International Energy Agency
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IEA Building Sector Strategies: Global and Ukraine

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Ukraine Workshop

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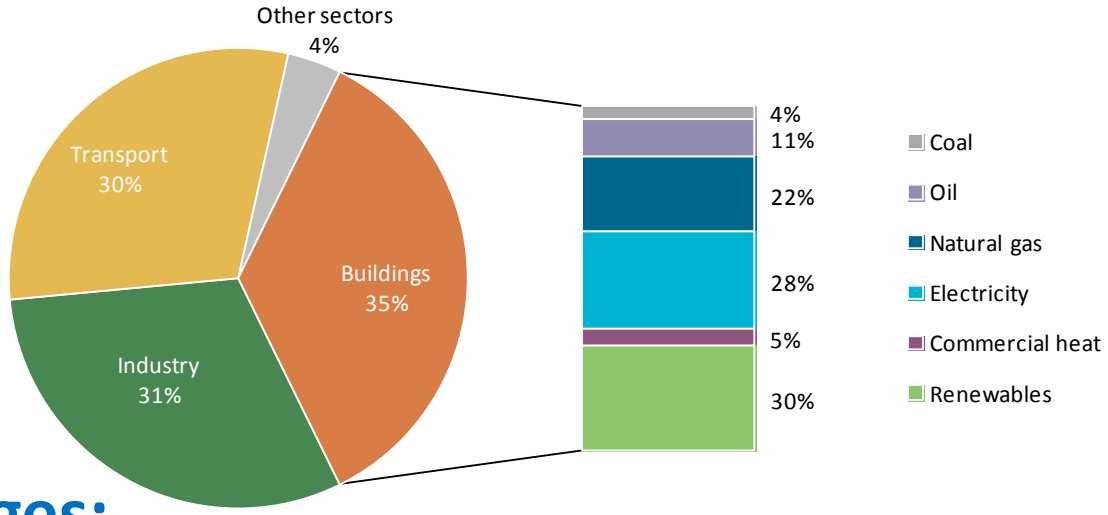
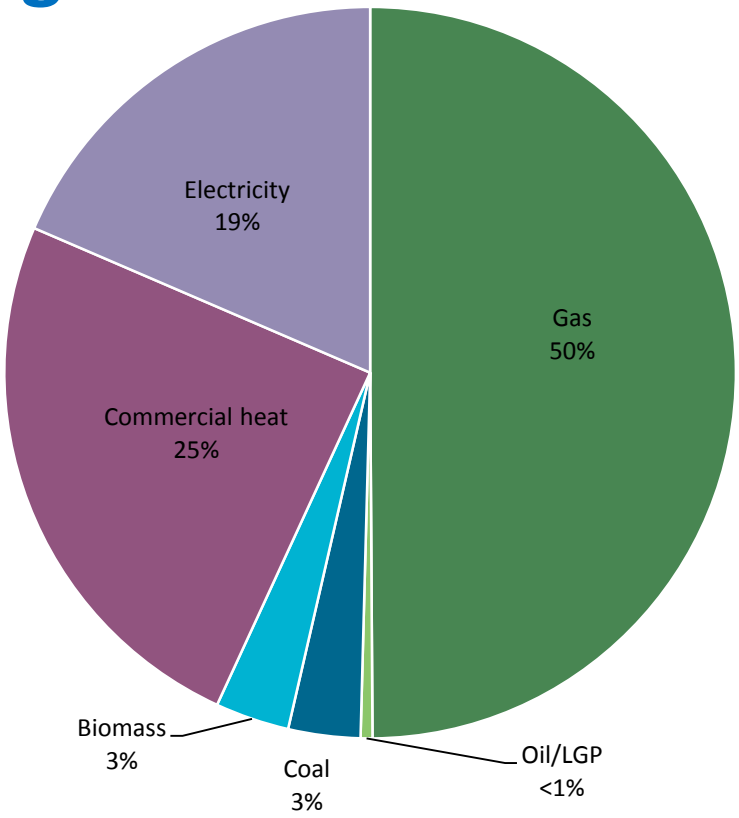
Importance of Buildings Sector

- **Largest end-use sector**
- **1/3 carbon emissions**
- **50% of electricity**
- **Major portion of GDP**
- **Opportunities/challenges:**
  - 75% - 90% of OECD building stock still in service by 2050
  - Large population growth in developing world will drive new floor area that needs to be efficient (2.5 billion more by 2050)



Ukraine Building's Energy Balance (2012)

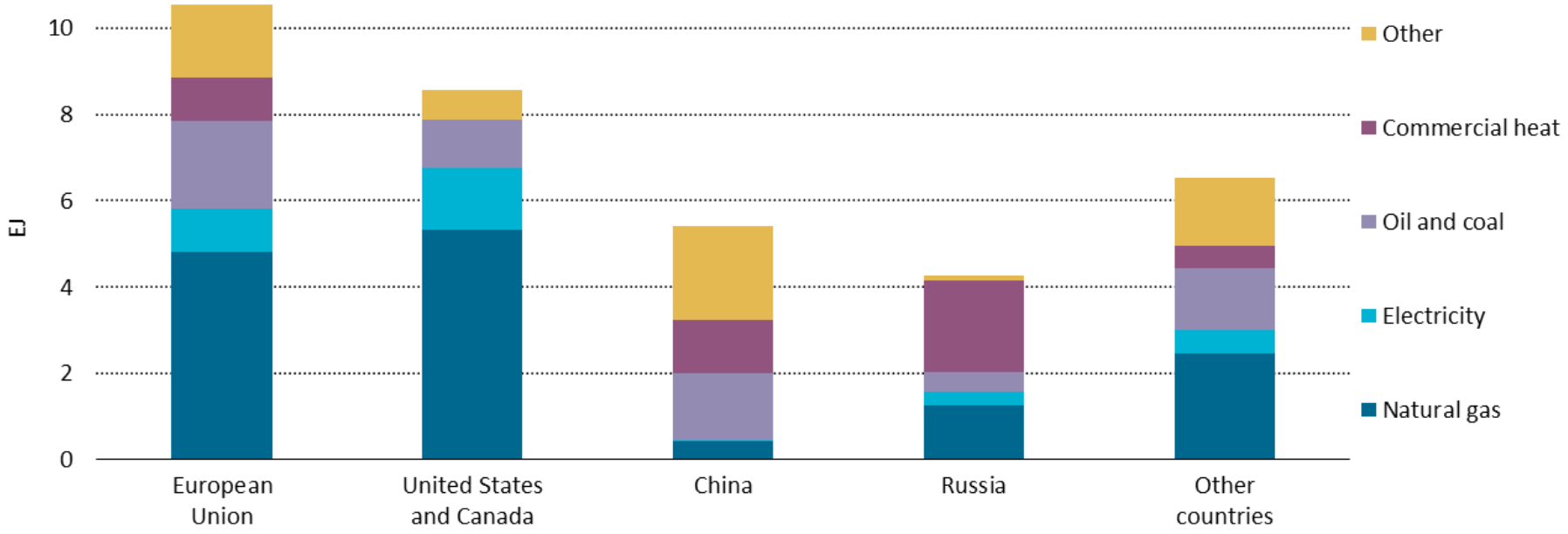
- **Major dependence on gas for space and water heating**



