Monitoring Progress towards a Clean Energy Economy: Energy Efficient Buildings – Heating and Cooling

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November 17, 2011

IEA Recommendations on Buildings

- Mandatory building energy codes and minimum energy performance
- Aiming for net-zero energy consumption in buildings
- Improving the energy efficiency of existing buildings
- Building energy labels or certificates
- Improved energy performance of building components and systems

From IEA Clean energy progress report, 2011

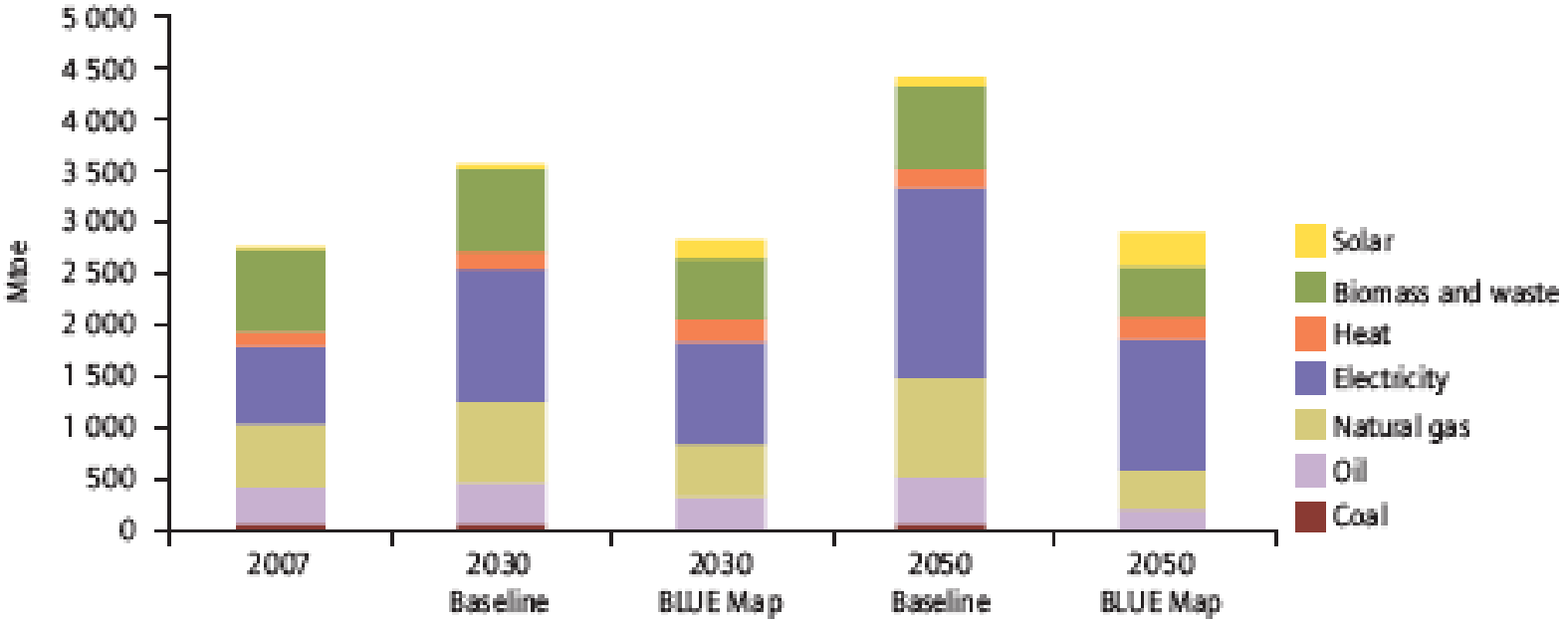
- energy consumption in buildings sector projected to grow from 2759 Mtoe (2007) to over 4400 Mtoe by 2050, with more than half in residential and significant increase in non-OECD
- to meet needs of longer-term, new buildings will need to be zero-energy and deep renovation of existing buildings will be required

From IEA Clean energy progress report - 2

- challenge is to put in place polices that target improvements in technical efficiency of building components as well as in design of new buildings and the design of systems, especially heating, ventilation and cooling
- during last 3 decades, improvement made in energy performance of insulation materials and windows. Double glazing is now becoming standard.
- increase of the sales of high-performing windows and insulating materials show the positive steps that are being taken to ensure improved efficiency of buildings envelope and shell technologies

