Clean Energy Solutions Center
IEA Technology Roadmap: Energy Efficient Building Envelopes Launch

Didier Houssin and Marc LaFrance
International Energy Agency

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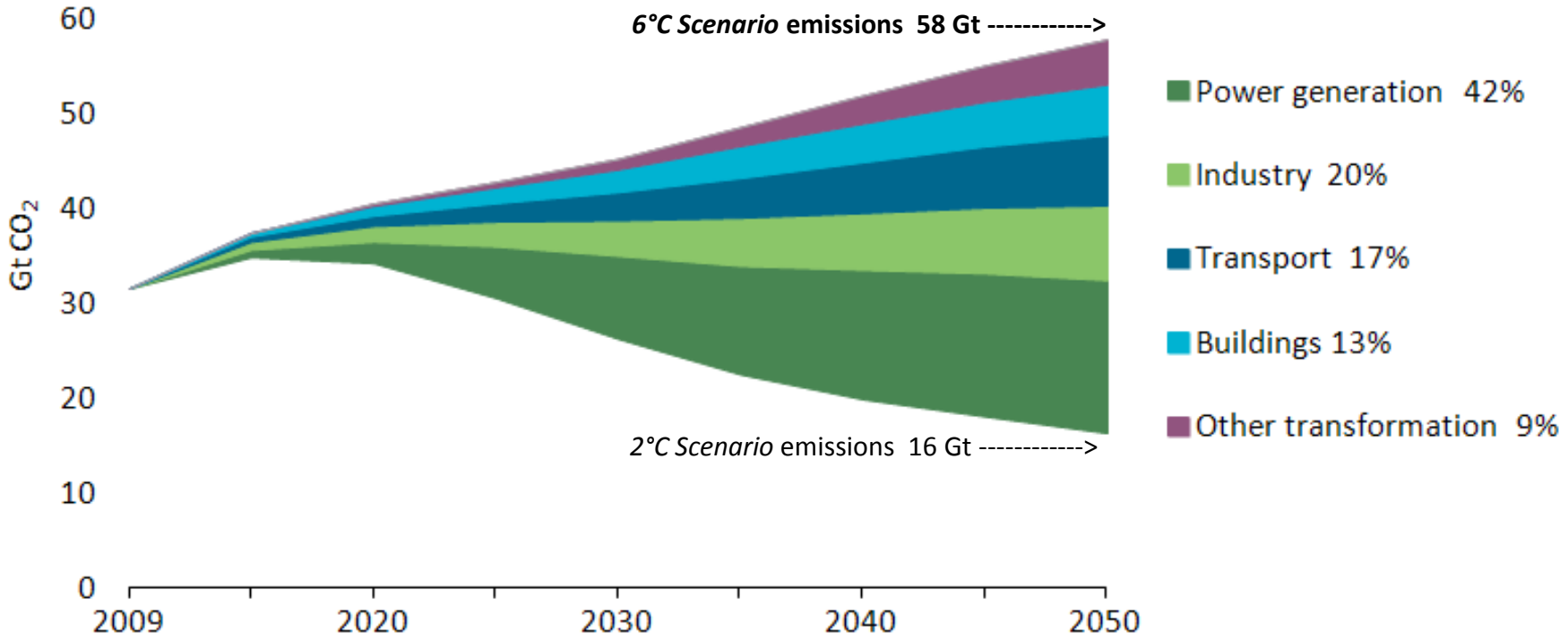
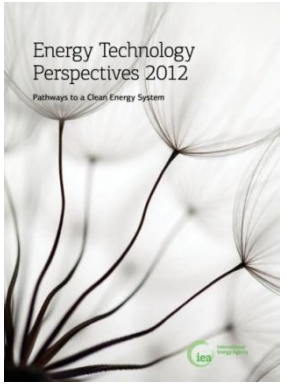
IEA/SPT Flagship Publication, Energy Technology Perspectives