Global Heating Impact

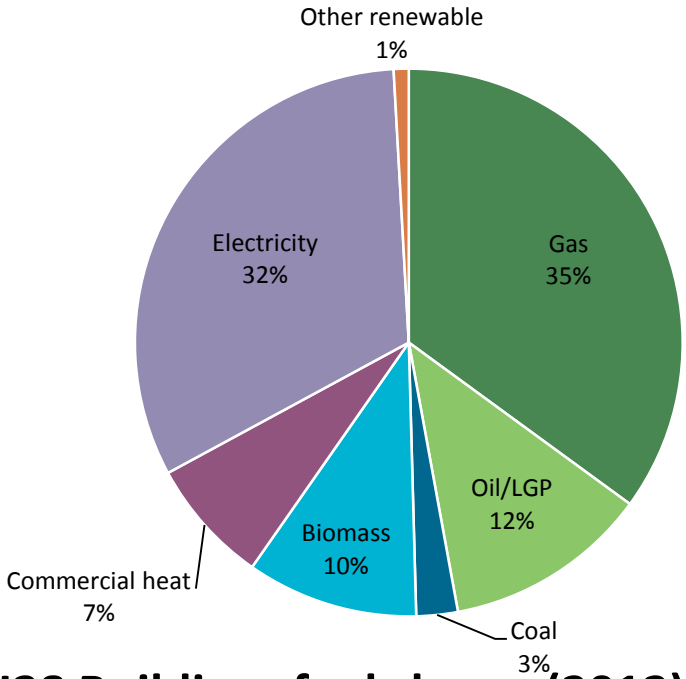
- **Space heating is 30% globally of the buildings sector and with water heating up to 50%**

Global space heating consumption and fuel shares in 2012 (exajoules)

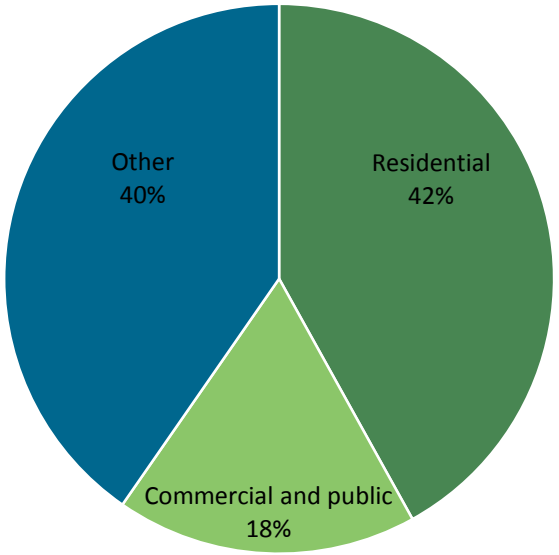


EU Gas Dependence for Buildings

- **Gas represents 35% of EU building's fuel share, but around 60% of final energy gas consumption of the economy**

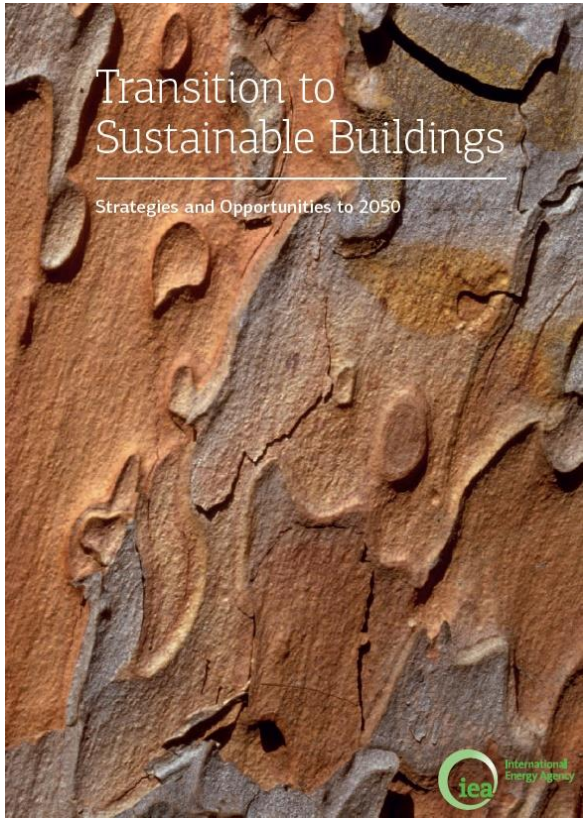


EU28 Buildings fuel shares (2012)



