REmap
A Renewable Energy Roadmap

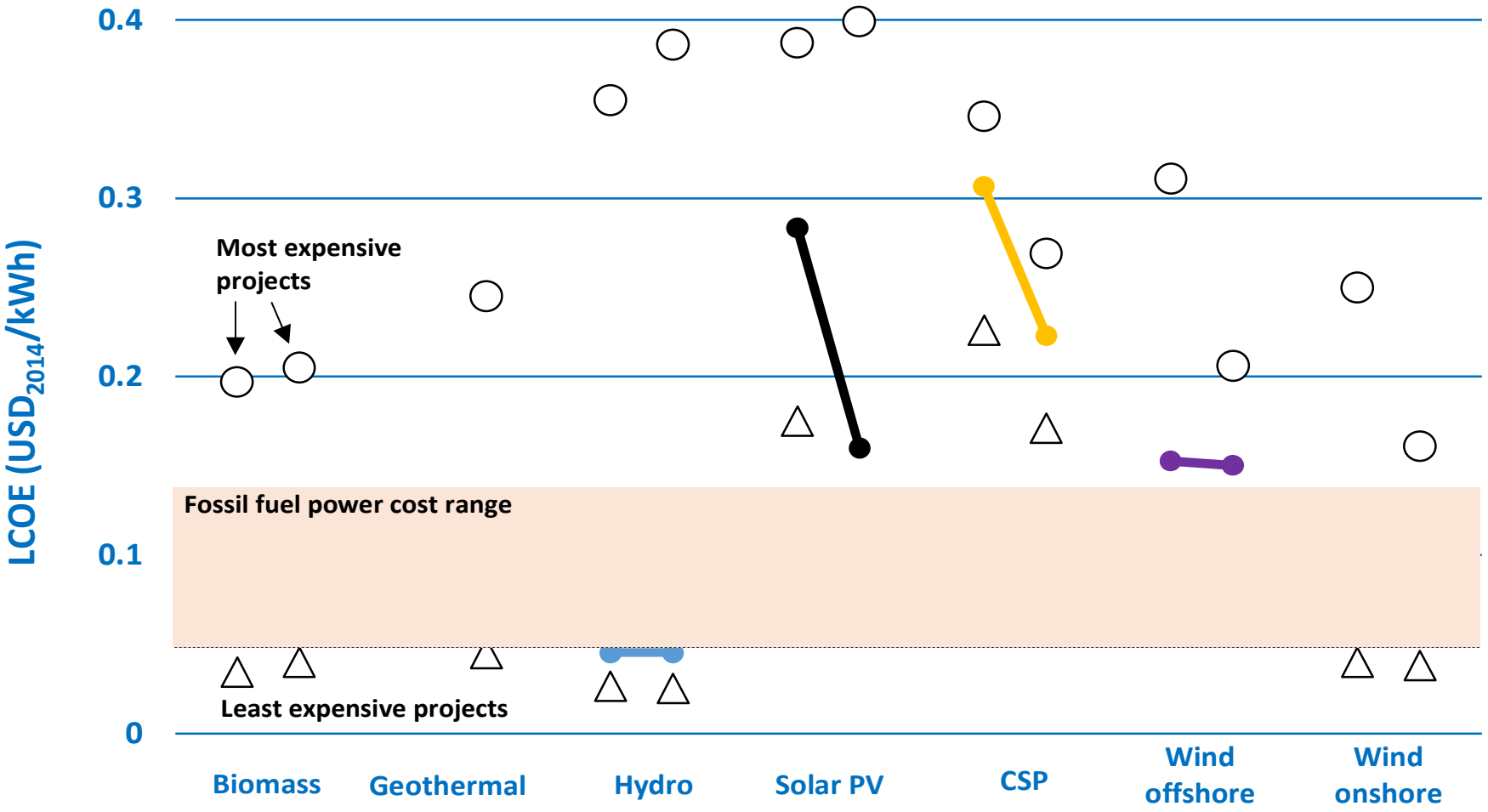
IRENA
International Renewable Energy Agency

#REmap

ROADMAP FOR A RENEWABLE ENERGY FUTURE

APERC ANNUAL CONFERENCE 2016

Falling Costs of RE Electricity



Left side: 2010
Right side: 2014

Costs have declined rapidly (2010-14) but vary (triangles low, circles high)

REmap 2015: Record Year for Renewables

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- **47 GW PV, 64 GW wind power installed – up >25% from 2014**
  - Over half of all new generating capacity globally is renewable
  - Renewables continue to expand despite low fossil fuel prices
- USD 360 billion of RE investments (330 billion for power)
- Cost continue to fall
  - **Solar PV – USD 48/MWh in Peru, 30/MWh in Dubai**
  - **Wind – USD 30-37.5/MWh in Morocco and Peru**
- **164 countries have specific RE policies in place**
- **The global energy transition is ongoing**