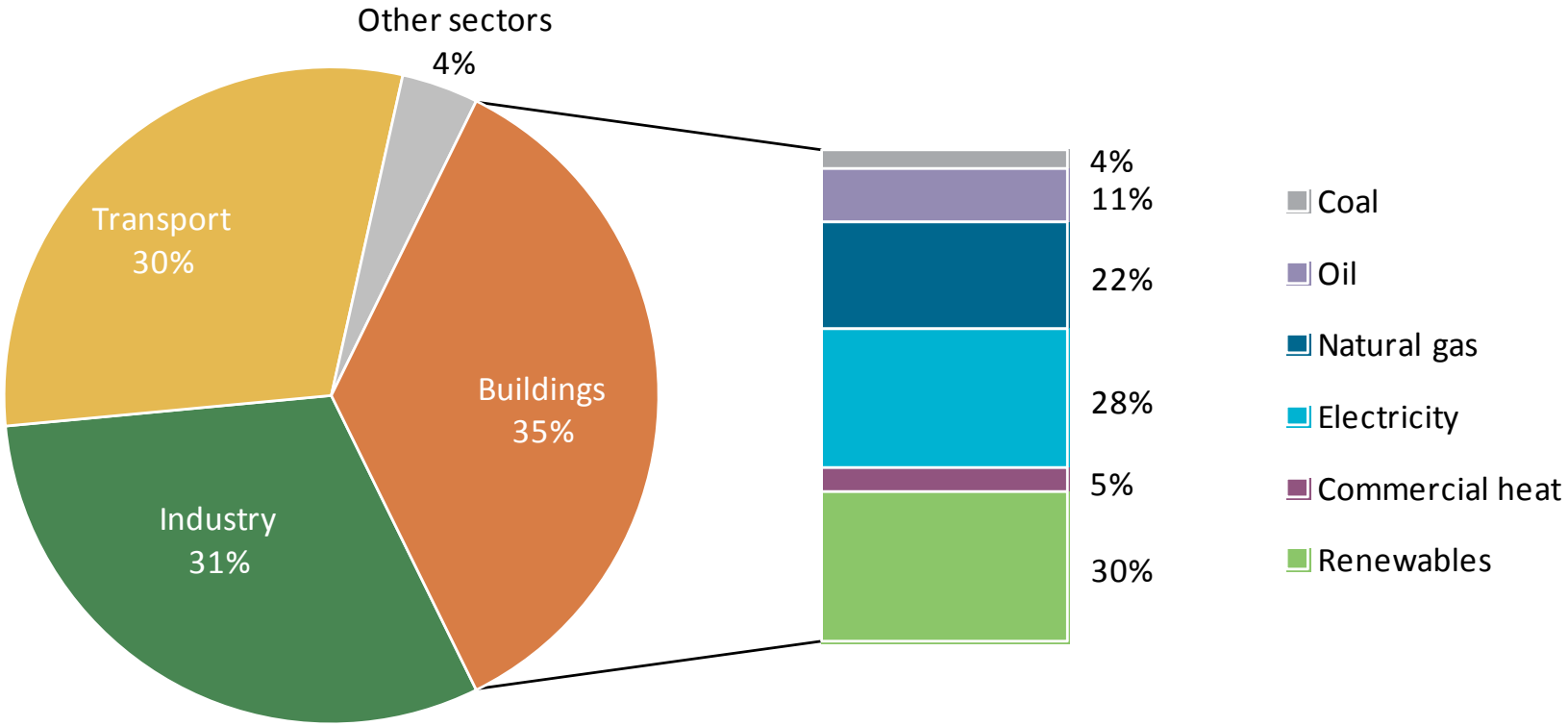
Source: Energy Technology Perspectives 2012

- 6°C Scenario – business-as-usual; no adoption of new energy and climate policies
- 2°C Scenario - energy-related CO_2-emissions halved by 2050 through CO_2-price and strong policies



ETP 2014 – Expected April 2014

Final Energy Consumption by Sector and Buildings Energy Mix, 2010



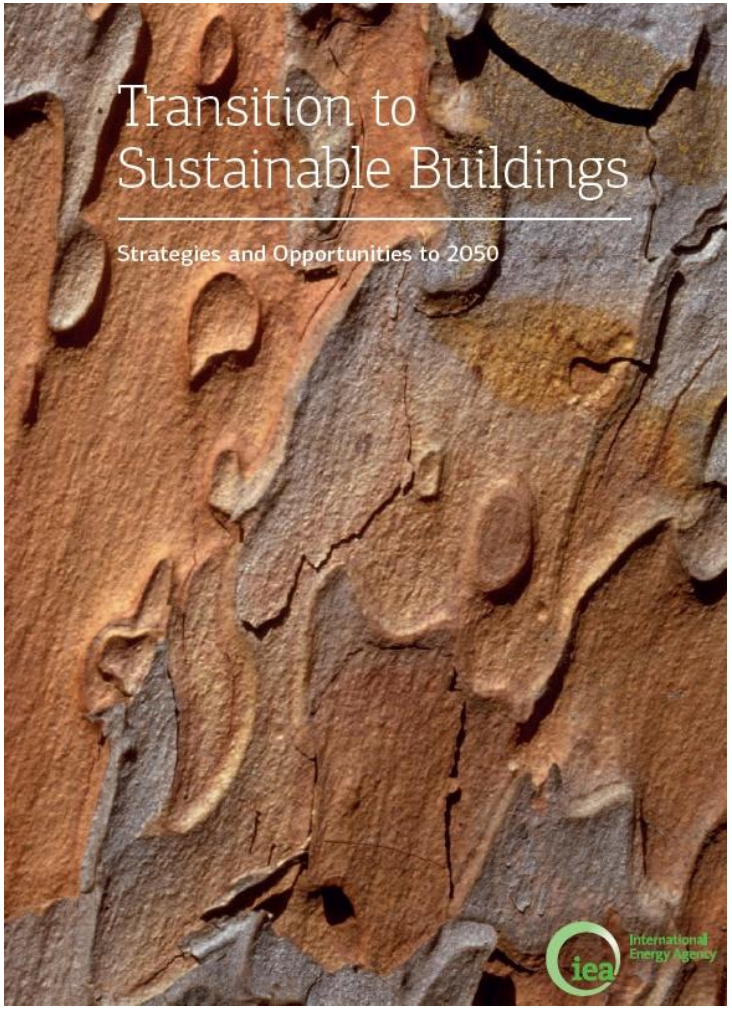
Buildings largest end-use sector!!