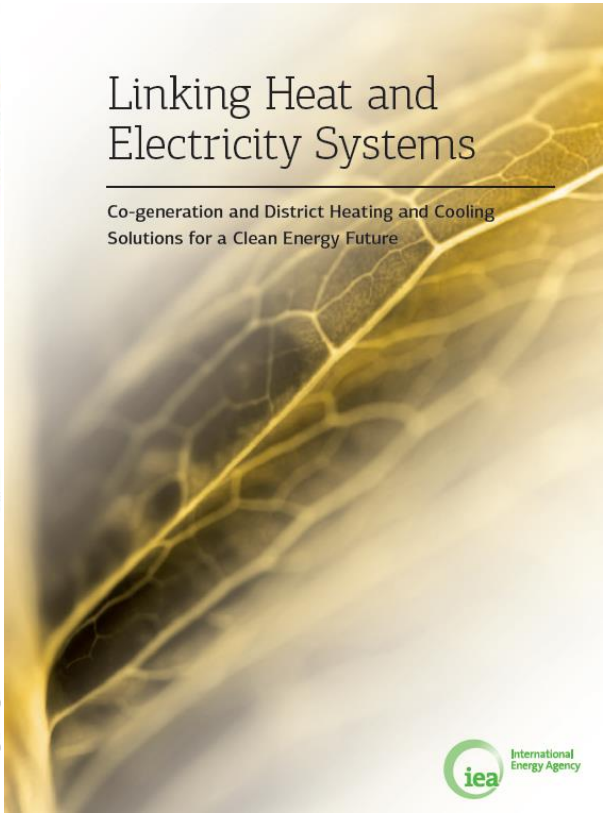
EU28 Final energy gas shares (2012)

