

ROADMAP FOR A RENEWABLE ENERGY FUTURE



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International Renewable Energy Agency – IRENA

MANDATE

- » To promote the **widespread adoption** and sustainable use of all forms of **renewable energy worldwide**

OBJECTIVE

- » To serve as a **network hub**, an **advisory resource** and an authoritative, unified, **global voice for renewable energy**

SCOPE

- » **All renewable energy sources** produced in a sustainable manner



KEY FACTS

- » Established in **2011**
- » Headquarters in **Abu Dhabi, UAE**
- » **IRENA Innovation and Technology Centre (IITC) – Bonn, Germany**
- » Permanent Observer to the United Nations – New York



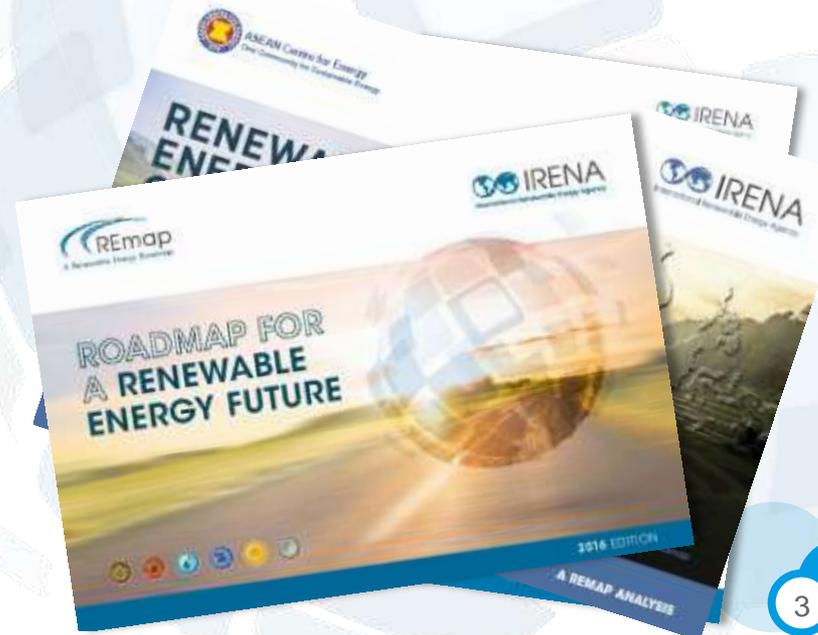
● **151 Members**

● **29 States in Accession**

REmap

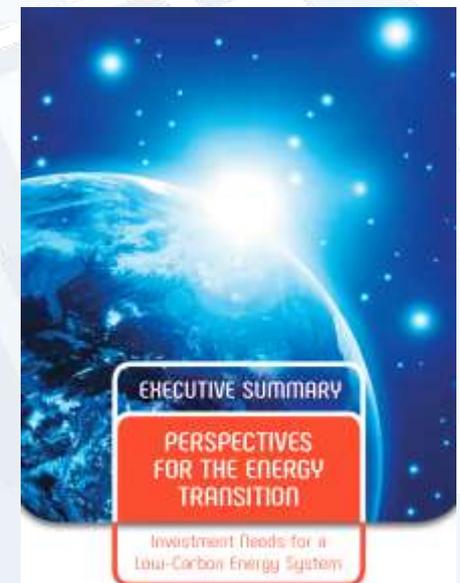
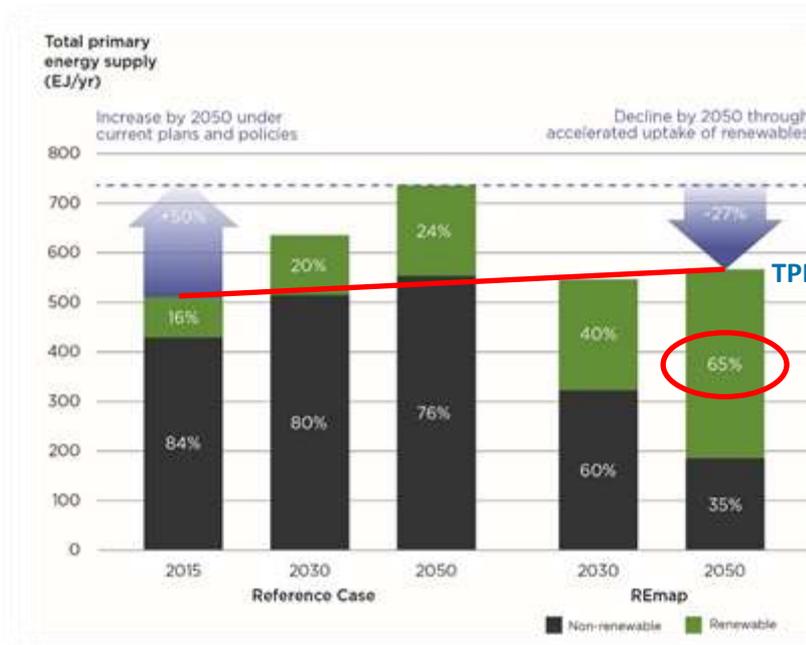