Importance of Building's Sector

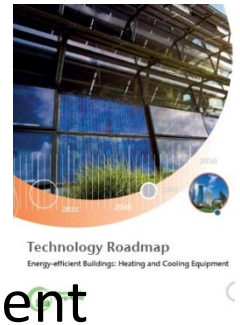
- 1/3 global carbon emissions
- 50% of electricity consumption
- Major portion of GDP, global economic crisis and decline was spurred by building sector collapse in many regions of the world
- Over 75% to 90% of OECD building stock will still be in service by 2050
- Large population growth, mostly in developing world (2.5 billion by 2050), will drive new floor area that needs to be efficient

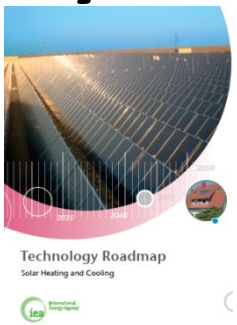
Transition to Sustainable Buildings: Strategies and Opportunities to 2050

- The overall ETP strategy for buildings
- Global and regional analysis, energy savings and emissions reduction forecasts
- Technical opportunities and recommendations: envelope; heating and cooling; appliances, lighting and cooking
- Policies to transform buildings

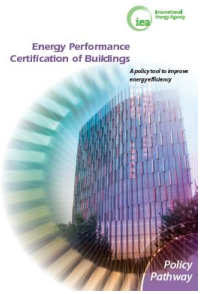


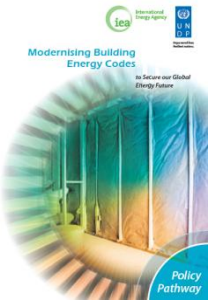
Technology Roadmaps and Policy Pathways





- Technology Roadmaps
  - Define and analyse available technologies
  - Develop vision for R&D and technology deployment
  - Assess policy, financial, and related needs
- Policy Pathway
  - Based on one of 25 IEA energy efficiency recommendations
  - 10 step guide for policy planning, implementation, monitoring and evaluation
  - Highlights best experience in countries

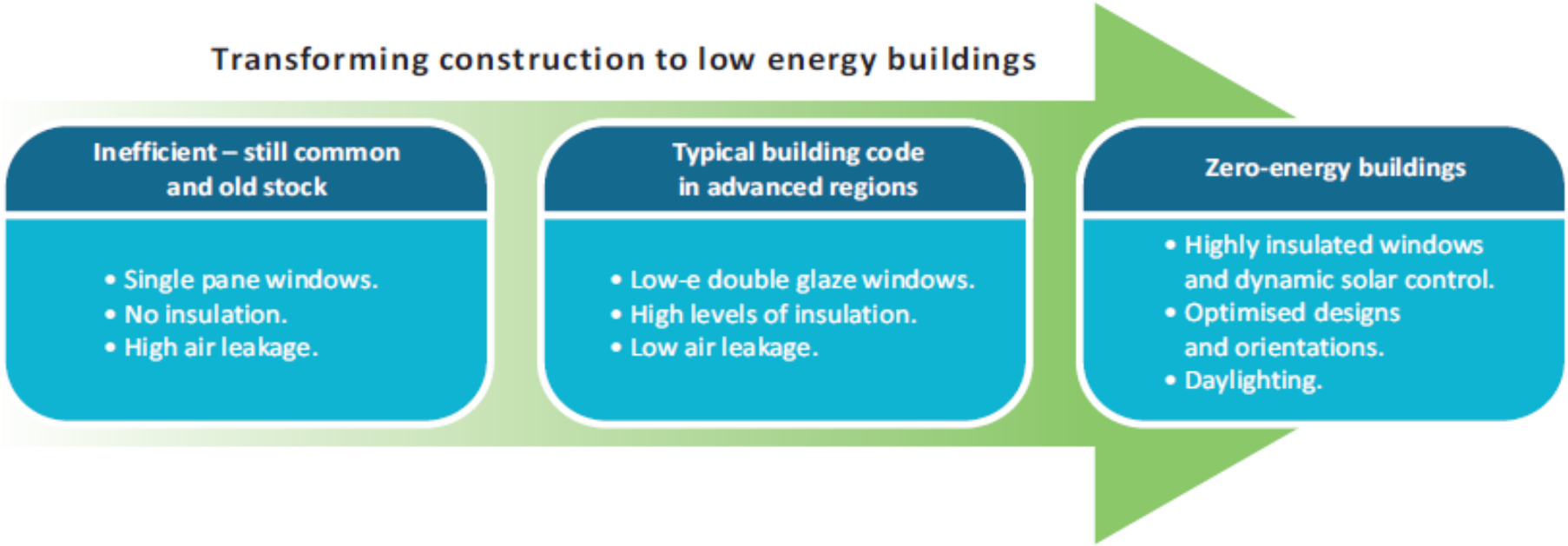




Technology Roadmap
Energy Efficient Building Envelopes

- Construction transformation strategy
- Provides technical, economic and strategic framework
- Assessment of high priority areas for 12 regions of the world
- Policy criteria and evaluation