KEY IEA BUILDING PUBLICATIONS



June 2013

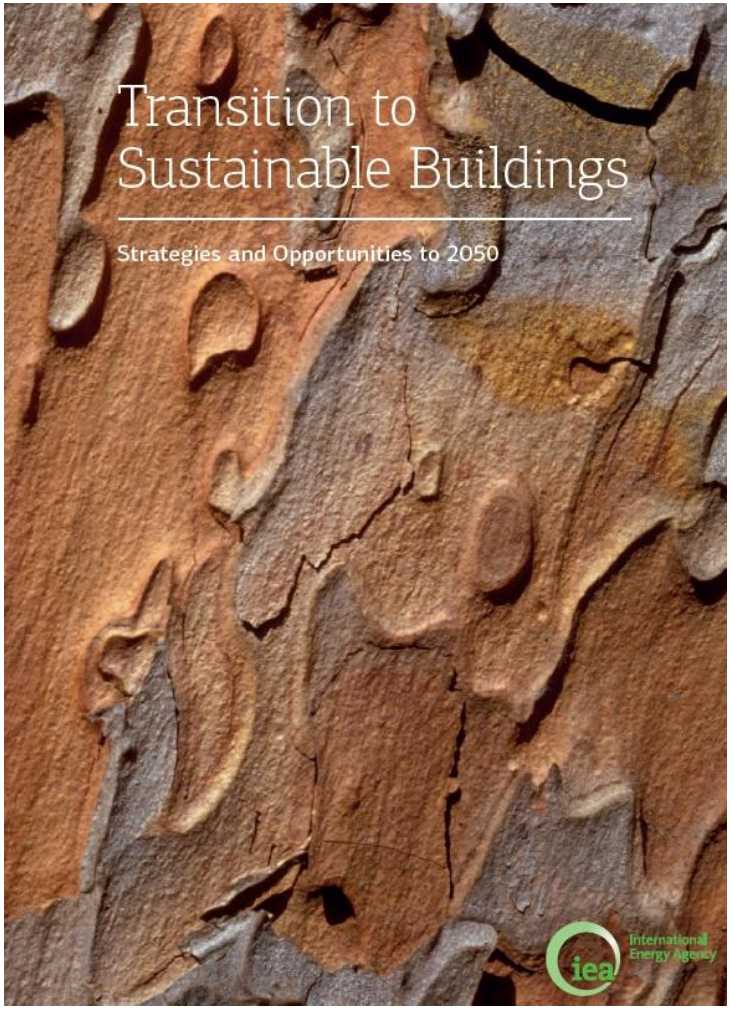
Dec 2013



April 2014

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



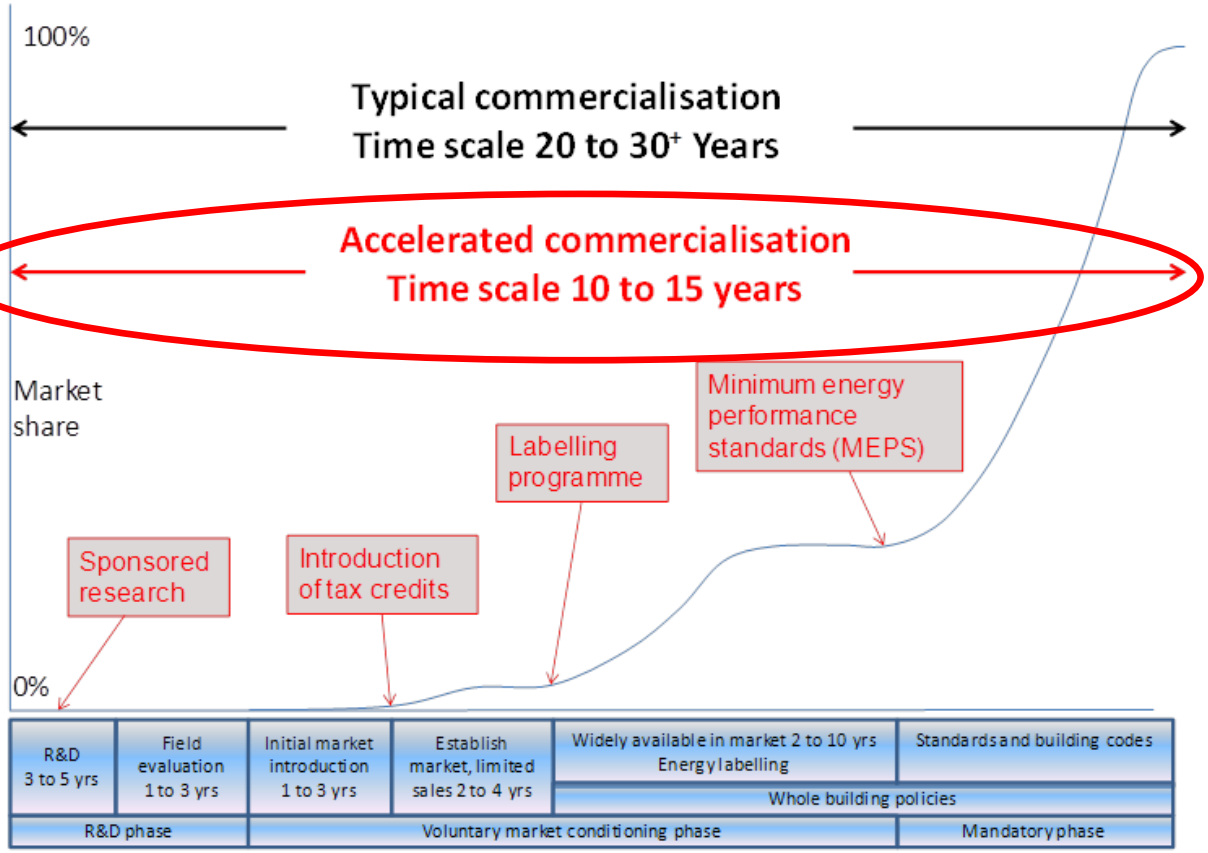
Priority Recommendations

	ASEAN	Brazil	China	European Union	India	Mexico	Ukraine	South Africa	United States
Technology									
Advanced envelope – cold climate									
Reduced cooling loads – hot climates									
Heat pumps									
Solar thermal									
More efficient use of biomass									
Policy									
Building codes with supporting infrastructure									
Appliance and equipment standard									
Deep renovation of existing buildings									
Zero-energy new buildings									

Note: Recommendations limited to top two for technology and policy, all items could be relevant for most countries. Red indicates immediate priority, while gold indicates second priority.

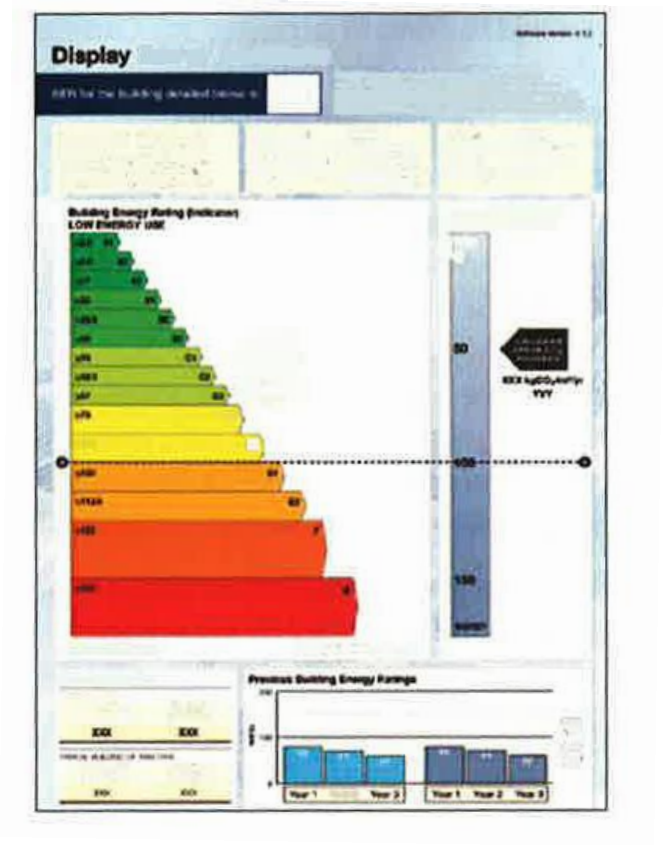
Integrated Policies – Systems and Components

- Promote integrated policy packages
- Deep renovation critical for Ukraine
- Building codes critical in emerging markets
- Systems level performance supported by advanced components



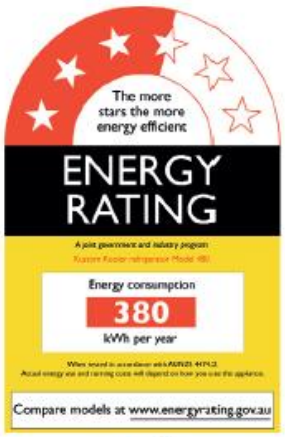
Ukraine Establishing its Own Buildings Policies – Whole Building Label

- **Energy Performance Certificates**
- **The "happy medium"**
  - Many EU low quality, but high market uptake
  - United States high quality, very low market update
- **Need to inspect property, measure air leakage, basic qualifications for rater**

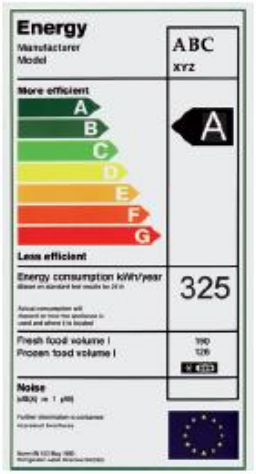


Ukraine Establishing its Own Buildings Policies – Move Beyond EU

- **Many EU product labels need to be re-scaled:** start with a "clean slate" and have real impact in the market place
- **Some new EU country window labels have "A+" for what should be a "C": define with future in mind (ZEB or energy positive windows)**



Australia



Europe

Example for Ukraine Criteria

EU	>	Ukraine
A+++	>	A
A++	>	B
A+	>	C
A	>	D
B	>	E
C	>	F
D	>	G
E	>	---
F	>	---
G	>	---