REmap 2016 Edition Highlights

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- **Doubling the share of renewable energy by 2030 is critical** for achieving sustainable energy and climate change objectives.
- **It is feasible only with immediate, concerted action** in all end-use sectors (transport, buildings, industry) and the power sector.
- **Economic Benefit:** Doubling renewables in the world's energy mix by 2030 will lead to **savings exceeding costs up to 15 times**
- **Environmental Benefit**: Renewables and energy efficiency, can **limit the global temperature increase to below 2 degrees**
- **Social Benefits:** More jobs and income for developing countries.

Expanding RE in All Sectors

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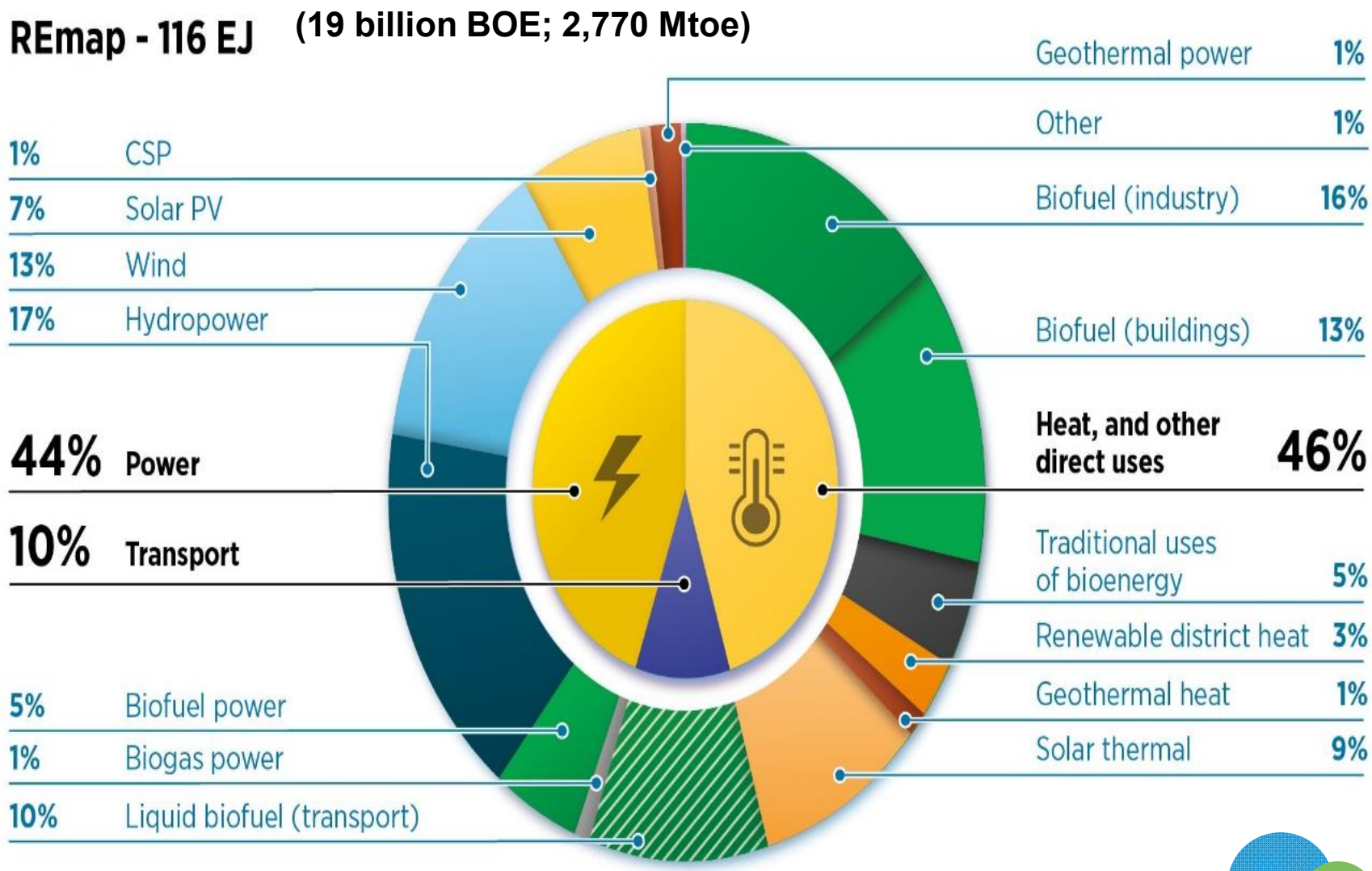
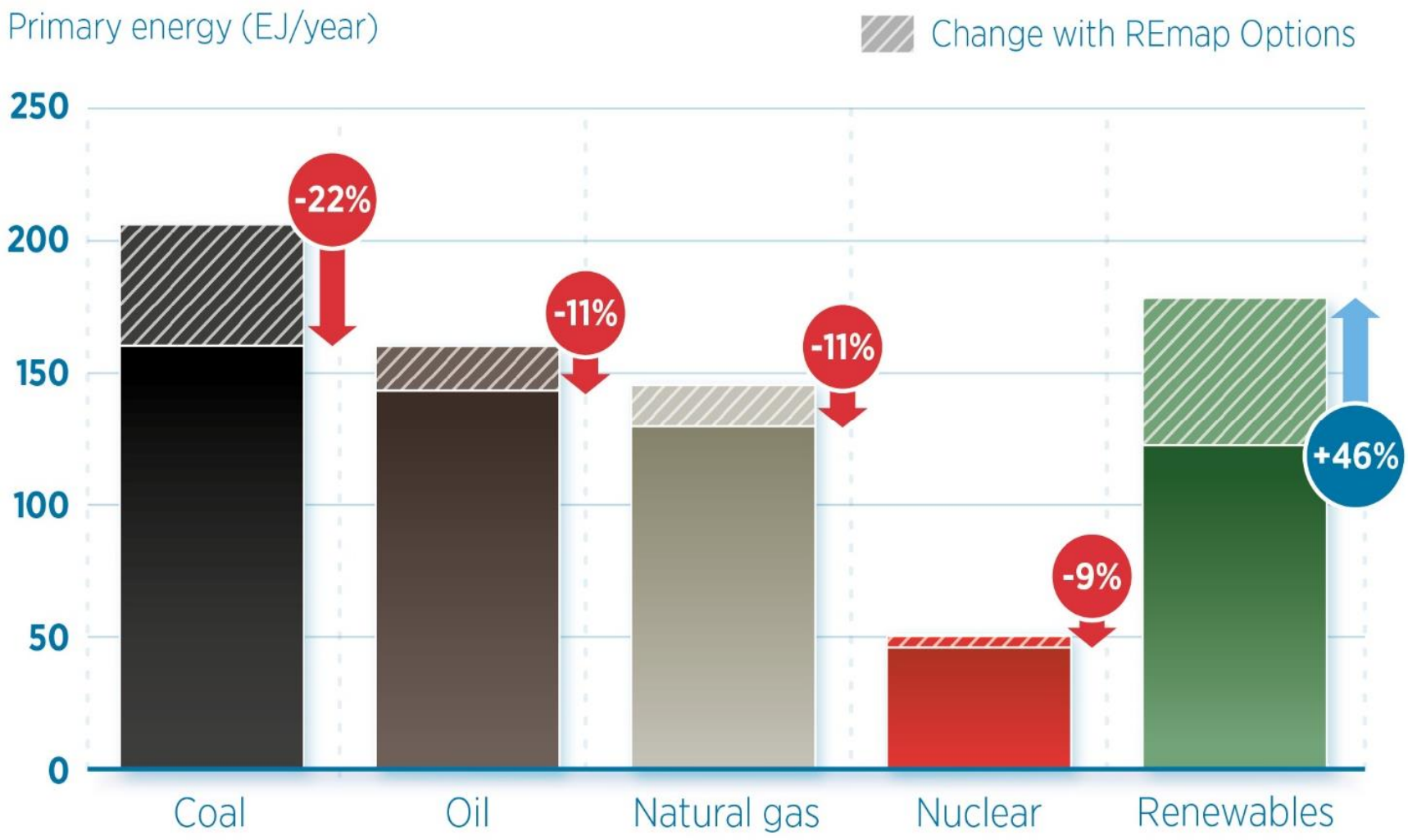


Renewables as Largest Primary Energy Source



Renewables would mainly replace coal to become the largest source of primary energy by 2030 in the REmap scenario.