- » IRENA's **Renewable Energy Roadmap**
- » Shows feasible, cost-effective ways to **increase renewable energy deployment** in world's energy mix
- » **Support the G20** in determining pathways for operationalising Paris Agreement with decarbonisation scenarios analysis to 2050, report released in March, 2017
- » Identifies concrete **technology options** for countries and sectors
- » Assesses policy and investment **implications**
- » Outlines **benefits** (economic, social, environmental)
- » In cooperation with **70 countries**
- » **40 publications** to date and datasets including country reports and sector studies



G20 Energy transition action agenda

- » The comprehension analysis of the energy transition and its effects on climate change, air pollution and economic aspects.
- » View to 2050, with joint IRENA-IEA report released in March, and IRENA reports on Innovation (June), Stranded Assets (July) and RE/EE Synergies (August)



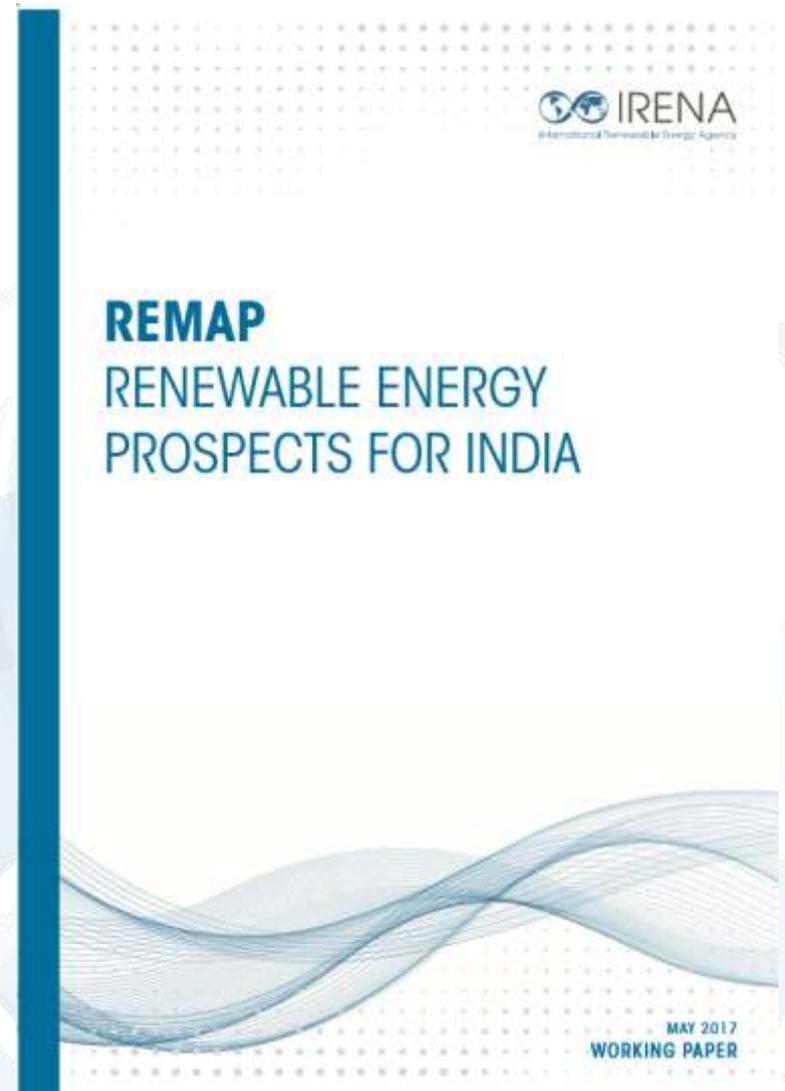
- » Reaching energy-related CO₂ emissions below 10 Gt/yr by 2050 will require an increase of about **1.2%/yr in renewables' share** between 2015-2050
- » This represents a **seven-fold growth** compared to 0.17%/yr in 2010-2015