Technology Roadmap: Energy Efficient Building Envelopes

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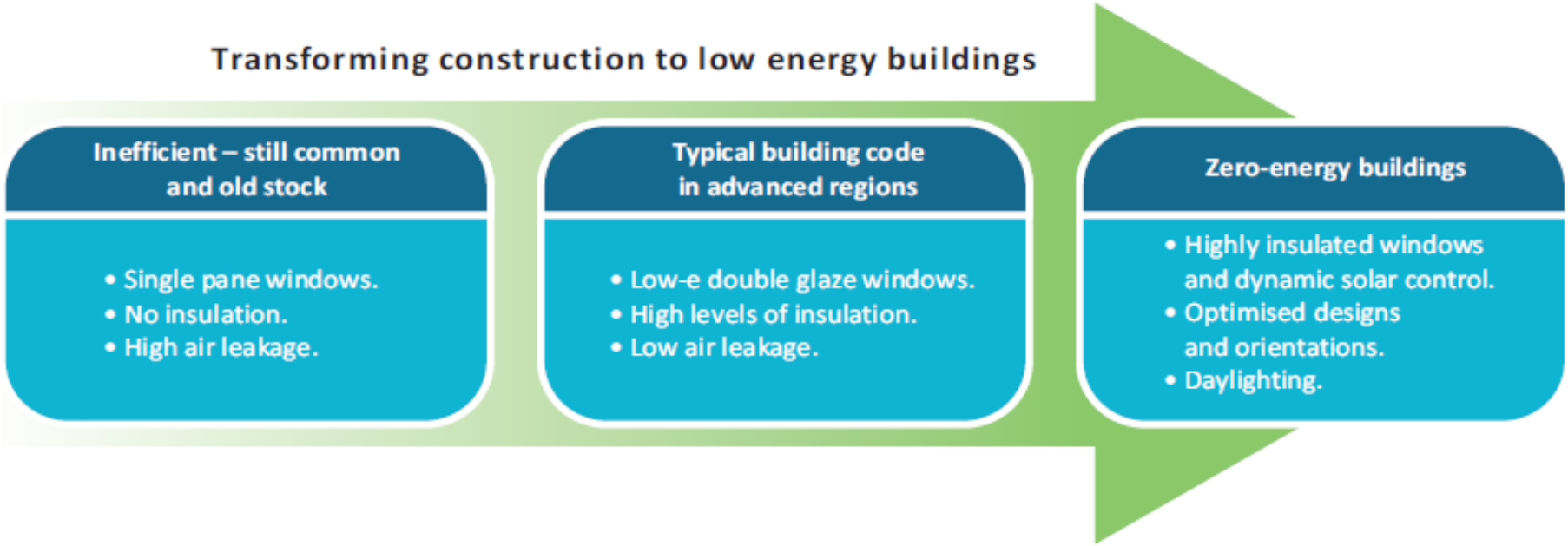
- Construction transformation strategy
- Provides technical, economic and strategic framework
- Assessment of high priority areas for 12 regions of the world
- Policy criteria and evaluation

Transformation to Low-Energy Buildings

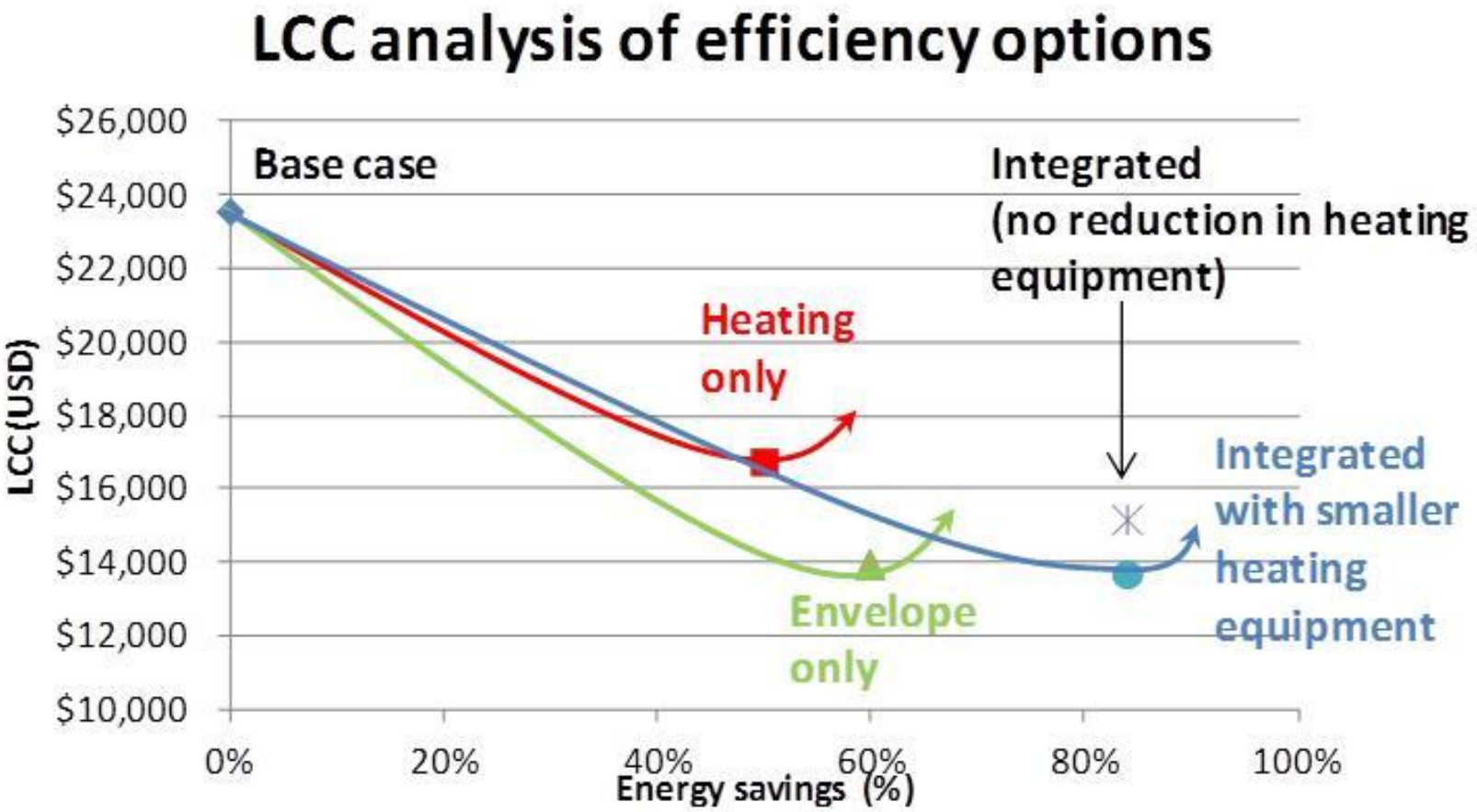


KEY POINT: the world needs to shift from very old buildings to modern buildings, and then to low-energy or zero-energy buildings.

First Step – reduce the need for heating and cooling!!

