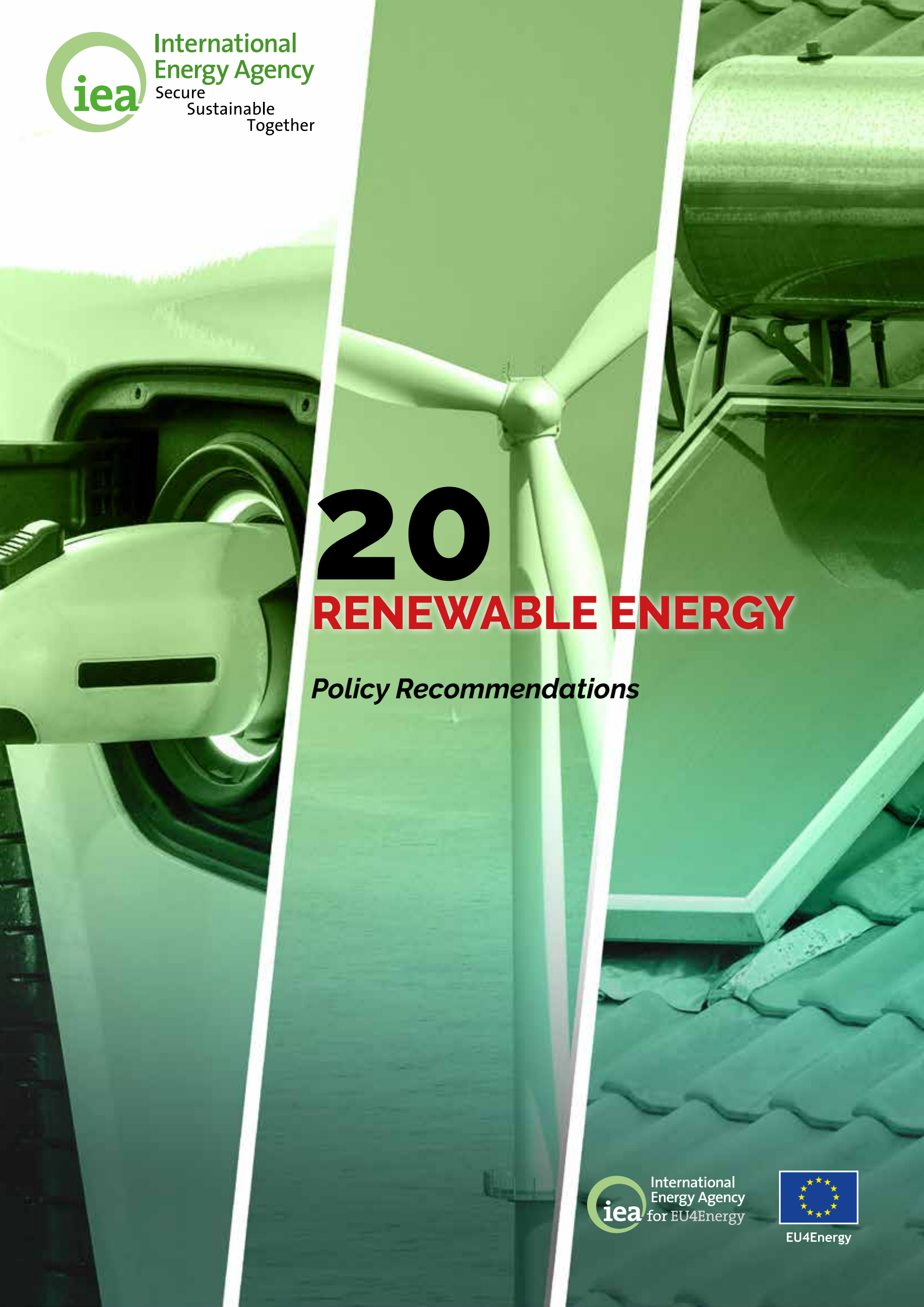

International Energy Agency
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20
RENEWABLE ENERGY

Policy Recommendations

International Energy Agency for EU4Energy

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20
RENEWABLE ENERGY

Policy Recommendations

This brochure has been produced with the financial assistance of the European Union and is part of the EU4Energy project. It reflects the views of the International Energy Agency (IEA) Secretariat but does not necessarily reflect those of individual IEA or the European Union member countries.