IRENA's engagement with India

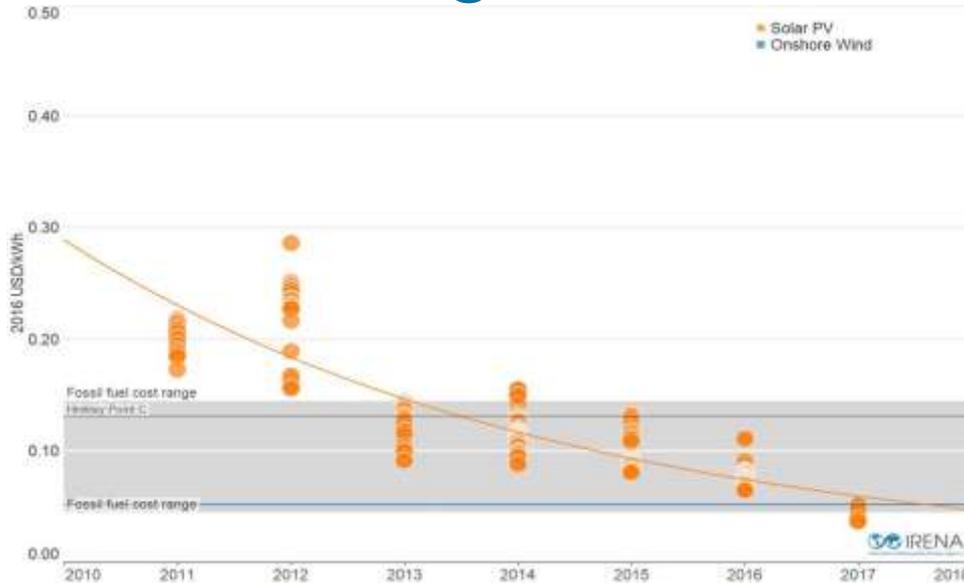
- » **REmap – Renewable energy prospects for India 2030 (2014-2017).**
- » **Electricity Storage:** Technologies, regulation and policies supporting small- and large scale deployment of renewables **workshop**, *3 December 2014, New Delhi.*
- » IRENA was in close collaboration with incubation centres in India (**SELCO Foundation, Centre for Innovation Incubation and Entrepreneurship(CIIE)**) to facilitate **knowledge sharing** between entrepreneurs in Asia and Africa, *22-27 September 2014, Bangalore.*
- » **Policy analysis:** Predominant focus of India on IRENA's auction work - *IRENA (2017), 'Renewable Energy Auctions: Analysing 2016. IRENA, Abu Dhabi.*
- » **Socio-economic benefits:** Contributions to IRENA's annual renewable energy jobs analysis from collaboration with Council for Energy, Environment and Water etc., *IRENA (2017), Renewable Energy and Jobs - Annual Review 2017, International Renewable Energy Agency, Abu Dhabi.*

REmap India

- » **10th REmap country report**
- » Collaborative process with Indian government(**Ministry of New and Renewable Energy (MNRE)**) in 2015 & 2016
- » In collaboration with **Council On Energy, Environment and Water (CEEW)**
- » Full report **launched in May 2017**