Example in Envelope Roadmap: Systems Approach –Envelope and Heat Pump

- Very poor existing building and equipment example but represents core life cycle cost economic analysis



Key Strategies for Ukraine Buildings

- **Immediate solutions to reduce heating**
  - Weatherisation, energy management, sub-metering, etc
- **Pursue deep energy renovation**
  - Motivate market through public building renovation
  - Incentives for high performance components and large systems improvements (> at least 50% heat demand reduction)
  - Development banks need to look at aggregated building sector the same as large energy supply projects
- **Key infrastructure outcome**
  - Long lasting human capacity development
  - Mature high performance commodity technology options
  - Manufacturing and construction job creation in lieu of energy import and more supply extraction

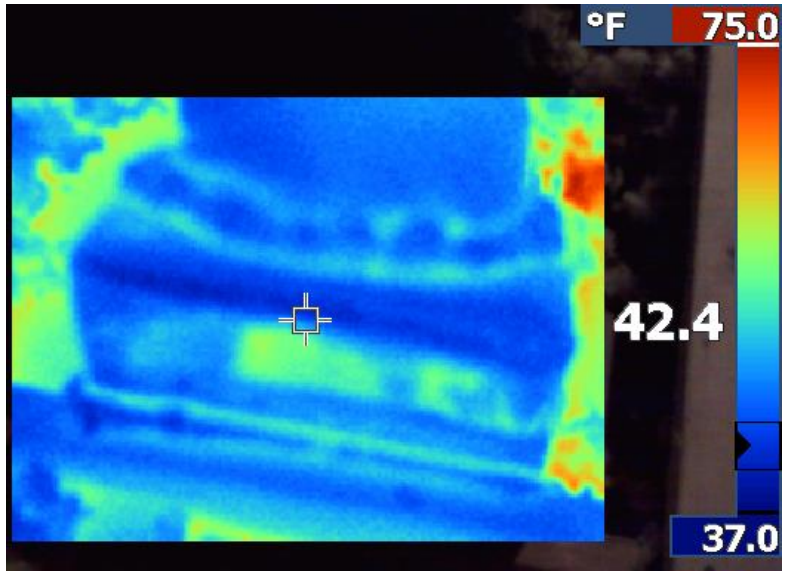
Air Sealing

- Validated air sealing is a critical measure for building codes and renovation
- Testing of large multi-family buildings can be expensive – possible to institute sampling and workmanship criteria to reduce cost
- More research needed to offer more affordable testing but many low cost and simple solutions exist today

Source: Oak Ridge National Laboratory

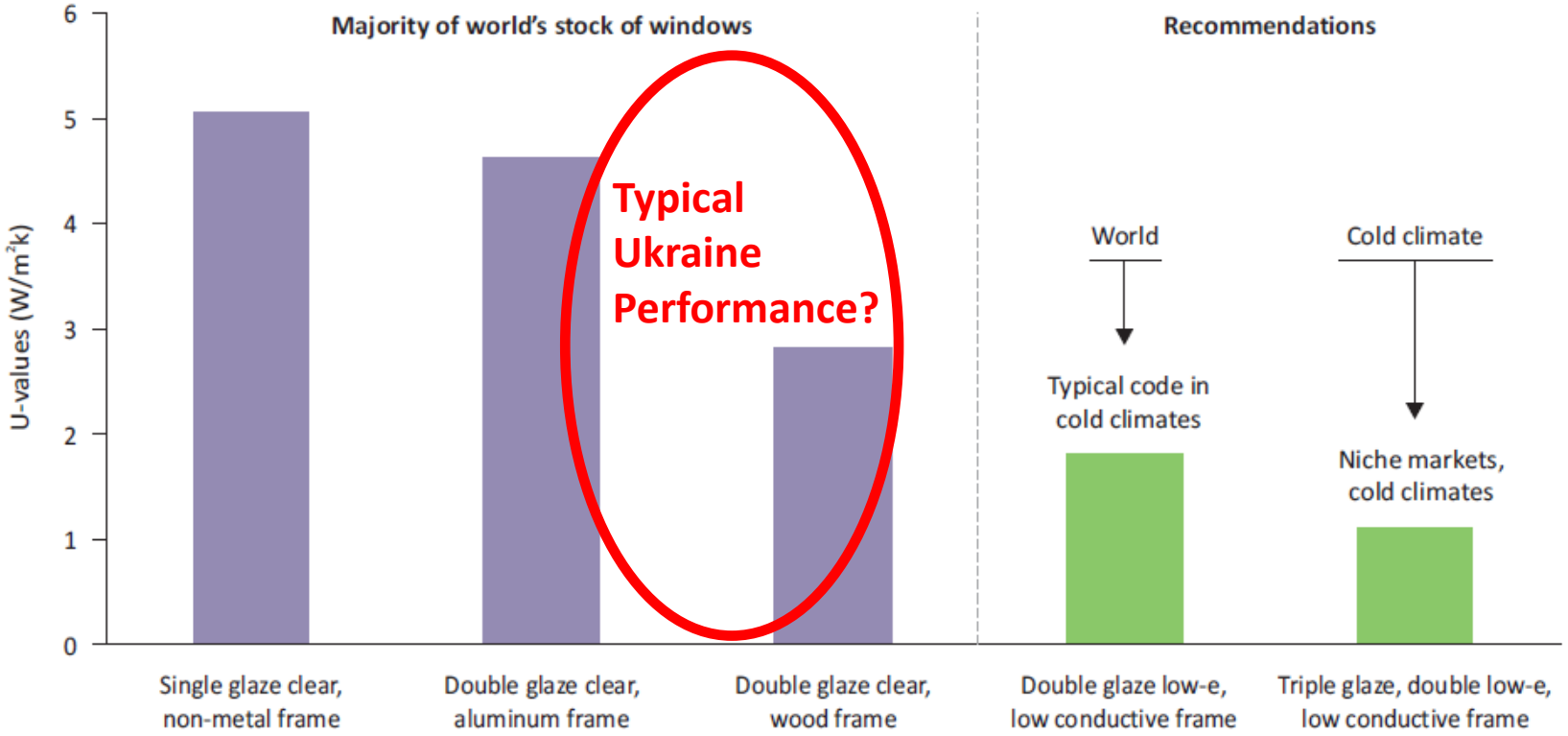
Air Sealing – Immediate and Cost Effective

- **Air sealing is very important**
  - Typically 10% to 30% heat reduction
- **Performance can be verified**
  - Infrared camera, air leakage, statistical sampling, etc