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Content

The Role of Renewable Energy Policy

Renewable energy has grown rapidly in recent years, especially in the electricity sector where renewables now account for the largest power capacity additions globally. However, renewables still account for only just above 10% of final energy consumption and the energy sector remains dominated by fossil fuels.

Renewables need to increase further and faster to bring about an energy transition that achieves climate targets, ensures energy access for all, reduces air pollution and improves energy security. IEA analysis suggests that renewables, together with energy efficiency, need to contribute 80% of the additional effort required to achieve the United Nation's Sustainable Development goals (Figure 1).

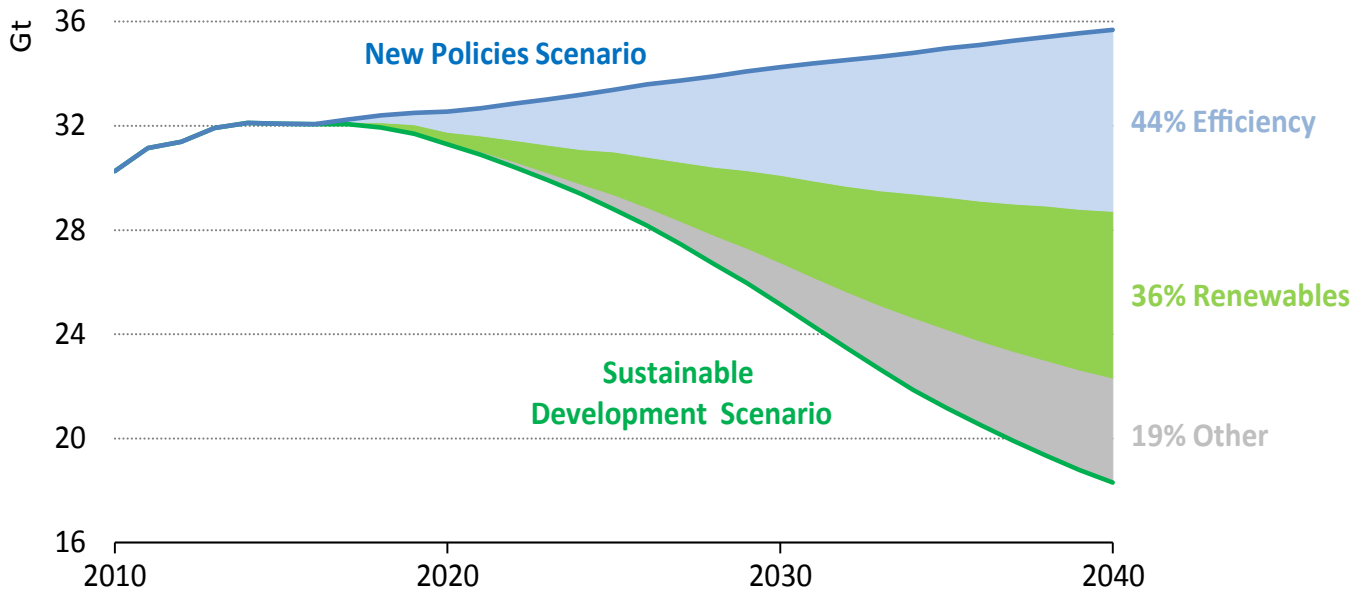
This will require accelerating the deployment of renewables across the electricity, heat and transport sectors. With heat accounting for half of final energy consumption and transport for another 30%, action in these end-use sectors is particularly important. There is a large portfolio of renewable energy solutions, some of which are cost-effective and already compete easily in energy markets. However, others face a multitude of economic and non-economic barriers.