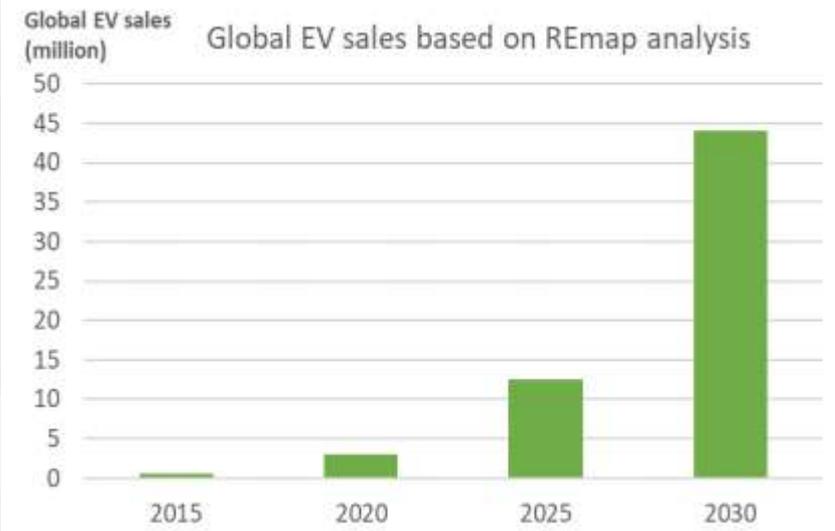


Global insights – Renewable Energy

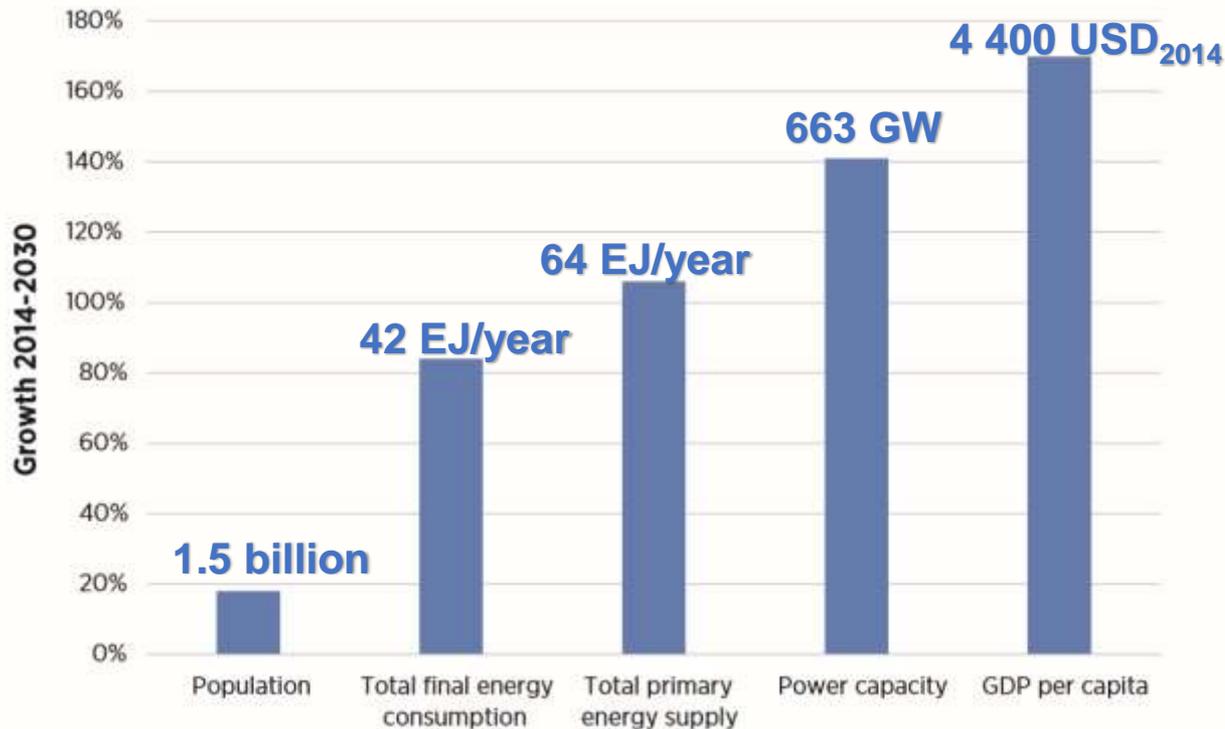


- » Dropping solar and wind power purchase agreement prices (0.03-0.06 USD/kWh by 2017)
- » Rising deployment.

- » Uptake of **Electric mobility** to increase renewables share in transport.
- » Research & development in innovative technologies (**floating wind turbines, CSP with storage**)
- » High involvement in **climate change mitigation actions plans** (Paris climate agreement)



