A rapid reversal in trends to meet global climate ambitions

Meeting global ambitions to meet 2°C or below will require a rapid reduction in CO₂ emissions.

Sources: Carbon Dioxide Information Analysis Centre; IEA World Energy Statistics and Balances; IEA Energy Technology Perspectives 2017
**Buildings are not on track to meet 2DS objectives**

Despite some positive developments in the last two years, more assertive action is still needed to put the global buildings sector on track.

**Tracking Clean Energy Progress 2017**

<table>
<thead>
<tr>
<th>Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendation for 2017:</strong> Countries can take immediate action to put forward commitments for low-carbon and energy-efficient buildings to implement their NDCs as a first step and a clear signal to scale up actions across the global buildings sector.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Building envelopes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendation for 2017:</strong> Global cooperation should seek to ensure that all countries implement and enforce building energy codes and standards for both new and existing buildings, with improvement in enforcement and verification of codes and standards to overcome barriers to their implementation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lighting, appliances and equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommendation for 2017:</strong> Countries should seize on momentum under the recent Kigali Agreement to rapidly move global markets for cooling equipment to much higher energy performances.</td>
</tr>
</tbody>
</table>
Energy demand in the buildings sector continues to grow.

Energy efficiency in buildings is not keeping up with the impact of a growing and more prosperous global population, resulting in 425 EJ of cumulative energy demand growth since 1990.

Source: IEA Energy Technology Perspectives 2017
Rapid energy efficiency deployment, alongside shifts from fossil fuels to high-performance, renewable and integrated energy technologies, leads to cumulative energy savings of 1 275 EJ under the B2DS.
...we can reverse historical trends

Decomposition of global final energy demand in buildings by key contribution

Energy efficiency measures under the B2DS reverse historical trends, offsetting the effect of an increasing global population, building activity drivers and growing floor area in buildings.

Source: IEA Energy Technology Perspectives 2017
Capturing the enormous energy efficiency potential in buildings

Buildings final energy consumption by scenario and fuel type

Going to B2DS would increase electrification and the use of renewables

Source: IEA Energy Technology Perspectives 2017
Space Heating and Cooling

Mission Innovation challenge #7
MI challenge #7: affordable heating and cooling in buildings

Rapid energy efficiency deployment, and a shift from fossil fuels to high-performance, renewable and integrated energy technologies, leads to most savings in heating and cooling under the B2DS.

Source: IEA Energy Technology Perspectives 2017
MI challenge #7: affordable heating and cooling in buildings

Heating and cooling final energy use and equipment stock shares by scenario

Strategic shifts to heat pumps, renewables and low‐carbon & efficient district energy would cut final energy demand for heating and cooling by more than 40% in 2060.

Source: IEA Energy Technology Perspectives 2017
Heat-pumps can drive energy efficiency in buildings

Heat-pump technologies continue to improve and can drive energy efficiency in buildings.

Source: IEA Energy Technology Perspectives 2017

© IEA 2017
Heating equipment

Evolution of heating equipment in buildings to 2060

Inner to outer ring

2014 2020 2030 2040 2050 2060

RTS 2DS B2DS

Coal and oil boilers Gas boilers Efficient gas technologies Heat pumps
Electric resistance District heat Solar thermal
Efficient biomass

Heat pumps, solar thermal and district heat is key to B2DS

Source: IEA Energy Technology Perspectives 2017
Demand for space cooling is heating up

Global energy consumption by building end-use, 1990-2050

Space cooling (along with appliances and lighting) is expected to have significant growth.

Cooling sales aren’t keeping up with performance potential

Typical energy efficiency ratios of split-package air conditioners in 2015

Cooling demand could increase as much as tenfold in some countries over the next 40 years, and average equipment performance is far from its energy efficiency potential.

Source: IEA Energy Technology Perspectives 2016
Space cooling energy savings are achievable

Space cooling energy use could plateau by 2060 with improved policies or decrease with the implementation of best available technology

Source: IEA Energy Technology Perspectives 2017, IEA Energy Efficiency Market Report 2017
Lighting
LED market share in residential lamp sales overtook incandescents in 2015 and reached nearly 30% of the lighting market in 2016.
Rapid deployment of energy-efficient technologies will create critical mass in the market, helping to lower technology costs and drive R&D for greater energy performance.
Building envelope
Locking in better buildings today…

High-performance building construction and deep energy renovations of existing buildings play a critical role in reducing buildings sector energy demand.