Accelerating RE Investment

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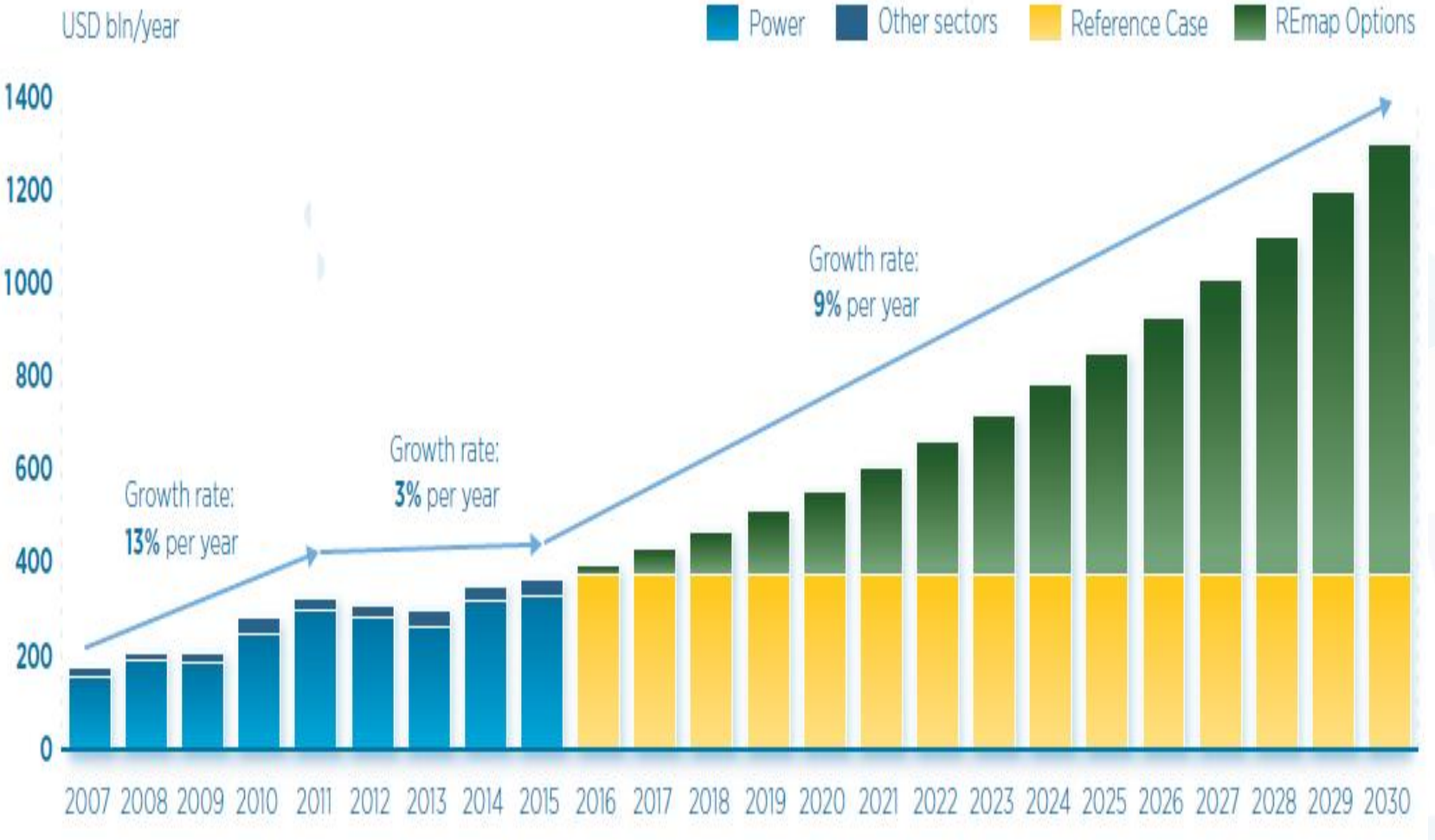