Key economic and energy drivers – growth by 2030



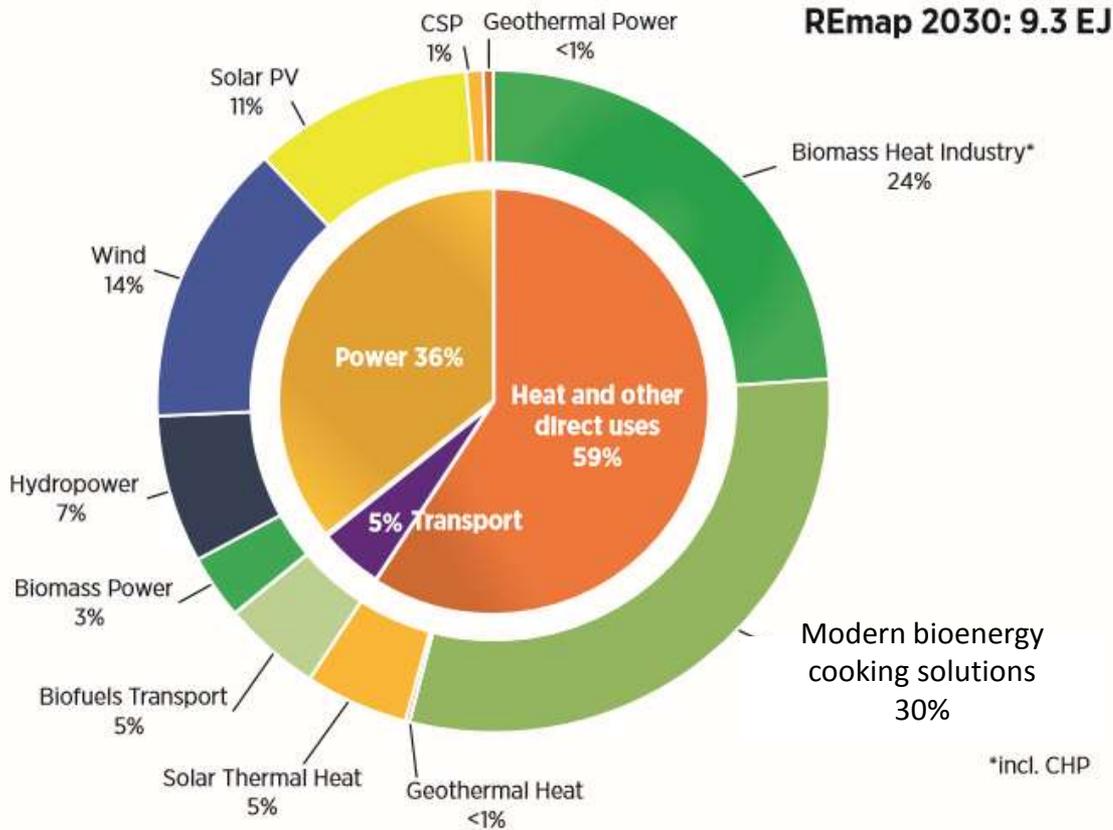
By 2030, total primary energy supply will grow by over 100%, while electricity capacity will increase 140%.

Reference Case – fossil fuels meet most new demand

- » The Reference Case - based on the estimates from **the Planning Commission and the CEEW**
- » With **accelerated growth in Renewable power generation growth**, even faster increases are expected in the **use of coal for industry, natural gas in residential and commercial buildings, and oil in transport**
- » India's demand for **coal is set to triple** by 2030
- » **Modern renewables share** could **decrease** from around **17% to only 12%** of India's total energy mix by 2030
- » A large share of energy demand to be supplied by imports, **increasing energy security risks** and growing reliance on coal imports adding to India's existing **import dependency for oil and gas**

	Reference Case 2030
Power generation	18%
Industry	11%
incl. renewable electricity	12%
Transport	2%
incl. renewable electricity	2%
Buildings (excl. trad. biomass)	15%
incl. renewable electricity	16%
TFEC - modern	12%
TFEC - incl. traditional biomass	23%

REmap - accelerated renewables deployment by 2030



- » **9.3 exajoules (EJ)** – equivalent to 222 million tonnes of oil or a **quarter of the country's total final energy demand**
- » **Various forms of biofuel** – for transport, electricity generation and heat – **62% of RE use**
- » **Solar** (both photovoltaics and thermal), at **16%**, represent the **second largest source of renewable energy use**, followed by **wind at 14%**, and **hydropower at 7% of total RE use**

India could become the fourth largest renewable energy market worldwide (9% of total global final renewable energy use by 2030)

Renewable energy in India by 2030

>> **REmap case** increase the renewable energy share to **25% in 2030**. **REmap + EE Case** further increases the **RE share by 5%pt of TFEC**.

>> **Renewable power** will maintain its strong growth in the Indian market reaching **35% share of generation**, and **60% share of power generation capacity**.

- Variable renewable electricity (such as solar PV and wind): 20% of total electricity generation, and 45% of installed power capacity in REmap.

>> **23 million electric four-wheeled vehicles** (11% of global) and **300 million electric two-and-three wheelers** (1/3rd of global) on the road by 2030 (30% penetration of battery electric two to-three wheelers, 20% of four-wheel battery electric vehicles (BEV) and 18% of public electric buses).