Countries have already deployed a variety of policy options to promote renewables but the required scale-up can only be achieved through more effective and comprehensive policies.

In addition, appropriate market design is needed to foster competition and innovation, as well as attract investment at scale.

Renewable energy policies will inevitably vary from country to country to reflect different resource potentials, the current state of deployment of renewables, regulatory frameworks, political priorities and fiscal constraints.

Figure 1: Key contributions to CO_2 emission reductions



Source: IEA (2017) World Energy Outlook

These 20 recommendations provide guiding principles for policy-making, based on best practice observed across IEA member states and partner countries.

They can be adapted to suit specific national and local circumstances.

Fundamentals

1. RENEWABLE ENERGY TARGETS

The setting of targets has been a key driver of the expansion of renewable energy in many countries. Targets have often been specifically focused on renewables, for example by requiring a certain share of renewables to be achieved or by setting specific technology deployment targets. Furthermore, targets for CO_2 reduction or fossil-fuel phase out can also drive renewables.

Targets have been set (and achieved) by national governments, local and regional authorities, as well as businesses. Targets, while not sufficient on their own, provide an important indicator of the direction of travel and, especially where enshrined in legislation, can provide some degree of policy certainty for investors.

The IEA therefore recommends that all countries should set ambitious, whilst realistic, renewable energy targets according to the following principles:

1. Targets should cover the short (5 years), medium (10-15 years) and long term (to 2050).
2. Targets should be set for all sectors: electricity, heating & cooling and transport.
3. Enshrining renewable energy targets in primary legislation can add certainty.
4. Renewables targets should be set with a clear purpose in mind (such as CO_2, air pollution reduction, or energy security) and align with other strategic policy goals to avoid perverse outcomes.

EXAMPLES

- The **European Union's** renewable energy directive for 2020 with member states' mandatory targets for the share of renewables in final energy consumption.
- **China's** renewable energy targets for 2016-20 covering various technologies for electricity and heat.
- **India's** renewable power target for 227 GW of capacity by 2022.
- **Morocco's** target to supply 42% of electricity from renewables by 2020 and 52% by 2030.

2. STRATEGIES AND ACTION PLANS

Target setting is an important first step towards higher renewables deployment. How the targets are to be achieved needs to be set out in strategies and action plans. These should provide a roadmap for deployment, based on an assessment of resources and acknowledging the current status of technology development and deployment in the country. These plans should be regularly updated. Best practice strategies and action plans for renewable energy should:

1. Be formulated on the basis of long-term scenarios to provide a clear trajectory towards the achievement of the targets.
2. Identify barriers and measures to overcome them.
3. Be clearly linked to the overall national energy strategy to meet strategic goals such as energy security and CO_2 emission reduction targets.
4. Involve all relevant levels of governance (e.g. national government and local authorities).
5. Ensure renewables and energy efficiency policies are well-aligned.

BEST PRACTICE EXAMPLES

- The National Renewable Action Plans under the **European Union's** renewable energy directive for 2020.
- **China**'s 13th Renewable Energy Development Five-Year Plan, closely linked to the 13th Five-Year Plan for Economic and Social Development and Five-Year Plans for individual renewable technologies.
- **Denmark's** long-established approach to integrated energy planning involving regional and local authorities.

3. RENEWABLE ENERGY DATA

Targets and strategies need to be underpinned by good data. Governments should produce and publish comprehensive data on renewables following international standards (e.g. UN International Recommendations for Energy Statistics), including:

1. Resource data for different renewables (e.g. solar and wind atlas) and make them freely available.
2. Deployment data for individual renewable technologies (including small-scale and renewable heat).
3. Deployment data for renewables under specific policy mechanisms.
4. Data on the costs of deployment.

BEST PRACTICE EXAMPLES

- Resource assessments for specific renewables sources in many countries (e.g. the **Kazakhstan** wind atlas).
- The **Australian** Renewable Energy Mapping Initiative.
- Deployment data for the **United Kingdom** Renewable Heat Incentive.