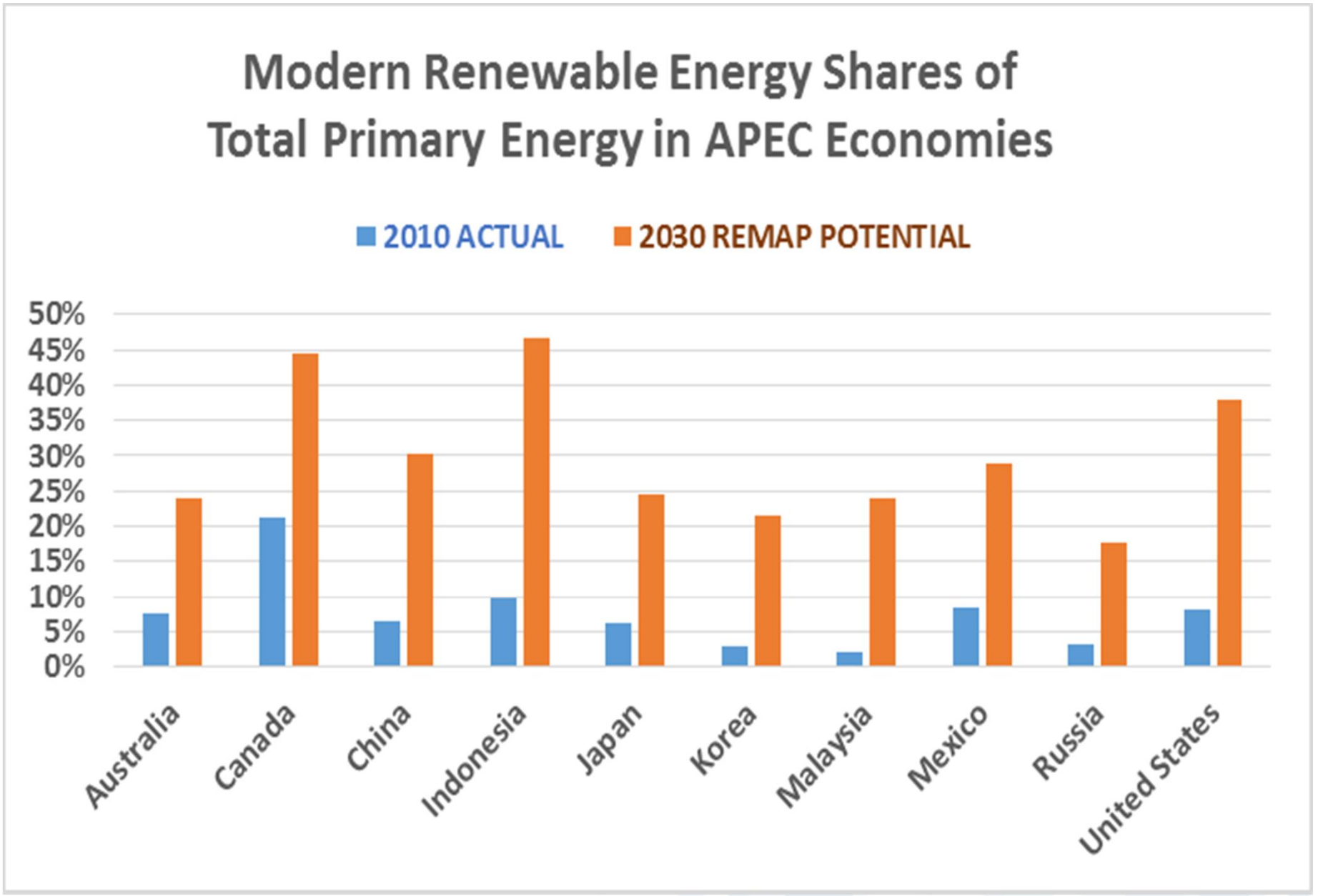
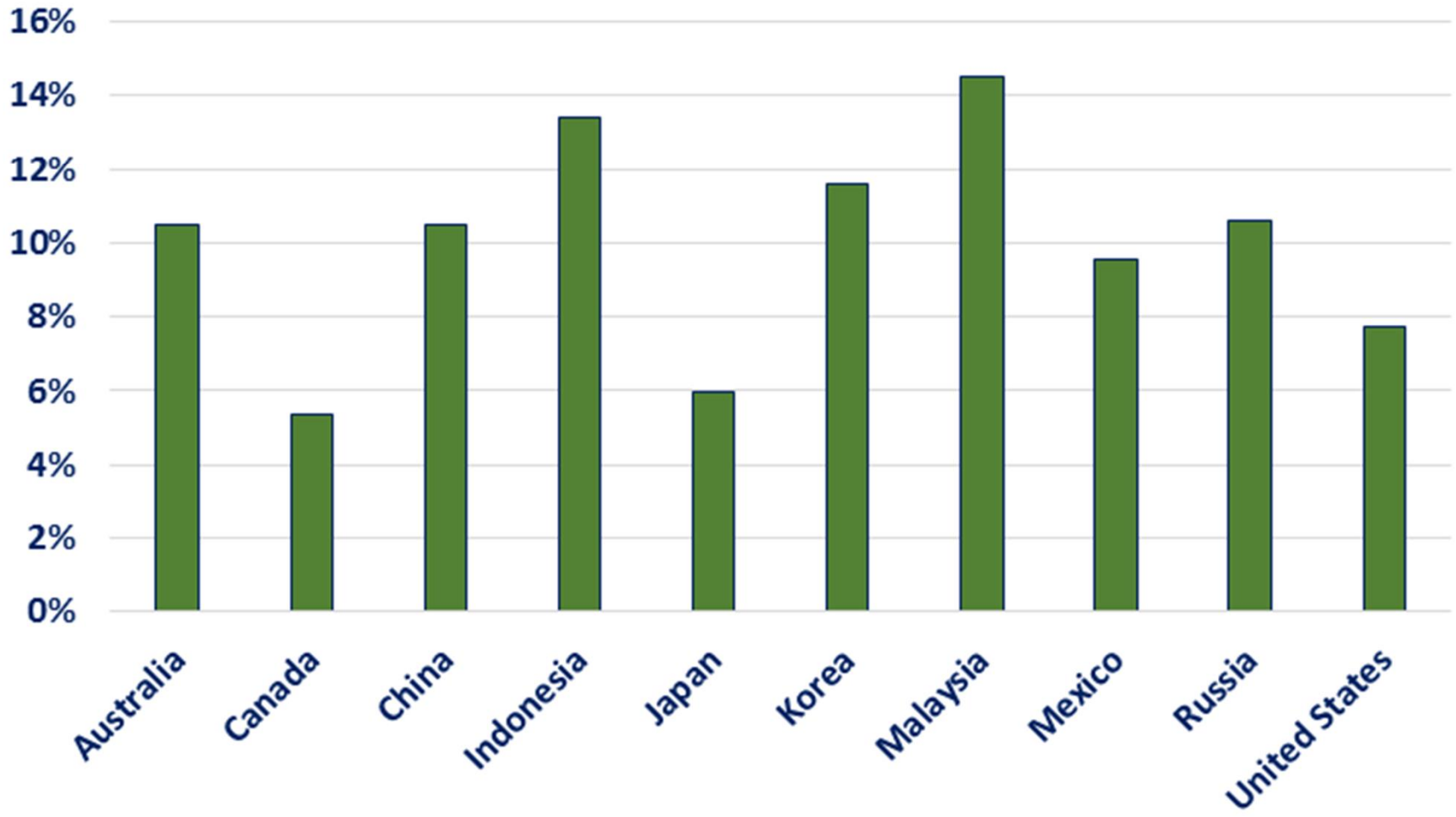