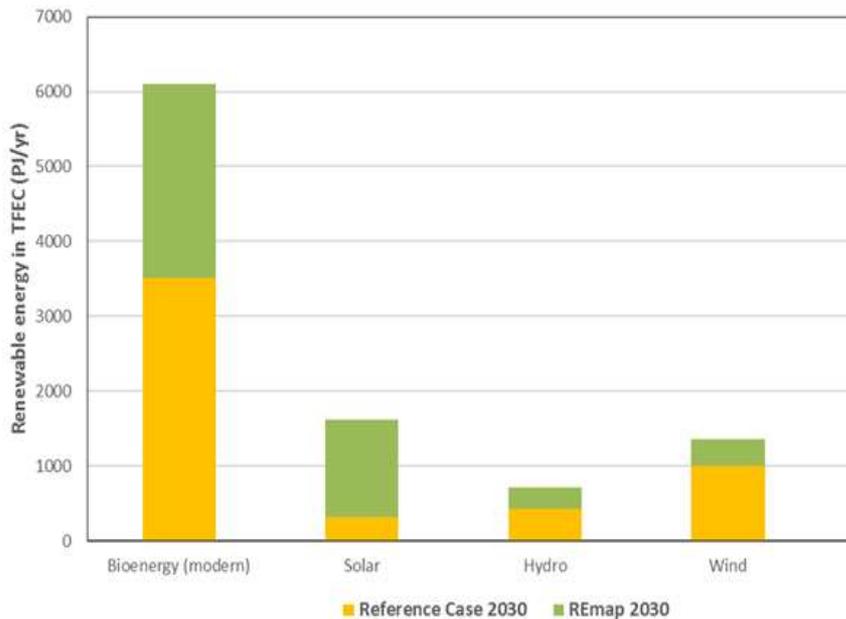
>> Renewable energy increases **0.9%pt annual energy intensity**.

	Base year 2010	Reference Case 2030	EE 2030	REmap 2030	REmap + EE 2030
Renewable energy share (% of TFEC) *	39.9	22.2	26.1	25.9	30.9
Annual rate of energy intensity improvement 2010-30 (%/yr)	2.4 (1990-2010) ^a	1.3	2.0	2.2	3.0

