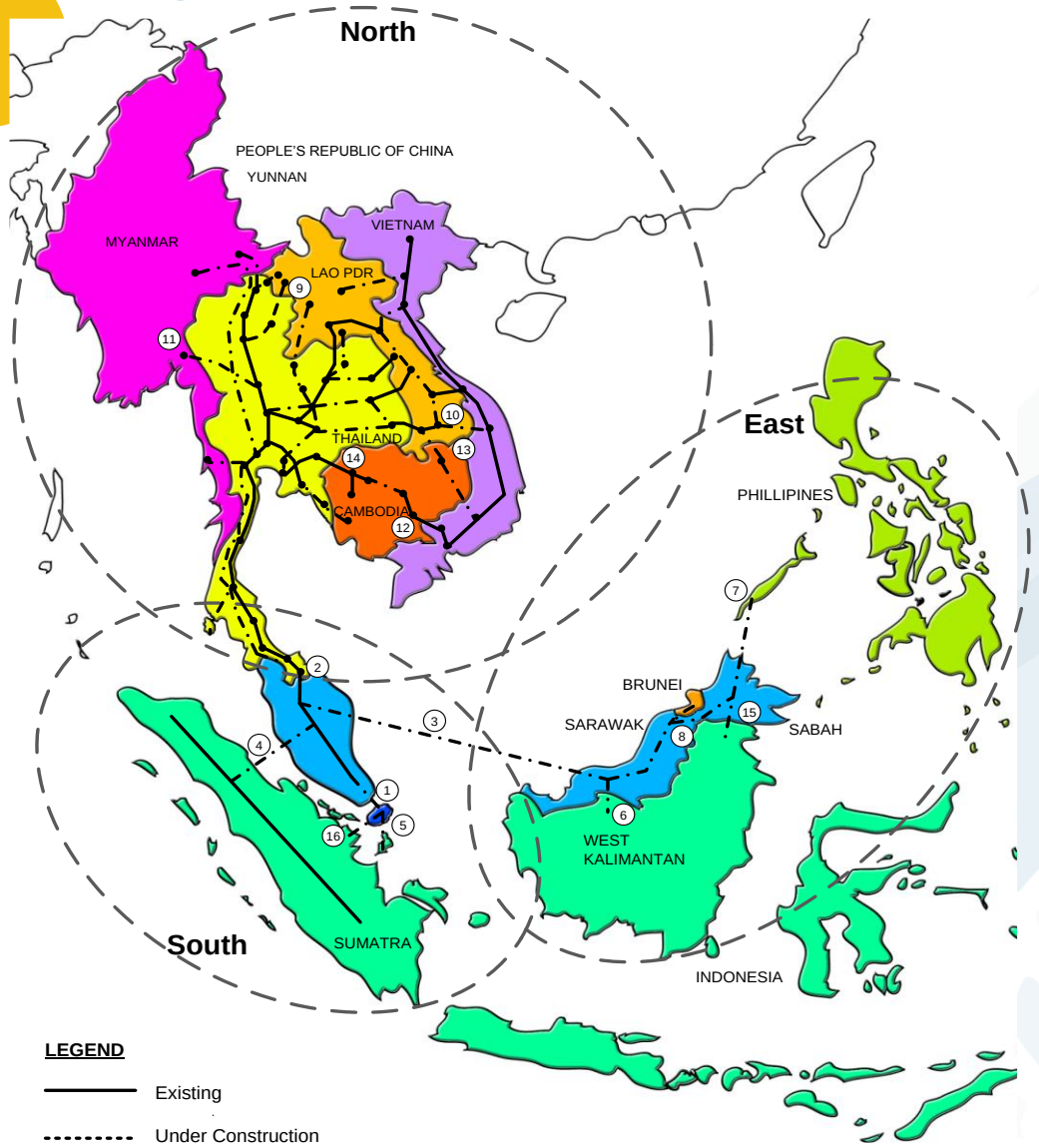
REmap
A Renewable Energy Roadmap

IRENA
International Renewable Energy Agency

Regional context

ASEAN Power Grid

#REmap



Key highlights on Thailand

Cross-border transmission capacity could total to approx.22,000 -25,000 MW by 2025

Breakdown:

- Thailand – Laos: 7,328 MW
- Thailand – Myanmar: 11,709-14,859 MW
- Thailand – Cambodia: 2,300 MW
- Thailand – P. Malaysia: 780 MW

National v.s. Regional Approach

- If APG is realised as planned, what would it mean to the AEDP and PDP?
- Would it be better off if a joint effort can be made at the regional level? Such as knowledge sharing or regional market development/expansion?
- What would be the opportunities that the ASENA RE target would create for Thailand, given Thailand's leading position in the region on RE development?

IRENA
International Renewable Energy Agency

REmap

ROADMAP FOR A RENEWABLE ENERGY FUTURE