Building Sector Energy Consumption by fuel and by scenario

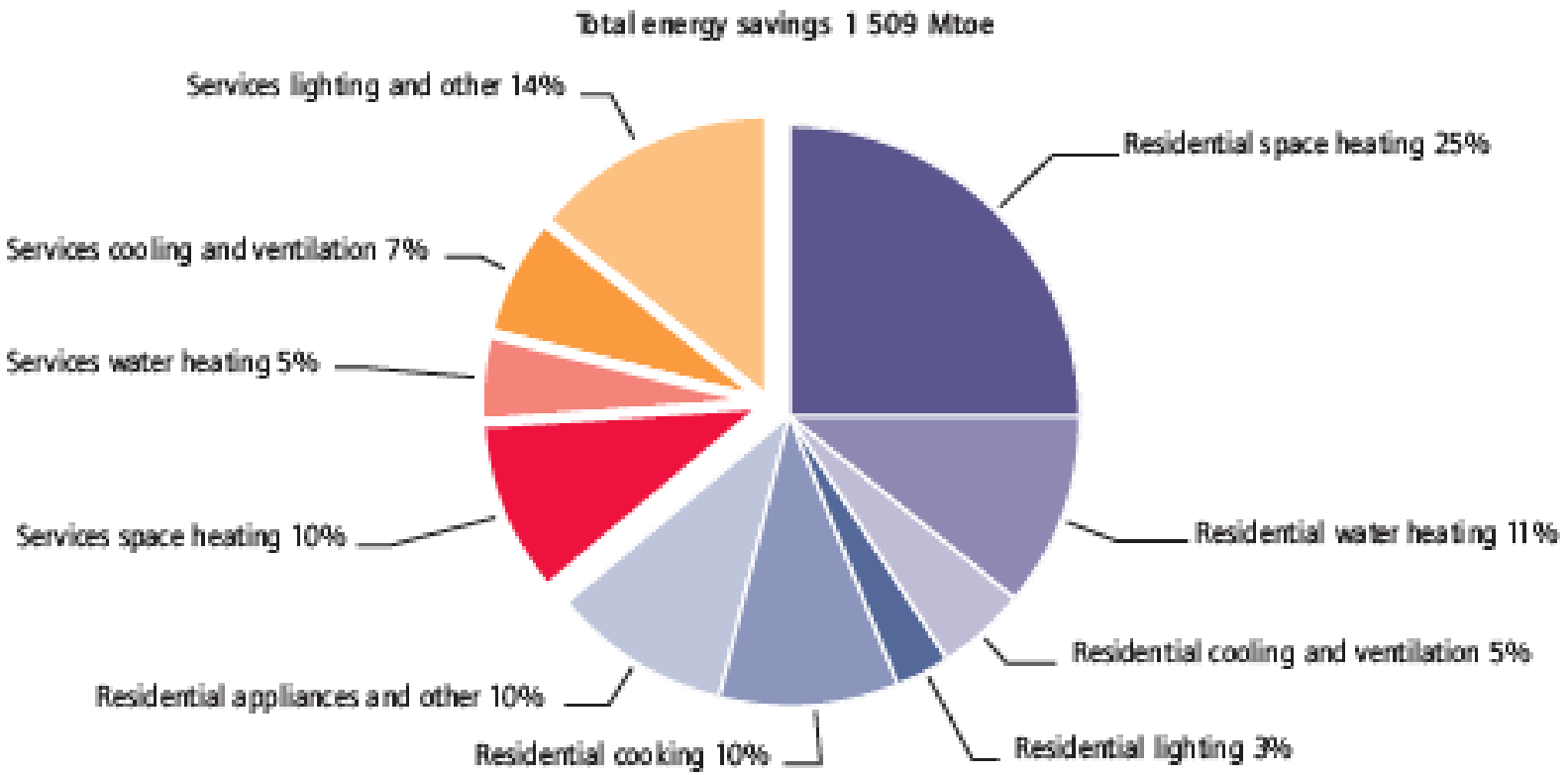
Figure 1: Buildings sector energy consumption by fuel and by scenario



Source: Unless otherwise indicated, material in figures and tables derive from IEA data and analysis.