4. MONITORING AND EVALUATION OF POLICIES AND MEASURES

Improved data is particularly important for assessing the progress under strategies and action plans, as well as assessing the effectiveness of specific policies and measures. Evaluations can help ensure that renewables deployment is as cost-effective as possible and does not impose unnecessary burdens on any sectors. Government should therefore:

1. Designate an appropriate institution to monitor progress against targets on a regular basis.
2. Develop metrics for performance against targets and cost-effectiveness.
3. Carry out regular evaluations for specific policy instruments.
4. Be prepared to adjust policies in response to the outcome of evaluations.

BEST PRACTICE EXAMPLES

- Progress reporting every two years by member states under the **European Union** 2020 renewable energy goals.
- Tracking report by the Custodian Agencies (including the IEA) on the **United Nations** Sustainable Development Goal 7 on affordable and clean energy.

Cross-Sectoral

5. LEVEL PLAYING FIELD IN ENERGY PRICING

Renewable energies provide benefits that are not necessarily priced in by the market such as reduced air pollution or greater energy security through using local resources. At the same time, some renewables find it hard to compete against fossil fuel alternatives due to greater up-front costs than fossil-fuel incumbents. In some countries, fossil fuel subsidies distort the market and there may be a lack of transparency about how energy prices are set (e.g. what subsidies or charges are included). Therefore, governments should create a level playing field, including:

1. Phase-out fossil fuel subsidies.
2. Set energy prices and tariffs in a transparent manner.
3. Develop a system of carbon pricing with a rising carbon price over time.
4. Ensure any impact on fuel poverty is alleviated (e.g. by ring-fencing revenues for energy efficiency investments).

BEST PRACTICE EXAMPLES

- **Sweden's** carbon tax which has increased substantially since being first introduced in 1991.
- **India's** tax on coal with some of the revenue going to fund renewable energy projects.
- **Indonesia's** efforts to cut fossil fuel subsidies and redirect remaining subsidies to poor households.

6. COUPLING OF ELECTRICITY, HEAT, COOLING AND TRANSPORT SECTORS

Opportunities for the direct use of renewables in the heating, cooling and transport sectors exist but face some constraints. Electrification in these sectors, combined with a rising amount of renewable electricity generation, provides a path to increase the overall contribution of renewables to final energy consumption.

At the same time, the heating, cooling and transport sectors offer some opportunities for balancing the contribution from variable renewables (see also recommendation 12), e.g. through thermal storage or using smart charging of electric vehicle batteries. Governments should therefore facilitate the greater linking of these sectors:

1. Develop scenarios for the transition of the heating, cooling and transport sectors, including the role of electrification.
2. Provide incentives for thermal storage solutions in district heat/cooling networks, linked to heat pumps or electric boilers.
3. Ensure mechanisms are in place to support the smart charging of electric vehicles.
4. Provide local authorities with responsibilities for integrated local energy planning.

BEST PRACTICE EXAMPLES

- 2050 scenarios to achieve 100% renewables in Frankfurt (**Germany**).
- Fifth carbon budget scenarios by the **United Kingdom's** Committee on Climate Change.
- **China**'s project to use excess wind power for heating.

7. FOSTER PUBLIC SUPPORT FOR RENEWABLES AT LOCAL LEVEL

In some countries, local public opposition to certain renewables schemes has been a barrier to the expansion of renewables.

Best practice ways to build public support for renewables include:

1. Require consultation with local communities during the project development phase.
2. Promote local community and individual ownership of renewables.
3. Enable profit-sharing from large renewables installations with local communities.
4. Ensure renewable support mechanisms stay affordable, especially for low-income households.

BEST PRACTICE EXAMPLES

- **Denmark and Germany** - extensive local community ownership of onshore wind turbines.
- Community Feed-In Tariff (COMFIT) programme in Nova Scotia, **Canada**.
- **India's** support for community cooking applications under the programme for off-grid and decentralized concentrated solar thermal.