Transformation to Low-Energy Buildings



KEY POINT: the world needs to shift from very old buildings to modern buildings, and then to low-energy or zero-energy buildings.

Envelope Savings Potential

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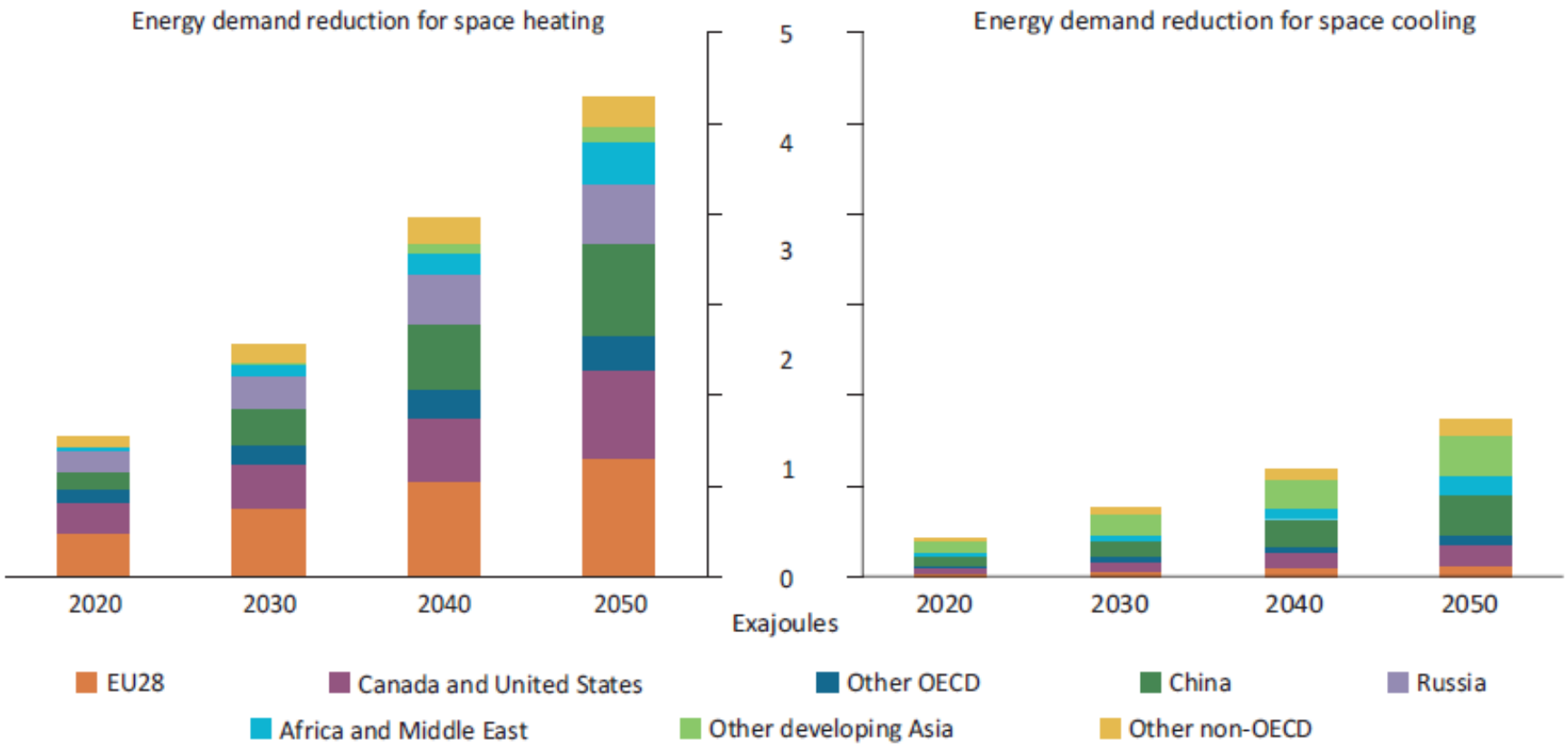
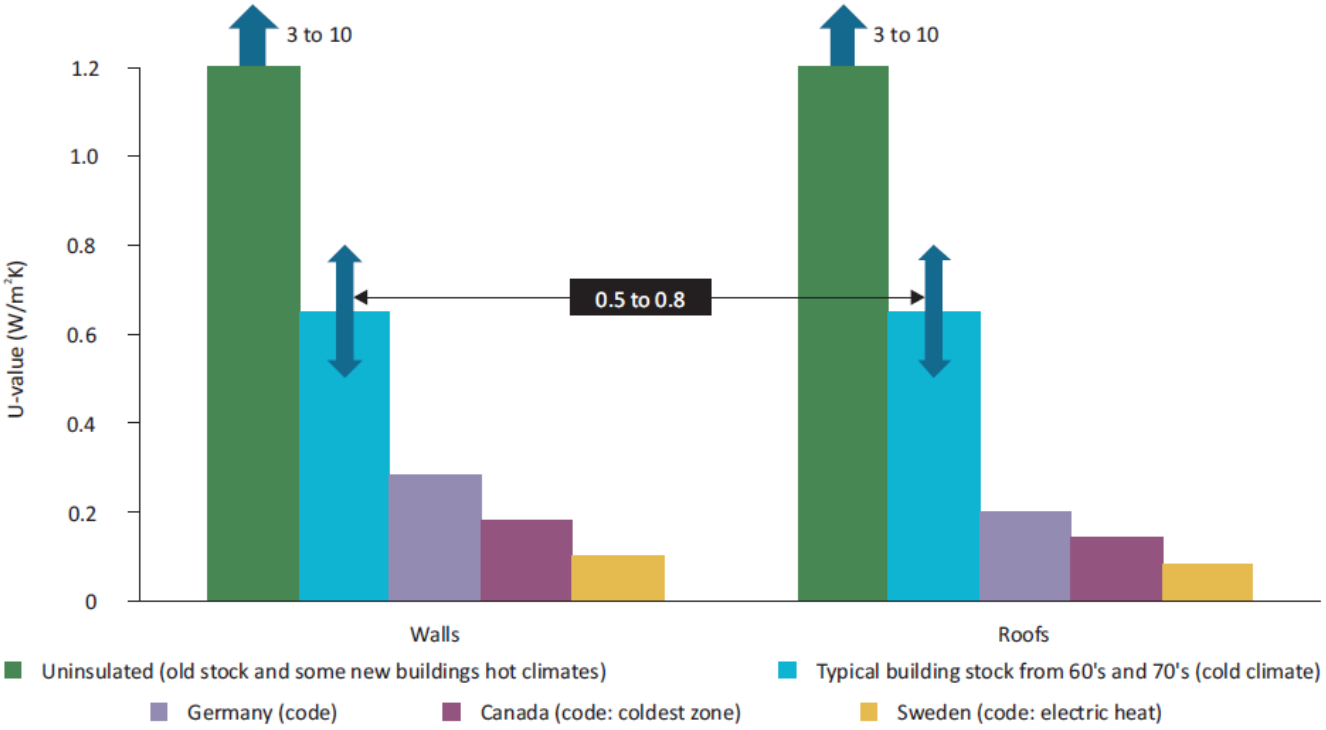
Figure 8: Energy reductions from improvement in building envelopes between the 6DS and 2DS