* including traditional biomass

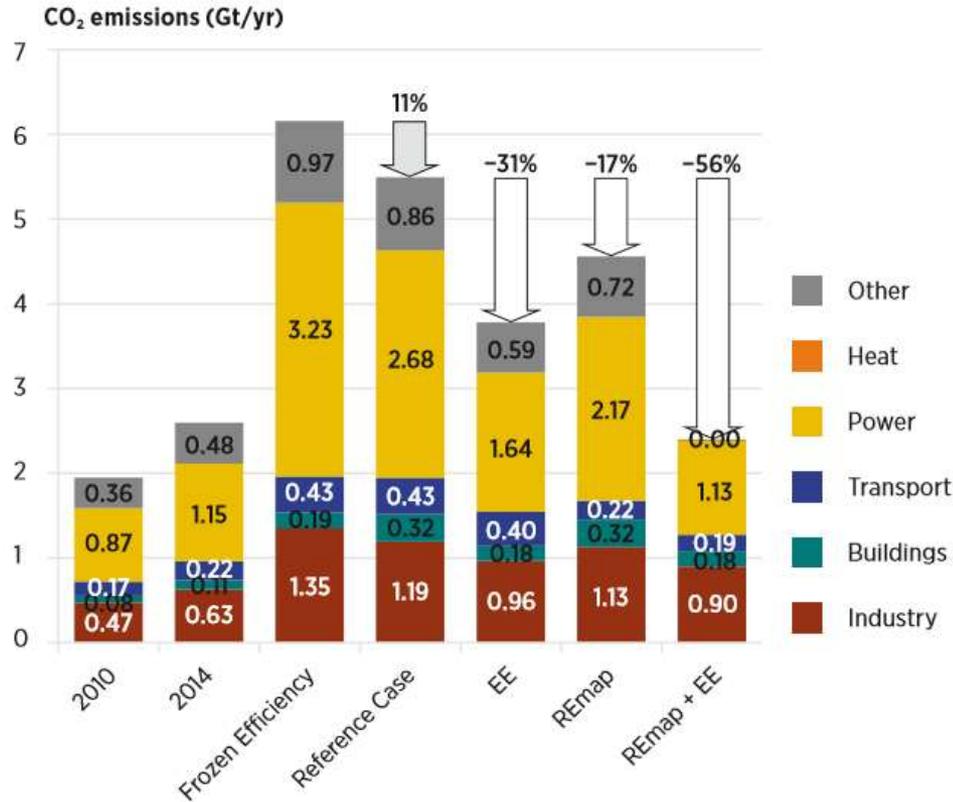
REmap - key results

- >> The share of **modern renewable energy in India's TFE** increases to **25% in REmap**, more than double the 2030 Reference Case level of 12%.
- >> **Renewable energy's share in power generation** increases to **35% in REmap**, compared to **18% in the Reference Case**
- >> **In REmap 13% of transport fuel comes from biofuel**, and the share climbs to 16% including renewable electricity.
- >> **The building sector's modern renewable energy share almost doubles to 39% in REmap**, driven by the modern use of biomass and solar thermal
- >>The various forms of **bioenergy** make up the **largest type of fuel used in end-use sectors.**



	REmap 2030	Total renewable energy use (EJ/yr)
Power	35%	3.4
Industry	15%	2.4
incl. renewable electricity and district heat	19%	3.9
Transport	13%	0.4
incl. renewable electricity and district heat	16%	0.7
Buildings (excl. trad. biomass)	41%	3.2
incl. renewable electricity and district heat	39%	4.8
TFEC (excl. trad. biomass)	25%	9.3

CO₂ emission reduction potential for India



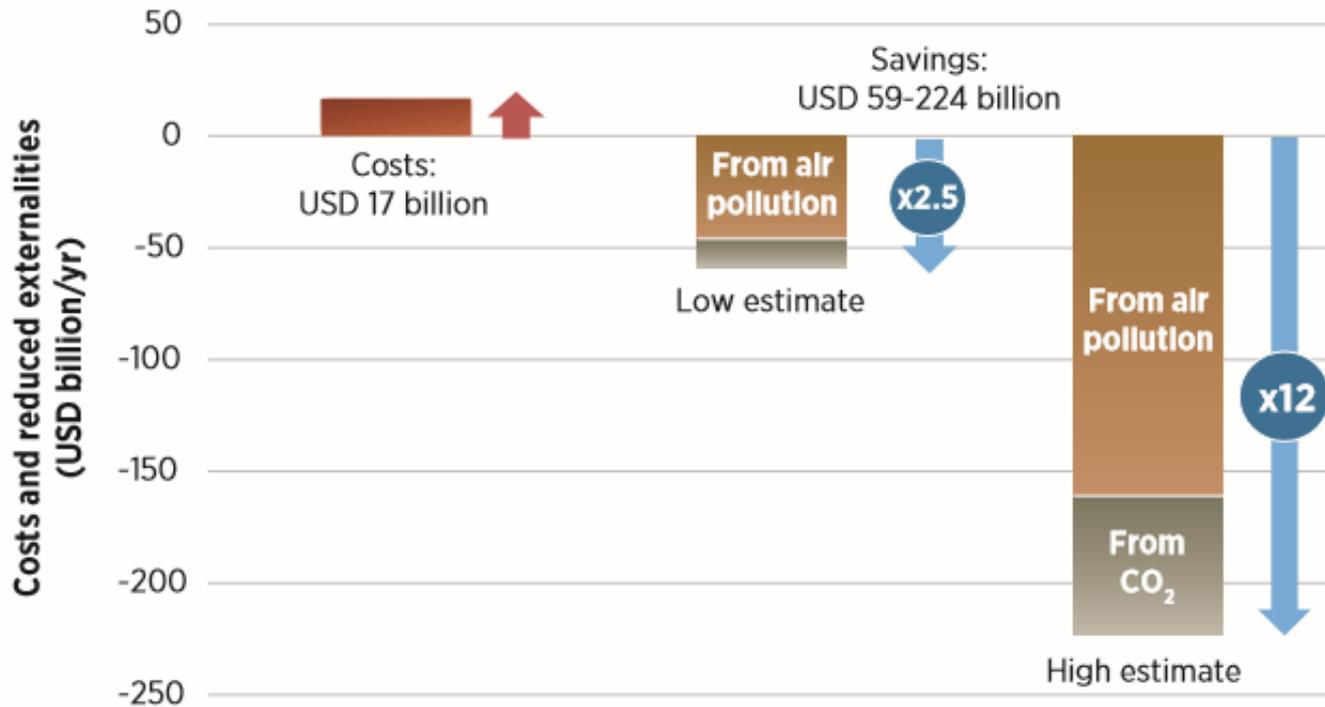
>> The CO₂ emissions in the Reference Case are 0.7 Gt/yr (-11%) lower compared to the Frozen Efficiency case in 2030 due to RE/EE measures .