8. ENSURE SUSTAINABILITY

While renewable energies have many benefits compared to fossil fuel alternatives, they can still have some negative environmental and social impacts. In most cases, these can be avoided if best practice is followed. It is therefore imperative that these potential impacts are recognised and minimised, mitigated or compensated. Measures to achieve this will vary according to project scale and technology but some broad recommendations include:

1. Effective project planning procedures with environmental and social assessments.
2. For biomass, develop appropriate sustainability criteria, with independent, third party verification.
3. Encourage industry-led initiatives that can cover multiple jurisdictions.

BEST PRACTICE EXAMPLES

- Environmental and social safeguards for energy projects of International Financial Institutions (e.g. **World Bank**).
- **Brazil** - criteria for environmental sustainability for sugar cane cultivation (used to make ethanol biofuel).
- **Netherlands** and **United Kingdom** legislation on solid biomass sustainability.
- Industry-led Sustainable Biomass Programme for the certification of woody biomass.

9. INNOVATION SUPPORT

While many renewables have become mainstream, there are still some technologies that are further from market and a number of technological challenges remain. Even for established technologies, the scope for innovation continues and there is a need to adapt technologies to local circumstances.

Research and development activities are also an important way to build up national expertise and competence. Some innovation activity will be funded by the private sector but there is a continued role for public sector support. Governments should:

1. Support innovation in renewables through national research, development and demonstration programmes where there is added value.
2. Identify priority technologies or priority areas of innovation in which countries have specific areas of expertise, e.g. by building on synergies with other areas of innovation.
3. Develop and track key performance indicators for priority technologies.
4. Participate in international research and development collaboration to share and complement national strengths.

BEST PRACTICE EXAMPLES

- The IEA's Technology Collaboration Programmes (nine of which are on renewables) involving groups of experts from governments and industry from **53 countries**.
- Mission Innovation which has **23 member governments** that have pledged to double their clean energy research over five years.

Renewable Electricity

The amount of electricity produced from renewables has been growing rapidly over recent years. Policy has driven much of this growth, with many countries setting targets for renewable electricity and implementing a range of policy measures.

Different policy instruments have been used to support renewable electricity deployment through different stages of technological maturity. Options include administratively-set feed-in tariffs or premiums, renewable portfolio standards, quotas and tradeable green certificate schemes, net metering, tax rebates and capital grants.

Some of these instruments have been deployed in parallel. Recently, auctions (centralised, competitive procurement of renewables capacity via a government or public body) have become increasingly widespread and have been instrumental in driving down prices in many countries, especially for solar PV and wind. In addition, growing shares of variable renewables require new approaches to electricity market design.

10. ADEQUATE REMUNERATION

The levelised costs of generation of many renewable electricity technologies (especially solar PV and wind) have decreased rapidly over recent years, while others (e.g. hydropower) have been competitive for some time. However, renewables often still require some sort of financial support, especially as most countries do not price carbon effectively (see policy recommendation 5) and there are other barriers such as high capital costs.

Financial support may be particularly needed at the early stages of deployment in a country, since the costs of initial deployment tend to be higher due to the absence of local supply chains, and a regulatory framework that may not be optimised.

Furthermore, investment is often seen as riskier, pushing up financing costs.

Even when the levelised costs of renewables are competitive, remuneration mechanisms such as long-term power purchase agreements are preferable since these are better adapted to renewable energy technologies which are more capital-intensive than those for fossil fuel generation. At the same time, governments need to ensure that support for renewables is not excessive, for example when costs come down.

Countries should consider the following principles when developing financial support measures:

1	2	3	4	5
Ensure market-appropriate remuneration levels, with degression over time linked to deployed capacity and where possible involving the competitive award of power purchase agreements (for example through auctions).	Constantly monitor market evolutions, to properly set the tariff/premium levels.	Develop remuneration levels that reflect the system value of specific renewables (e.g. location, ability to generate at specific times) – see also recommendation 12.	For small-scale, decentralised renewables, consider alternatives to net-metering that reflect system value (e.g. variable tariff levels according to time of day).	Ensure overall fairness to consumers, e.g. by not overcompensating individual owners of rooftop solar at the expense of other consumers.