KEY POINT: building-envelope energy savings under the 2DS are significant, with heating savings around four times higher than cooling savings.

Insulation Opportunity

- Very stringent U-values for electric resistance heaters in Sweden, and Canada's coldest climate zone
- IEA recommending goal for average wall and roof U-values ≤ 0.15 W/m2K cold climate, ≤ 0.35 W/m^{2}K hot climate based on LCC



Source: Adapted from IEA (2013a), "Transition to Sustainable Buildings: Strategies and Opportunities to 2050", Organisation for Economic Co-operation and Development (OECD) Publishing, Paris.

KEY POINT: levels of insulation vary widely for the existing stock of buildings, as well as for new construction.

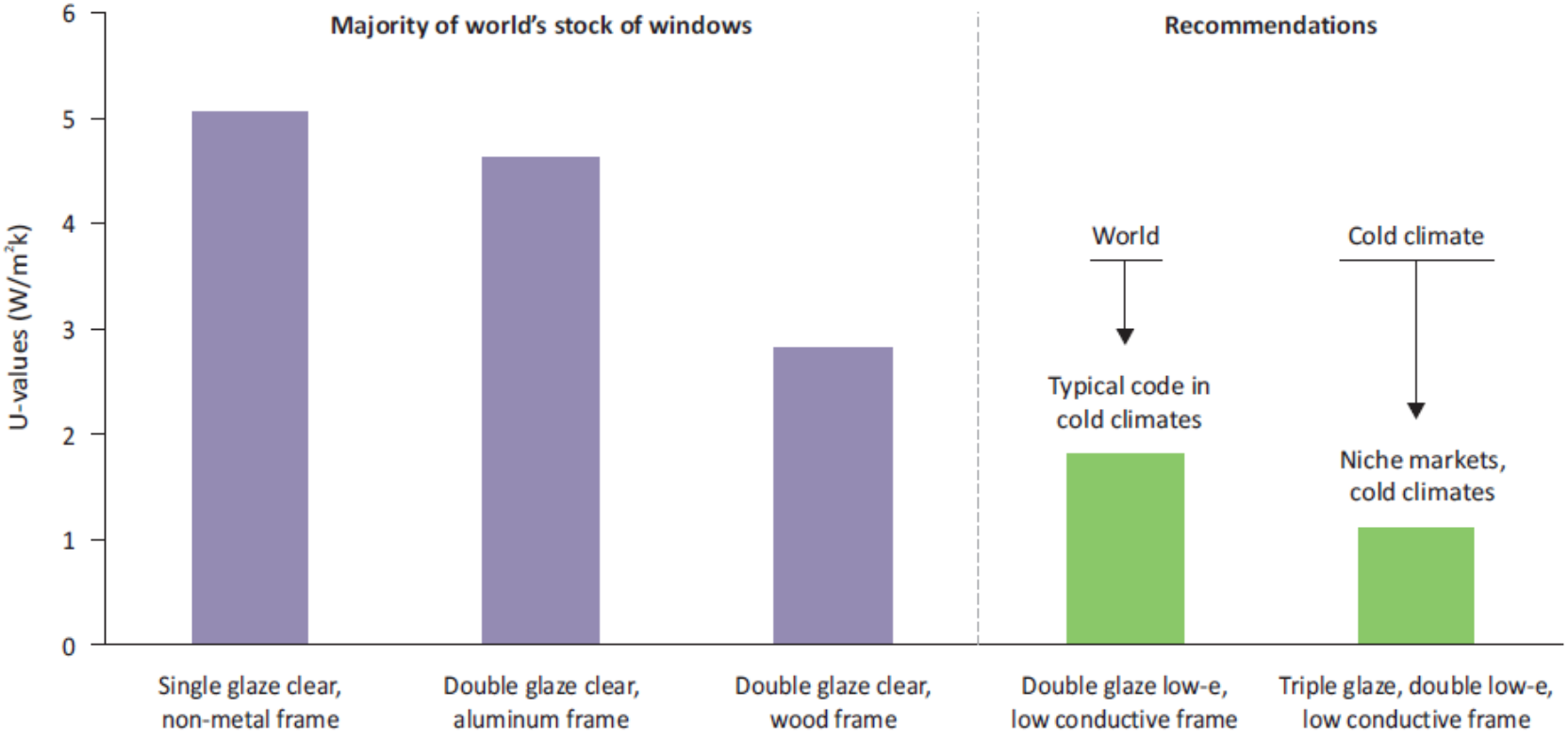
Validated Air Sealing

- Validated air sealing is a critical measure for building codes and renovation