Changes in global residential building stock and energy intensity to 2060

- nZEBs
- Renovated buildings
- Improvement
- New construction
- Renovated stock
- Global average

High-performance building construction and deep energy renovations of existing buildings play a critical role in reducing buildings sector energy demand.
Delaying building envelope measures would result in the equivalent of three years of additional energy consumption for heating and cooling in the buildings sector.
A call to action
Delivering sustainable energy in buildings at affordable prices

Continued R&D and larger economies of scale can help to drive down the costs for high-performance, energy-efficient and renewable technologies to 2060.

Building investment to 2060 and share of total B2DS investment by key region

<table>
<thead>
<tr>
<th>Region</th>
<th>Share of Total B2DS Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>12%</td>
</tr>
<tr>
<td>Western Europe</td>
<td>10%</td>
</tr>
<tr>
<td>Eurasia</td>
<td>3%</td>
</tr>
<tr>
<td>China</td>
<td>18%</td>
</tr>
<tr>
<td>India</td>
<td>18%</td>
</tr>
<tr>
<td>Other Asia &amp; Pacific</td>
<td>6%</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>6%</td>
</tr>
<tr>
<td>Middle East &amp; Africa</td>
<td>18%</td>
</tr>
<tr>
<td>Latin America &amp; Caribbean</td>
<td>17%</td>
</tr>
</tbody>
</table>

USD trillion

<table>
<thead>
<tr>
<th>Year</th>
<th>RTS 2016-30</th>
<th>2DS 2031-45</th>
<th>B2DS</th>
<th>RTS 2046-60</th>
<th>2DS</th>
<th>B2DS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
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# Technology strategies for a B2DS buildings sector

## Whole building
- High-performance envelope components and whole building packages
- nZEB(+) building construction across all countries
- Low-cost deep energy renovation solutions
- Zero-carbon building energy communities

## Heating and cooling equipment
- Improved thermal distribution and control
- High-performance heat pumps and solar thermal solutions
- Responsive and affordable thermal energy storage
- Integrated, flexible district energy solutions

## Lighting and appliances
- High-performance, lower cost solid state lighting
- Integrated design and control for lighting service
- High-efficiency appliance technologies
- Performance standards for plug loads and smarter use of connected devices

## Cooking and energy access
- Clean, affordable cooking solutions for developing countries
- Low-cost solar thermal and storage solutions
- Efficient, low-polluting biomass solutions

Source: IEA Energy Technology Perspectives 2017
### Policy strategies for a B2DS buildings sector

<table>
<thead>
<tr>
<th>Building construction &amp; renovation</th>
<th>Transition to zero-carbon buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Mandatory building energy codes for new <em>and</em> existing buildings</td>
<td>▪ Long-term, strategic vision for energy transition</td>
</tr>
<tr>
<td>▪ Capacity building and training</td>
<td>▪ Phase-out of fossil fuel subsidies and other perverse incentives</td>
</tr>
<tr>
<td>▪ Financing and market incentives</td>
<td>▪ Assertive market frameworks</td>
</tr>
<tr>
<td>▪ Cooperation and knowledge sharing</td>
<td>▪ Integrated, flexible district energy solutions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rapid energy efficiency deployment</th>
<th>Technology innovation</th>
</tr>
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<tbody>
<tr>
<td>▪ Minimum energy performance standards</td>
<td>▪ Supporting R&amp;D beyond current BAT</td>
</tr>
<tr>
<td>▪ Labelling and awareness programmes</td>
<td>▪ Cost reductions for critical technologies</td>
</tr>
<tr>
<td>▪ Financing and market incentives</td>
<td>▪ Integrated energy technology solutions</td>
</tr>
<tr>
<td>▪ Support for market scale (e.g. bulk procurement)</td>
<td>▪ Advances in clean energy technologies</td>
</tr>
</tbody>
</table>

Source: IEA Energy Technology Perspectives 2017
Energy Efficient Prosperity

Energy efficiency as a means to support economic and social development.