Windows Market/Opportunity

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

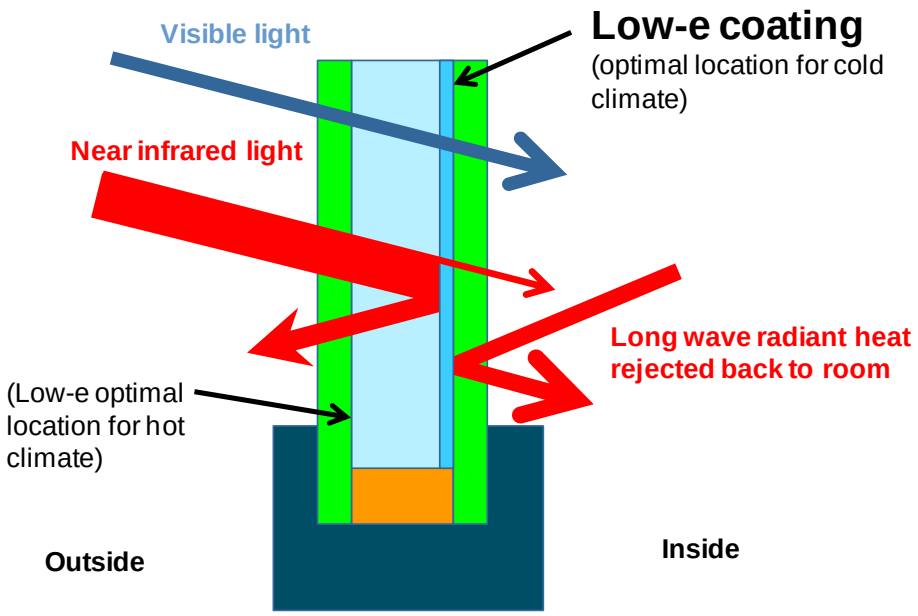


Note: U-values presented in this roadmap represent whole-window performance unless noted in accordance with ISO 15099, thus an ISO 10077 standard of 1.0 W/m²K is roughly equal to 1.1 W/m²K per ISO 15099.

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.

What is Low-e (low emissivity) Glass?

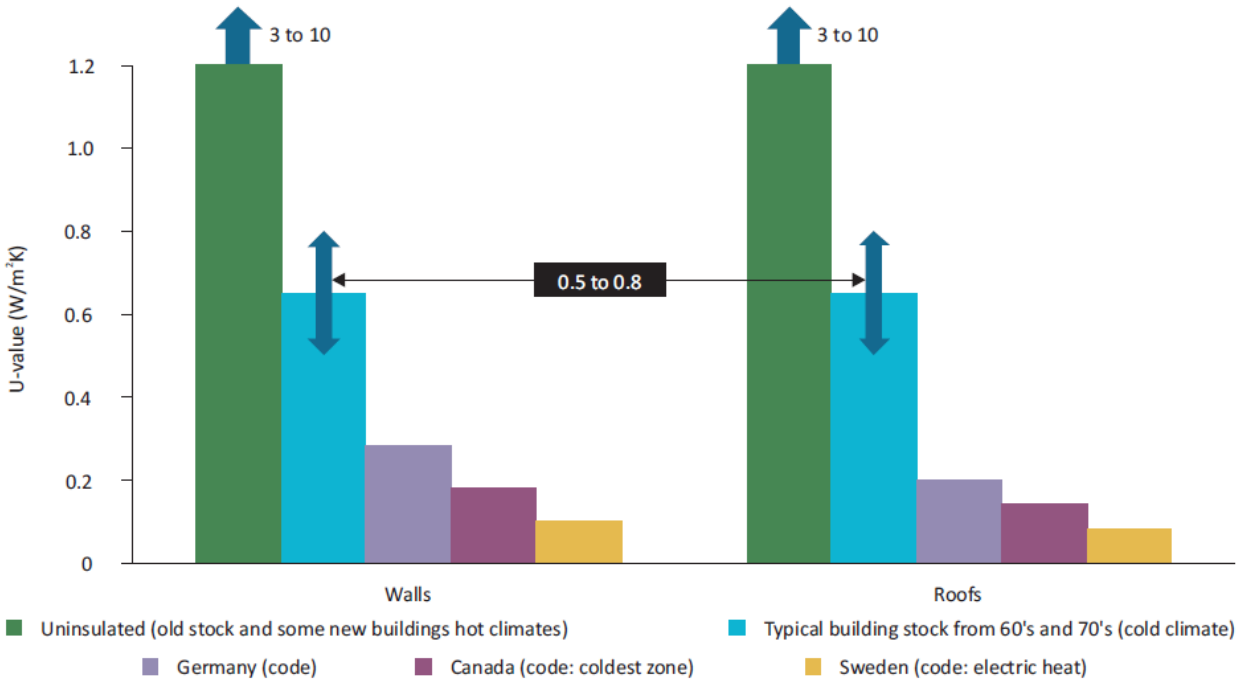
- Transparent metal coatings that reflect radiant heat (long wave radiation)
- Often combined with solar selective coatings that reflect visible light and near-infrared light (heat we feel)
- In winter, low-e glass reflects heat back into the building and in summer reflects heat back outside from the sun
- Immediate retrofit low-e storm panels and low-e window films when window replacement is not possible



What is the Ukraine current market share of low-e?

Insulation Opportunity

- Very stringent U-values in coldest climate zone
- IEA recommending goal for average wall and roof U-values ≤ 0.15 W/m2K cold climate, ≤ 0.35 W/m2K 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.