- Majority of energy performance certificates do not require validation
- More research needed to offer more affordable testing and solutions (mostly for developing markets)

Source: Oak Ridge National Laboratory

Windows Opportunity

Figure 3: Most common types of windows in service and being sold today



Note: U-values presented in this roadmap represent whole-window performance unless noted in accordance with ISO 15099, thus an ISO 10077 standard of 1.0 W/m²K is roughly equal to 1.1 W/m²K per ISO 15099.

KEY POINT: the majority of the world's installed windows can be significantly improved and more work is needed to ensure that new sales meet more stringent performance criteria.

Reflective Roof Opportunity

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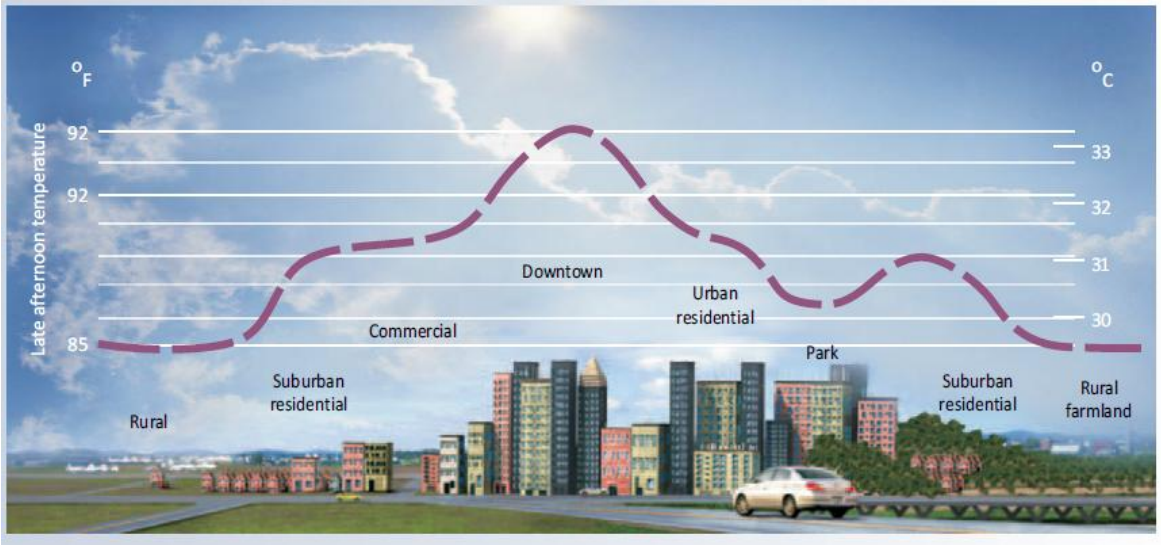
Table 3: Performance characteristics and energy-savings potential for reflective roofs