To reach REmap 2030 goals, investment in renewable generating capacity must return to a steady growth path of around 9% per annum.



Modern renewables have cost-effective potential to make up about a sixth to a half of TPES in APEC economies studied.

REMAP Potentials for Average Annual Growth in Cost-Effective Modern Renewable Energy in APEC



Potential renewable energy growth in ten APEC economies studied averages 9.4% and ranges from 5.3% to 14.5% per year for 2010-2030.

PV and Wind Potentials in APEC

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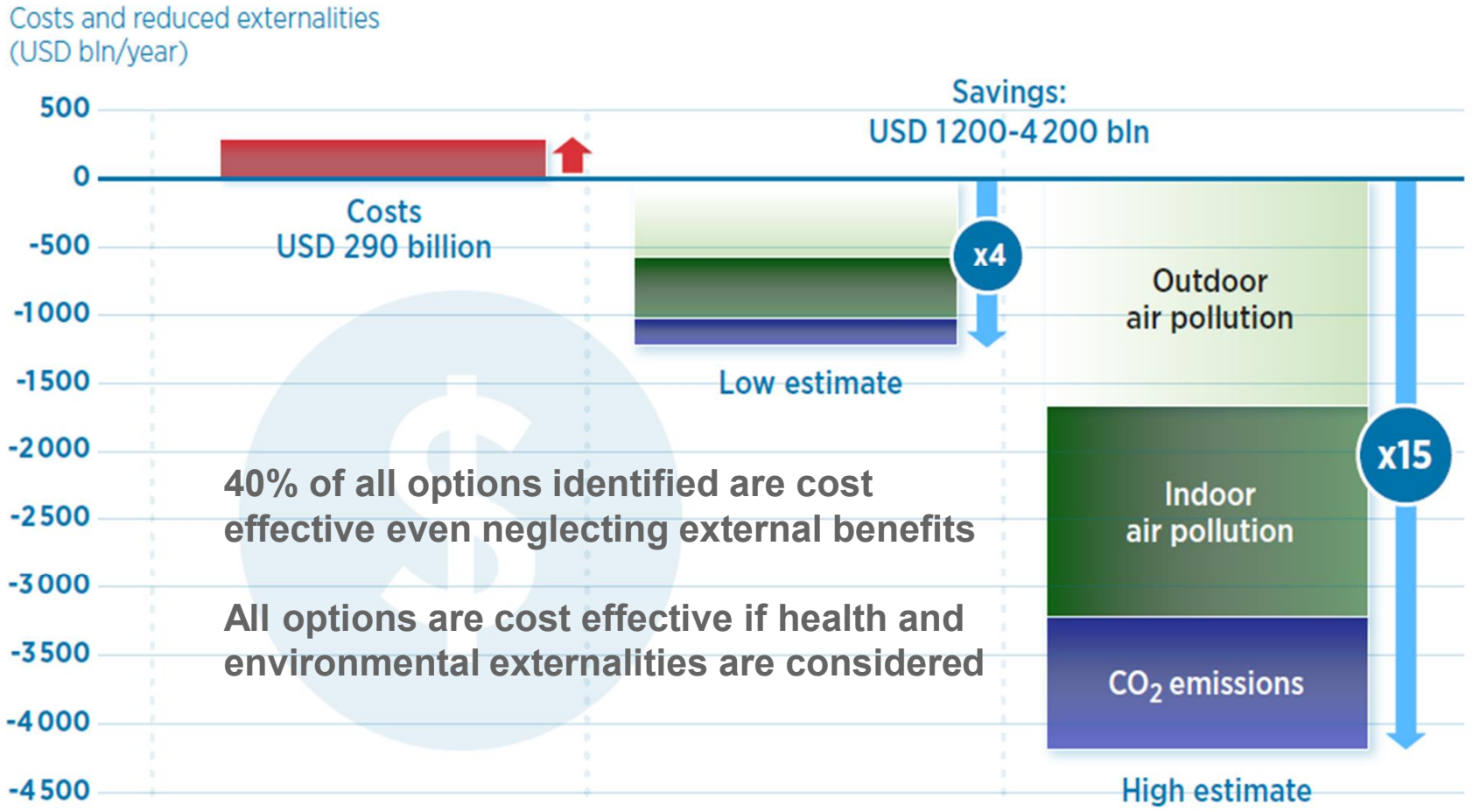
Economy	PV PJ 2010	PV PJ 2030	PV Annual Growth	Wind PJ 2010	Wind PJ 2030	Wind Annual Growth
Australia	4	182	**21.7%**	51	239	**8.0%**
Canada	4	163	**20.0%**	31	386	**13.4%**
China	3	2,998	**40.4%**	161	5,338	**19.1%**
Indonesia	0	267	**39.2%**	0	163	**40.6%**
Japan	15	968	**23.3%**	15	380	**17.4%**
Korea	3	363	**27.6%**	3	354	**27.1%**
Malaysia	0	80	**42.8%**	0	38	**N/A**
Mexico	0	261	**39.1%**	4	357	**25.1%**
Russia	0	201	**N/A**	0	287	**64.3%**
United States	13	1,657	**27.3%**	344	4,657	**13.9%**
Ten APEC Economies	*43*	***7,139***	***29.2%***	*609*	***12,200***	***16.2%***

Savings greatly exceed costs



Savings from reducing human health damage and CO_2 emissions would be 4 to 14 times the cost of the doubling renewable share