Exterior Insulation

- Best approach to reduce thermal shorts
- Part of “stucco” types of systems
- **Applicable to all buildings, new/existing, commercial/residential**

Before

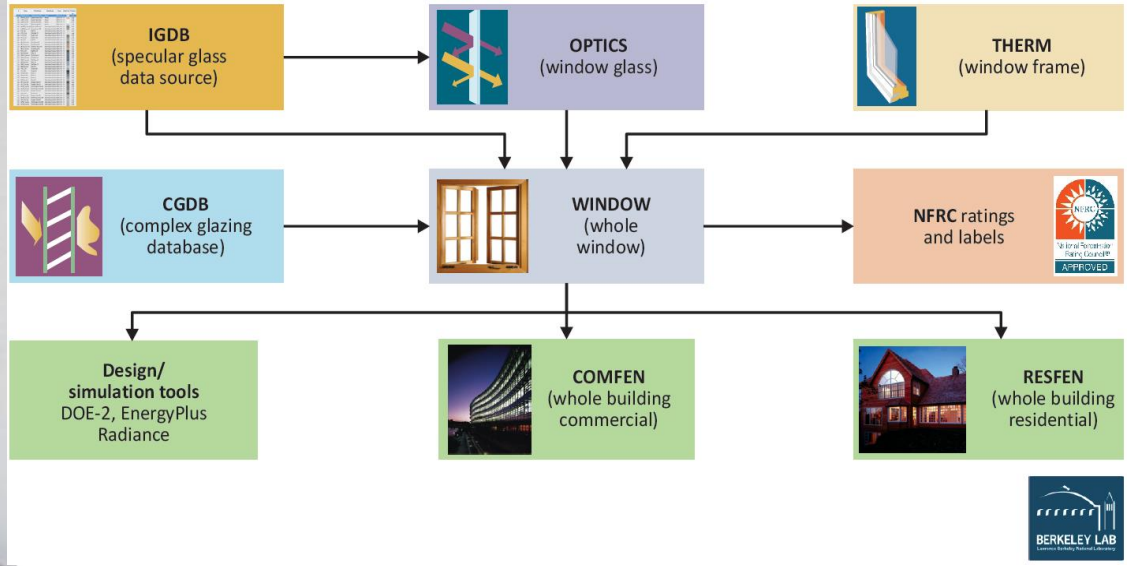
After

Source: Sto Corporation

Performance Research: Essential in Emerging Economies – Global Priority

- Construction material energy performance ratings are essential
- **Ukraine can pursue collaborative effort including government, academia, and industry – supports building codes and can drive market for commodity priced EE product availability**

Thermal Chamber, Source: Fraunhofer, IBP



Window Simulation Tools, Source: LBNL

Criteria for Policy Self-Assessments to Promote Efficient Construction

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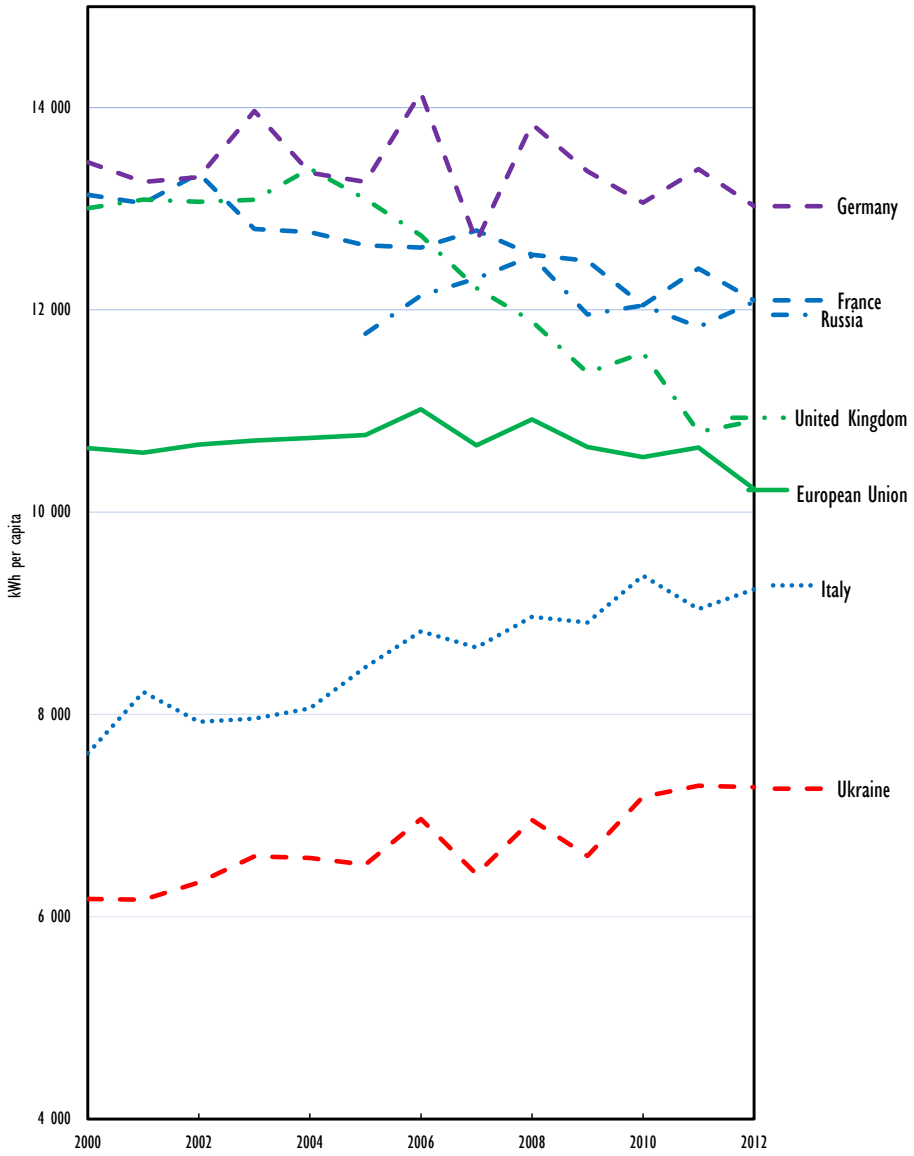
- **Ukraine can use IEA criteria to conduct self-evaluation among policy, technology, industry and academia experts**
- If progress is not made, EE construction will be stagnant

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

Pending Report - Joint IEA/IPEEC Study on Building Energy Performance Metrics

- Focused on G20 and MEF countries
- Example with Ukraine, final building energy consumption per capita (kwh/person)
- Ukraine is much lower but growing!
- Increased GDP drives larger spaces, more comfort, appliances, electronics, etc



Next Steps

- Significant investment needed for immediate and longer term comprehensive renovations
- Building energy efficiency and advanced district heating optimised for total system benefits
- Move towards local manufacturing and construction jobs instead of energy supply extraction and import (a core Ukraine and EU strategy)

Contact Data

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Buildings – www.iea.org/topics/energyefficiency/subtopics/sustainablebuildings/