	SR of a dark roof	SR of a white roof	SR of a cool-coloured roof	Roof energy-savings potential (with high level of insulation)	Roof energy-saving potential (with low level of insulation)
Roof performance characteristics	SR 5 (black) to SR 20 (grey)	SR 60 (soiled) to SR 80 (clean)	SR 25 (darker colour) to SR 50 (lighter colour)	13%	25%

Note: High insulation refers to a U value of 0.29 W/m²K, and low level of insulation has a U value of 0.51 W/m²K or higher.



Source: LBNL, Heat Island Group

Assessment of Advanced Envelope Components

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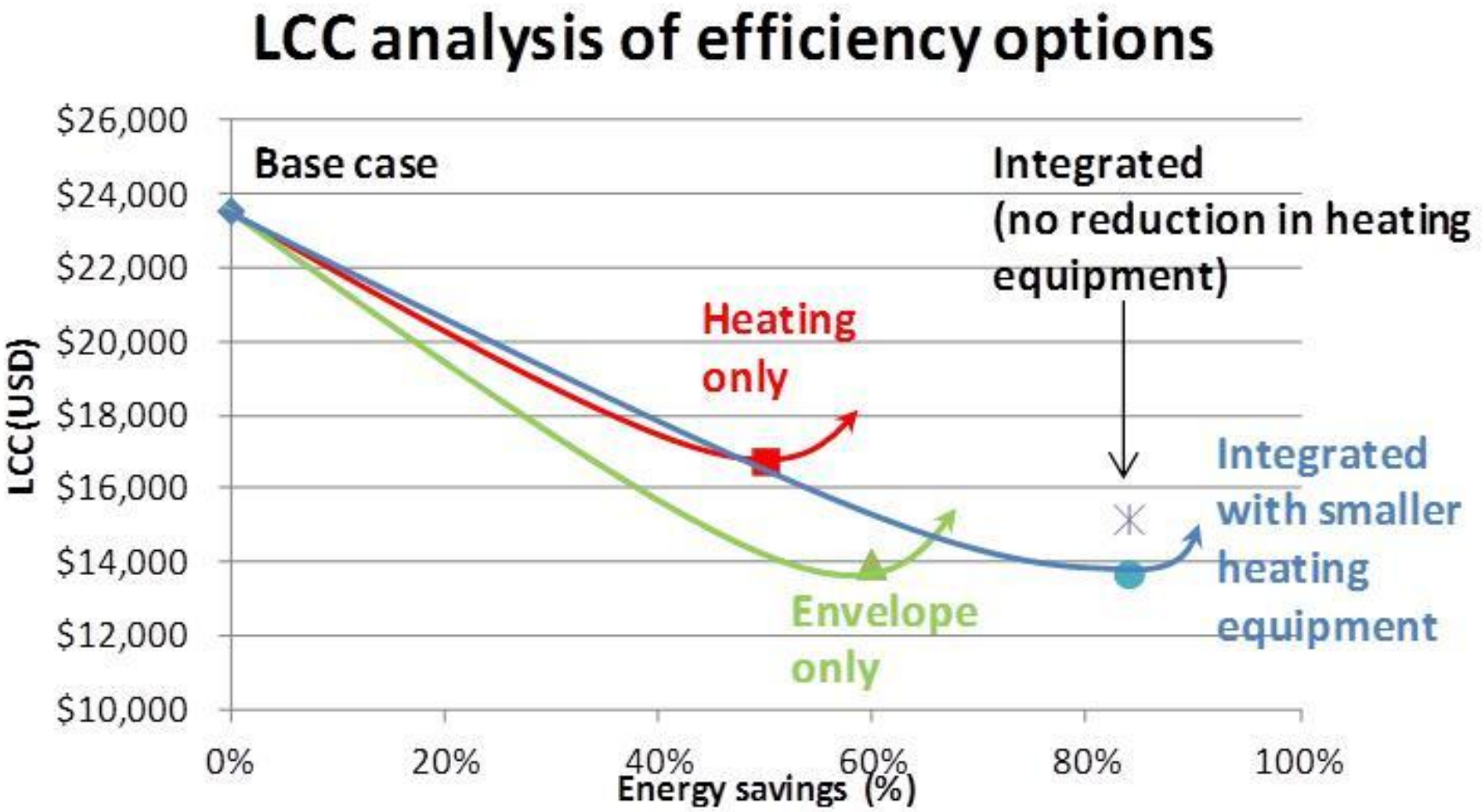
Market maturity/ saturation	ASEAN	Brazil	China	European Union	India	Japan/ Korea	Mexico	Middle East	Australia/ New Zealand	Russia	South Africa	United States/ Canada
Double-glazed low-e glass	●	▲	▲	★	▲	●	●	▲	●	●	●	★
Window films	▲	▲	▲	●	▲	●	▲	▲	●	▲	▲	●
Window attachments (e.g. shutters, shades, storm panel)	●	▲	●	★	▲	●	▲	●	●	▲	●	●
Highly insulating windows (e.g. triple-glazed)		▲	▲	●		▲		▲	▲	▲	▲	▲
Typical insulation	★	●	★	★	●	★	●	★	★	★	●	★
Exterior insulation	●	▲	●	★	●	●	▲	●		▲	▲	★
Advanced insulation (e.g. aerogel, VIPs)				▲		▲				▲	▲	▲
Air sealing	●	▲	▲	★	▲	●		▲	▲	▲		●
Cool roofs	▲	▲	▲	●	▲	▲	▲	▲	▲			★
BIPV/ advanced roofs	▲	▲		▲	▲	▲			▲	▲	▲	▲