KEY POINT: Energy consumption in the building sector is 5% higher in 2050 than in 2007 in the BLUE Map scenario.

Building Sector Energy Savings by Sector and End-Use



KEY POINT: Two-thirds of the buildings sector energy savings in the BLUE Map scenario

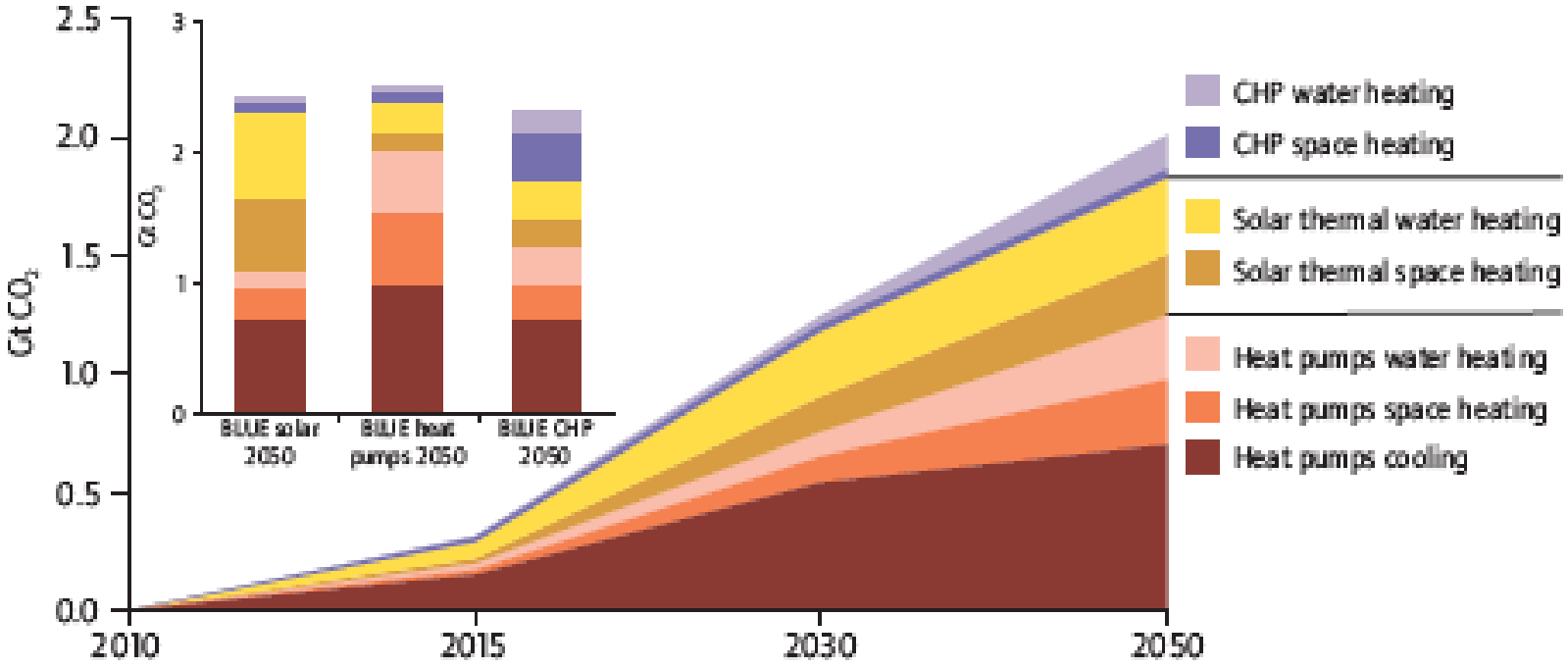
Table 7: Cost and performance goals for heating and cooling technologies, 2030 and 2050