RE Doubling Needed to Limit Temperature Rise to 1.5-2.0°C

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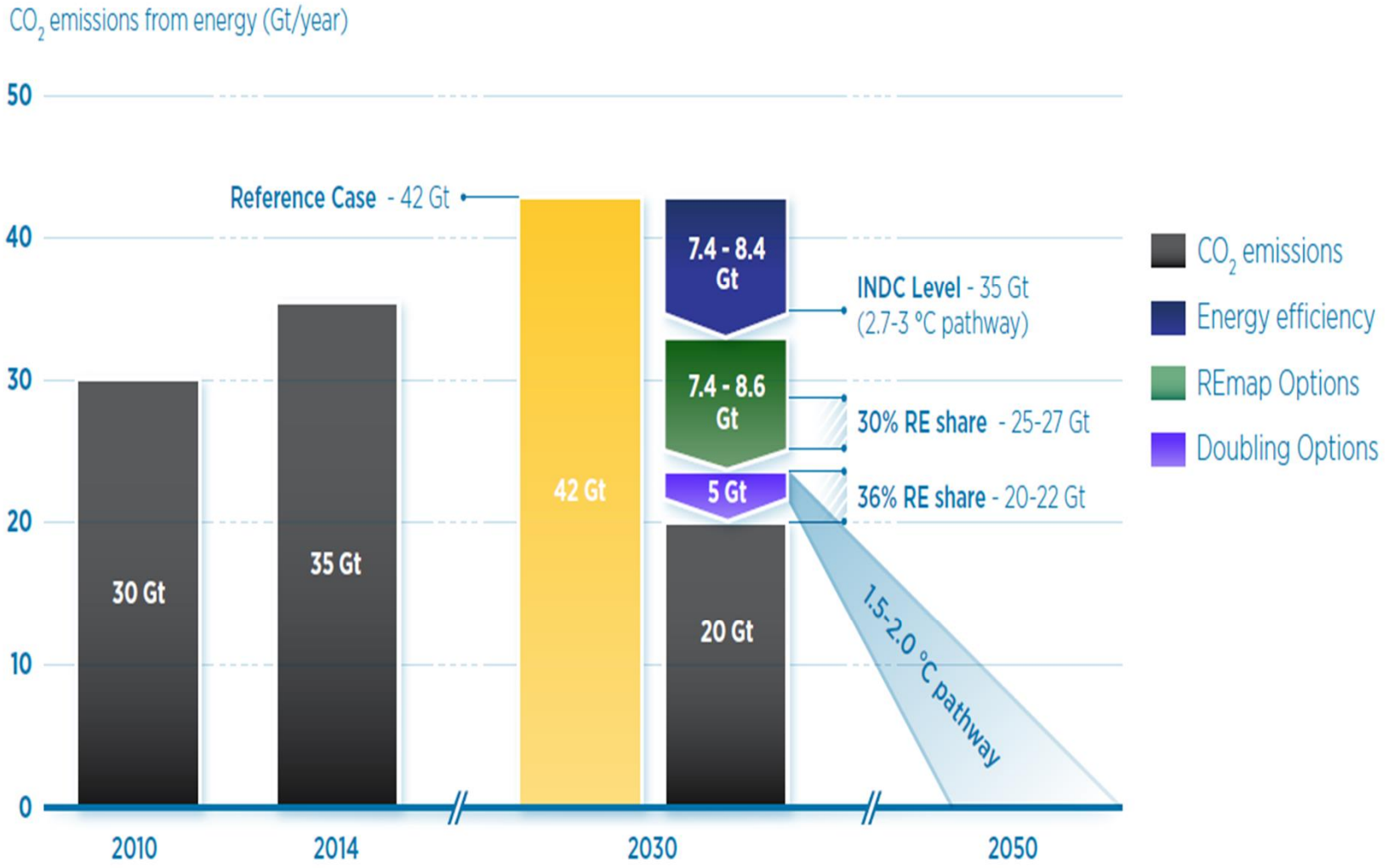
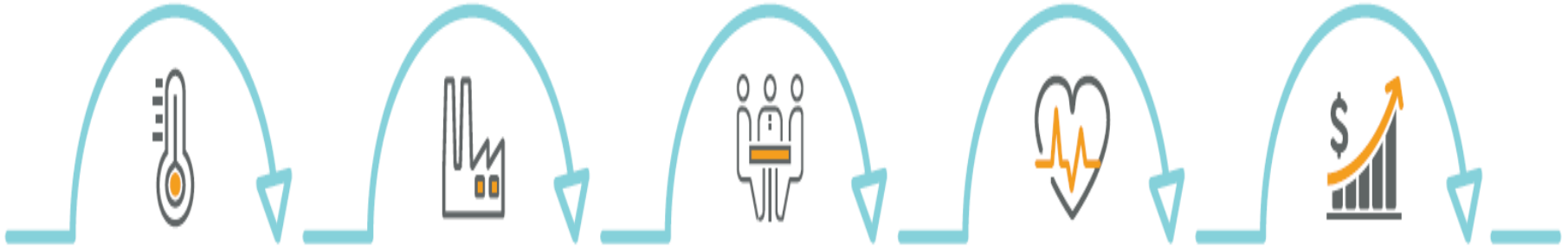


Benefits of a doubling



Limit average global temperature rise to **2 °C** or below (when coupled with energy efficiency)

Avoid up to **12 gigatonnes** of energy-related CO_2 emissions in 2030

24.4 million jobs in the RE sector by 2030, compared to 9.2 million in 2014

Reduce air pollution enough to save up to **4 million lives** per year

Boost global GDP by up to **$ 1.3 trillion**

Key Action Areas

Correct for market distortions to create a level playing field and reform power markets

Introduce greater flexibility into energy systems and accommodate the variability of key renewable energy sources and increase sector coupling

Develop and deploy renewable heating and cooling solutions for urban development projects and industry

Promote transport based on renewable power and biofuels

Ensure the sustainable, affordable and reliable supply of bioenergy feedstock

Technology developments that facilitate doubling: business opportunities and employment

- **Battery Storage – cheaper and lighter**
  - Declining costs facilitate greater use of variable RE on grids
    - USD 1500/kWh lithium-ion storage capacity in 2010
    - USD 200/kWh Li-ion storage capacity projected for 2020
  - Greater energy density means greater range for EVs and expanded market for EVs which can provide additional storage on grids, further facilitating variable RE penetration.
- **Floating and Offshore Wind – easing land constraints**
- **Biogas – allowing combined heat and power from farm**

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