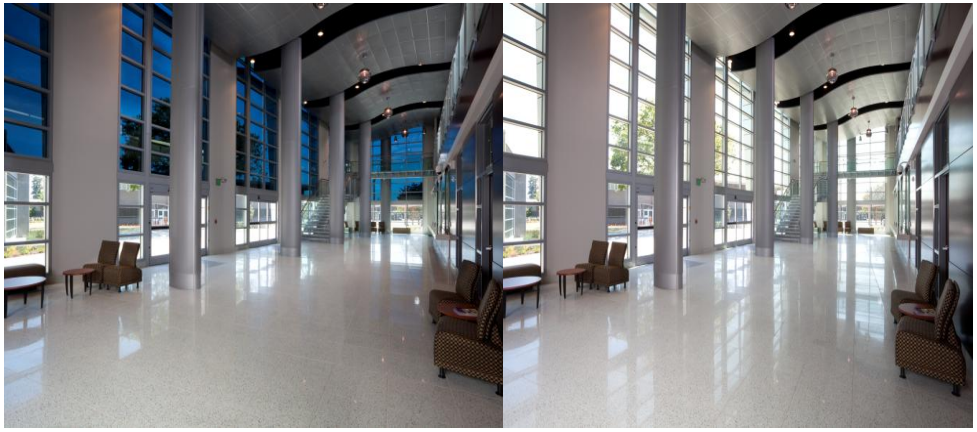
★ Mature market ● Established market ▲ Initial market

Integrated Approach with Life-Cycle Cost



R&D Areas

- Highly insulated windows (U value ≤ 0.6 W/m²K for ZEB) and dynamic solar control - integrated solution increase daylight and passive heating harvesting
- Lower air sealing approaches with validation testing
- Lower cost high performance "thin" insulation
- More durable and lower cost reflective surfaces



Source: Sage Electrochromics (St Gobain)

Source: Aspen Aerogel

Source: ORNL

Criteria for Policy Assessments, IEA Perspective

Policies	ASEAN	Brazil	China	European Union	India	Japan/ Korea	Mexico	Middle East	Australia/ New Zealand	Russia	South Africa	United States/ Canada
Governance	L	M	H	H	M	M	M	L	M	L	M	M
Energy prices	L	M	M	H	M	H	L	L	M	L	M	M
Infrastructure and human capacity	M	L	M	H	M	H	M	L	M	M	M	H
Commodity of efficient materials	L	M	H	H	M	H	M	L	M	M	L	H
Voluntary programmes	L	L	L	M	L	L	L	L	L	L	L	L
Mandatory building codes	L	L	M	H	L	M	M	L	M	M	M	H

Note: H: high, M: medium, L: low

Tracking Progress – Next Steps

- Much more data is needed
  (e.g. new technology adoption rates, market share of zero-energy buildings, etc)
- More specific performance criteria needed even for most advanced regions
  (e.g. EU specifications for renovation in public buildings)
- IEA is considering a new building's partnership
  (for policy assessment, to improve data and modeling, and to enable deployment)

Key Focus for Action

- Greater deployment of proven technology in developed countries
- Introduction of mature products and technologies to developing markets
  (e.g. infrastructure – skills, product availability, performance metrics, etc)
- R&D to improve performance, reduce cost and provide greater overall return on investment

Contact Data

International Energy Agency

9, rue de la Federation

757 Paris Cedex 15, France

Marc LaFrance

Energy Analyst Buildings Sector, Energy Technology Policy Division

marc.lafrance@iea.org, +33 (0)1 40 57 67 38

Download Roadmap after launch

http://www.iea.org/publications/freepublications/publication/name,45205,en.html