BEST PRACTICE EXAMPLES

- Degression applied to Feed-in-Tariffs in **Germany**, **Australia**, and **Japan**.
- Auctions for long-term power purchase agreements in **Morocco** and **Chile**.
- Minnesota (**United States**) Value of Solar tariff.

11. GRID ACCESS

New renewables installations (especially smaller producers) can face excessive costs for connecting to the electricity transmission and distribution grids, which can in turn undermine competitiveness. Particular problems can occur where renewables projects are in remote locations because of good resource availability (e.g. for offshore wind) and grid infrastructure may be non-existent or inadequate. This can add significant delays to a renewables project becoming operational. To address these issues, governments should:

1. Establish clear rules governing grid connection costs to allow private operators to connect on a non-discriminatory basis and determine fair levels of costs.
2. Ensure timely connection for new renewable plants or provide compensation for excessive delays.
3. Support grid development and strengthening to allow renewable electricity to connect from remote areas.

BEST PRACTICE EXAMPLES

- A requirement in **France** for regions to develop plans for the connection of renewables to the grid, as well as government financial support to cover a share of grid connection costs.
- In **Germany**, consumers have to bear part of the costs incurred by delayed grid access for offshore wind farms.

12. SYSTEM INTEGRATION OF VARIABLE RENEWABLE RESOURCES (VRE)

Many renewable electricity technologies have some degree of daily or seasonal variability related to weather factors or time of day. The impact of this variability depends on the characteristics of particular electricity systems, and generally can be managed without problems, especially in the initial stages of deployment.

At higher deployment levels, policy-makers need to introduce measures that encourage system-friendly generation from renewable sources (wind and PV in particular) and increase overall system flexibility, including:

1. Recognize (e.g. through differentiated tariff levels) the different locational, time and technological value of the renewable power plants and decentralised installations.
2. Reform electricity market design to provide accurate pricing at growing shares of VRE.
3. Provide support for system flexibility (e.g. demand response, storage such as pump storage hydro, batteries or thermal storage).
4. Ensure that grid connection codes include appropriate requirements for VRE.
5. Plan for deploying a mix of technologies that bring valuable synergies.

BEST PRACTICE EXAMPLES

- **Mexico's** auction system that reflects system value.
- **Denmark's** support scheme for wind power plants designed to promote the use of larger rotors for a system-friendly wind power production.
- Demand response programmes in the **United States**.

13. TACKLE NON-ECONOMIC BARRIERS

Even where resource and market conditions are favourable to renewable electricity deployment, a number of non-economic barriers can prevent rapid progress. These include barriers such as difficulties in obtaining planning consent or skills shortages. Some are technology or location-specific and policy measures are needed to create an enabling environment. Governments can act to deal with non-economic barriers, for example:

1. Accelerate permitting and planning, without compromising public consultation and impact assessment (recommendations 7 and 8).
2. Schemes for increasing relevant skills in the energy industry and supply chains.
3. Financial support such as risk guarantees (e.g. to reduce pre-development risks for geothermal energy).

BEST PRACTICE EXAMPLES

- Certification under the RGE scheme in **France** for installers of various renewables technologies.
- Geothermal risk mitigation facility for **East Africa**.

14. REDUCE THE COST OF FINANCING

Some countries in the developing world and emerging economies have seen little renewables development despite good potential, with the cost of financing of renewables projects as a major barrier.

Mechanisms should be developed that reduce the cost of financing and lower off-taker risks.

Options include:

1. Provide government-backed guarantees for long-term Power Purchasing Agreements (PPAs).
2. Work with international financial institutions to develop renewables policies and debt financing programmes.
3. Provide some public funding to leverage private investment.