>> The REmap and EE 2030 Options results in a further reduction of 1.7 and 0.9 GtCO₂/yr, respectively.

>> By combining RE/EE measures (REmap + EE), total CO₂ emissions can be reduced to 2.4 Gt/yr.

The CO₂ emission reduction potential with additional RE/EE under the REmap + EE Case is 56% compared to the Reference Case by 2030.

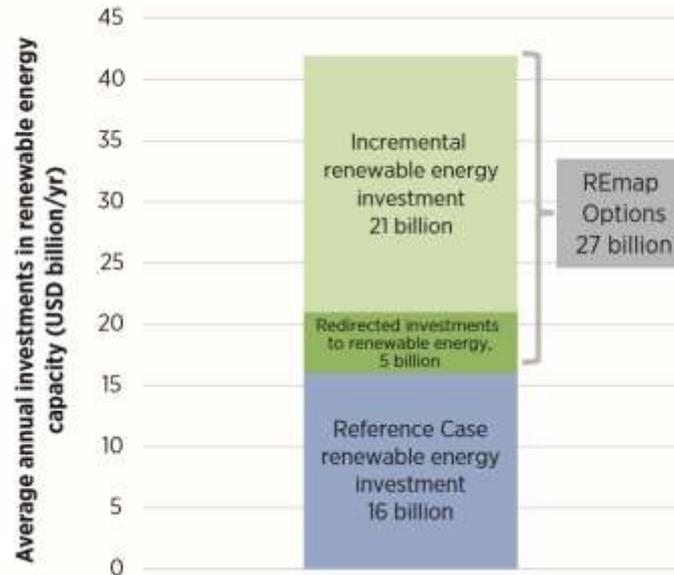
Renewables – the cost-effective solution



REmap case would result in savings twelve times higher than costs

- » Savings from reduced air pollution - between **USD 45 billion and USD 160 billion per year**
- » Cutting energy-related CO₂ emissions by 750 megatonnes a year by 2030 saves another **USD 13 billion – USD 63 billion per year**

Investment in renewables can help drive India's future economic growth.



Average annual investments of **USD 42 billion** in renewable energy technologies until 2030 will be required.

USD 16 billion annually taking place in the Reference Case, and

USD 26 billion for additional renewable energy options identified in REmap,

>> USD 21 billion – Incremental renewable energy investment

>> USD 5 billion – redirected investments from fossil fuels

Key challenges and focus for Renewable energy deployment in India

- >> Improvements in **grid infrastructure** for reliable, affordable and secure electricity production
 - *Current situation:* Frequent power outages, electricity network collapse in extreme weather conditions, high transmission losses etc.,
 - *Focus:* Requires **planning, developing a future grid** and modification in electricity tariff structure and regulations
 - *Developments:* Green Energy corridor, NREL recent study – “Integrating 175 GW by 2022 is possible”

- >> **Modern bioenergy deployment** in heat and power sector
 - *Target:* 100% access to modern energy carriers for cooking and lighting by 2030
 - *Focus:* **Expanding Rural energy access** – modern biomass cooking options, rural electricity access, **national bioenergy mission** creation: to meet industrial energy demand, including increasing the collection of agricultural, forest and waste residue

- >> **Electrification in transport** to reduce total petroleum consumption (*100% Electric cars by 2030*)
 - *Target :* 100% Electric Vehicles (EVs) by 2030
 - *Focus:* **Charging infrastructure** deployments and commodity price reductions

Key Action Areas

Establishing transition pathways for renewable energy

Promote **energy efficiency** and renewable-based energy access

- Establish **Renewable energy purchase obligations (RPOs)**
- Conduct **land acquisition policies**
- Establish **priority-sector lending** for renewables

Creating an enabling business environment

Develop **policy framework**

Ensure **transparent bidding processes**

Reduce or **mitigate red tape**

Reflect the **true costs of fossil fuels in energy pricing** by including externalities relating to air pollution and carbon emissions

Integrating renewable energy

Strengthen transmission grids

Give **incentives to renewable energy project developers** through priority dispatch schemes

Encourage the **use of information and communication technologies**

Support research into the synergies between electric mobility and renewable power

Create a **national bioenergy mission**

Managing knowledge

Collect data regularly – projects status, capacity added, jobs

Establish **information platform** for lending institutions

Improve **air pollution emission standards**

Promote programs to increase awareness for **modern energy technologies**

Unleashing innovation

Revise **Building codes and standards**

- Promote **technological development** in **energy storage, energy monitoring and mechanisms** to maintain a system balance

Thank you!



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