	2030		2050	
Active solar thermal				
Installed cost	-50% to -75%		-50% to -75%	
Maintenance cost	0% to -40%		0% to -40%	
Delivered energy cost	-50% to -60%		-50% to -65%	
Thermal energy storage	PCM, thermal-chemical and centralised		PCM, thermal-chemical and centralised	
Installed cost	-50% to -75%		-65% to -85%	
Delivered energy cost	Depends on cycle regime		Depends on cycle regime	
Heat pumps	Space/water heating	Cooling	Space/water heating	Cooling
Installed cost	-20% to -30%	-5% to -15%	-30% to -40%	-5% to -20%
Coefficient of performance	30% to 50% improvement	20% to 40% improvement	40%to 60% improvement	30% to 50% improvement
Delivered energy cost	-20% to -30%	-10% to -20%	-30% to -40%	-15% to -25%
CHP	Fuel cells	Microturbines	Fuel cells	Microturbines
Installed cost	-40% to -55%	-20% to -30%	-60% to -75%	-30% to -50%
Electrical efficiency	35% to 40%	30% to 35%	35% to 45%	35% to 40%
Total efficiency	75% to 80%	70% to 75%	75% to 85%	75% to 85%
Delivered energy cost	-45% to -65%	-10% to +5%	-75% to -85%	-15% to +20%

Note: Improvements in costs or performance are expressed as a percentage relative to the base year (2010) specification. However, the electrical and total efficiencies for CHP are actual percentages, not improvements. For fuel cells, the delivered energy cost is for thermal energy and is based on a long-run cost of CO_2-free hydrogen of between USD 15/GJ and USD 25/GJ in 2050.

Contribution to CO2 Reduction

Figure 7: Heating and cooling technologies' contribution to CO_2 emissions reduction (BLUE Map and alternative scenarios)



Note: Excludes the impact of improved building shells on reducing heating and cooling loads.

KEY POINT: Energy-efficient and low/zero carbon technologies for heating and cooling save 2 Gt CO_2 by 2050.

Where are we?

- Technological Readiness
  - From the previous table, the heating and cooling technologies are on a good path in terms of goals and meeting them
  - most of these heating and cooling technologies are commercially available today, as IEA Technology Roadmap states
  - IEA Technology Roadmap states that R&D efforts should focus on reducing costs, improving the efficiency and integration of components. I fully agree
  - more work needed on materials but most of that is outside energy R&D
  - regions such as EU coming out with new R&D strategies and those will be interesting to follow. Much more emphasis on low carbon economies and the full implications of what that means

Where are we?

- Market Readiness
  - There is a lot of policy activity that will contribute to the 2050 target:
    - EU recast of Buildings Directive takes energy performance perspective which is much more systems oriented. Also, it brings cost optimality concept into approach. And nearly zero energy buildings
    - While EU has Ecodesign for minimum energy performance standards, there has been a slowdown in approval for boilers. While this may not affect 2050, it will affect 2020 goals
    - EU has target of 80-95% reduction in GHG emissions by 2050

Where are we?

- Market Readiness
  - There is a lot of policy activity that will contribute to the 2050 target:
    - significant code development in US, especially since 2009 recovery programme
    - A recent study from Pacific Northwest National Lab estimates more than $15 billion in annual savings on bills in 2030
    - More targets and programmes for zero energy buildings
    - US and many others have signed up to Copenhagen Accord that, inter alia, increase in global temperature should be below 2 degrees Celsius
    - Fukushima has set off a tsunami of policy re-thinking

Where are we?

- Market Transformation
  - many of the products are traded regionally or globally
  - energy labelling and MEPS have had an effect on market transformation
  - transformation in for a shock as we move to low carbon society. We are seeing this in Roadmap 2050 from EC. But events such as Fukushima also make major contribution

Where next? - 1

- We are talking about a major transformational change when we look to 2050. Everything has to be "on the table" to discuss
- What will a conventional heating system be in 2050?
  - Depends on how we define a conventional building then
  - We have a lot of re-thinking to do

Where next? - 2

- Areas that need urgent attention:
  - Design – integration of new solutions, fostering ICT technologies
  - Systemic approach
  - integration between buildings, grid and heat networks
  - systems and storage
  - integration with renewables
  - Deep retrofits and the full implications
  - policy support tools: labelling, standardisation, global harmonisation

Monitoring

- Since many of the technologies we need are already there, key is on policy developments:
  - national, regional and global
  - essential to have policy targets on GHG emissions
  - buildings policies such as nearly zero energy buildings will be important marker
- Level of funding
- Activity of private sector in development

Thank You

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