BEST PRACTICE EXAMPLES

- The **European Bank for Reconstruction and Development's** 200 USD million renewable energy financing programme in **Kazakhstan**, in conjunction with support to the Kazakh government on renewable energy legislation and Feed-in-Tariff development.
- The **African Development Bank** Facility for Energy Inclusion which provides pan-African debt finance for small-scale renewables projects.

Renewable Heating and Cooling

Heat is the most important energy end-use and is a significant contributor to global CO_2 emissions. Heat accounts for over 50% of final energy consumption, with around 55% consumed in industry and agriculture, and the remaining 45% in buildings. Additionally, cooling is a fast-growing energy end-use. Heat is primarily produced by fossil fuels and is responsible for 39% of energy-related CO_2 emissions, as well as locally contributing to air pollution problems.

Renewable energy plays a key role in decarbonising and cleaning up heat supply, both directly (e.g. through biomass, geothermal or solar heat) and indirectly (through heat pumps and renewable electricity).

Solutions are often complex and location-specific. Policy intervention is needed to accelerate the deployment of renewable heating and cooling solutions but has to be carefully designed to reflect specific national and local circumstances.

Progress can be slow due to low building renovation rates and a slow turnover of appliances. A long-term commitment and strategy is therefore particularly important in this sector.

15. INTEGRATE RENEWABLE HEAT AND ENERGY EFFICIENCY POLICIES

Much heat is being wasted, through inefficient buildings, appliances, and industrial processes. Energy efficiency and the switch to cleaner heat provisions must go hand in hand. This can improve the suitability of renewable heat options (e.g. heat pumps operate best in energy efficient buildings). It also ensures efficient resource use which is particularly important for bioenergy where the resource is constrained. Improvements to the energy performance of building envelopes, the efficiency of heating appliances and networks, as well as the efficiency of industrial processes using heat are needed. Policy-makers should therefore:

1. Align policies that promote renewable heating and cooling with those targeting energy efficiency, aiming at optimal and cost-effective deployment.
2. Use instruments such as energy performance certificates that cover both energy efficiency and renewable heating and cooling options.
3. Identify opportunities for using waste heat (e.g. from industry or data centres).
4. Where there is district heating and cooling, ensure the systems are highly efficient (well-insulated pipes etc).

BEST PRACTICE EXAMPLES

- Building codes in many countries (e.g. **Sweden**, **India**, **Canada**) that require both high levels of energy efficiency and low-carbon heat solutions.
- Incentive schemes such as the **German** market incentive programme that offer a bonus when energy efficiency and renewable heat measures are deployed together.

16. TACKLE BARRIERS

Heat markets are complex and fragmented, and generally less well understood than electricity markets. Renewable heat faces multiple barriers to compete in these markets and policy-makers need to carefully target instruments to overcome specific barriers. Solutions vary according to existing infrastructure (e.g. district heating or gas grids). They are also often location-specific and need to take into account local authorities as important actors. Policies need to overcome:

1. Economic barriers (e.g. through financial support mechanisms, carbon taxes).
2. Non-economic barriers (e.g. through obligations, building codes, installer certification).
3. And facilitate actions at the local level.

BEST PRACTICE EXAMPLES

- Solar water heater mandates (often at city level) in many countries (e.g. **Brazil**, **China**, **Italy**).
- In the **Netherlands**, local authorities have responsibility for creating natural gas-free areas.

17. RENEWABLE HEATING AND COOLING DATA

Heat data is generally much less available than electricity data. To help develop and monitor effective policies, it is important that countries acquire more reliable heat statistics, both for heat generally and for renewable heat specifically. Where no comprehensive data is available, sampling and modelling can be effective. Important areas for development include:

1. National and local heat demand (including temperature requirements) and renewable heat resource mapping.
2. Buildings stock models to establish heating and cooling requirements.
3. Better understanding of industrial heat needs.
4. Renewable heat deployment data (including cost data) to facilitate policy evaluation and revision.

BEST PRACTICE EXAMPLES

- **Denmark** heat supply act of 1979 required local authorities to map heat demand.
- **United Kingdom** comprehensive deployment data under the Renewable Heat Incentive.
- Improvements in biomass data through household consumption surveys in **Armenia and Moldova**.

Renewable Transport

Transport is the second largest energy end-use sector, accounting for almost 30% of global energy consumption and is almost entirely petroleum product-based. Currently, the principal options for using renewable energy in the transport sector involve the use of biofuels. Renewable electricity also contributes increasingly through the small but rapidly rising number of electric vehicles for road transport, as well as rail systems.

Biofuels can play a useful role in improving energy security by reducing dependence on oil imports. However, this requires careful policy development that takes into account potential land use and sustainability impacts (see also recommendation 7). Biofuels policies also need to deal with economic and technological barriers and promote a shift to advanced biofuels over time.

Biofuels and electric vehicles are only two elements of a much broader portfolio of options for the transport sector. Countries need to promote other transport options which can reduce transport demand (e.g. through better urban planning) and make transport use less energy-intensive, such as improved public transport, walking and cycling. Efficiency improvements of the transport fleet are also important.

18. TACKLE BARRIERS

The competitiveness of conventional biofuels depends both on the costs of the feedstock and conventional oil prices. With current low oil prices, biofuels can rarely compete against conventional fuels. In addition, structural constraints may limit the amount of biofuel that is compatible with existing vehicle fleets.

Where biofuel consumption has increased, generally the driver has been policy intervention. Governments should therefore consider measures such as:

1. Mandates that either specifically oblige suppliers to incorporate often increasing shares of biofuels into the fuel mix or to reduce the carbon-intensity of the fuels they supply.
2. Financial support mechanisms such as tax exemptions.
3. Financial incentives for cars that can run higher blends and flex fuel vehicles.
4. Support the expansion of biofuels distribution infrastructure.

BEST PRACTICE EXAMPLES

- Biofuel mandates in **64 countries**, including **Brazil, China, the European Union, Indonesia** and the **United States**.

19. SHIFT TO ADVANCED BIOFUELS

Given the need to improve the life-cycle carbon emissions associated with biofuels production and to minimise land-use impacts a shift to advanced biofuels over time is desirable. These have a number of potential benefits such as making use of low-value waste and residue feedstocks and have a high emission reduction potential. Furthermore, some advanced biofuels offer good potential for more challenging sectors such as aviation. To achieve this, governments could consider:

1. Specific mandates for advanced biofuels, increasing over time.
2. Loan guarantees to de-risk the initial capital investment in advanced biofuel plants.
3. Tax incentives for biofuel innovation.
4. R&D into appropriate local feedstocks.
5. Legislation to stipulate defined reductions in the life-cycle carbon intensity (CI) of transportation fuels.
6. Carbon taxes on aviation fuels based on their lifecycle greenhouse gas emissions.

BEST PRACTICE EXAMPLES

- Advanced biofuel mandates in the **United States** under the Renewable Fuel Standard and in **Italy**.
- Low-carbon fuel standard in California (**United States**).
- Renova Bio programme in **Brazil**.

20. ELECTRIC VEHICLES

Electric vehicles (cars, two wheelers, buses and trains) can play an important role in reducing urban air pollution. However, they are only truly clean when operating on electricity that is from renewable and other low-carbon sources. Governments need to make sure that the electrification of transport is integrated with measures that stimulate the use of renewable electricity by:

1. Integrated planning for electric mobility and renewable electricity production, transmission and distribution (e.g. including smart charging).
2. Considering explicit measures that stimulate the use of renewable electricity in transport (e.g. through mandates or grants).
3. Targets for public transport operators.

BEST PRACTICE EXAMPLES

- **Austria** provides grants for electric vehicles if they use renewable electricity.
- **Germany** offers grants for electric vehicle charging stations that supply renewable electricity.

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