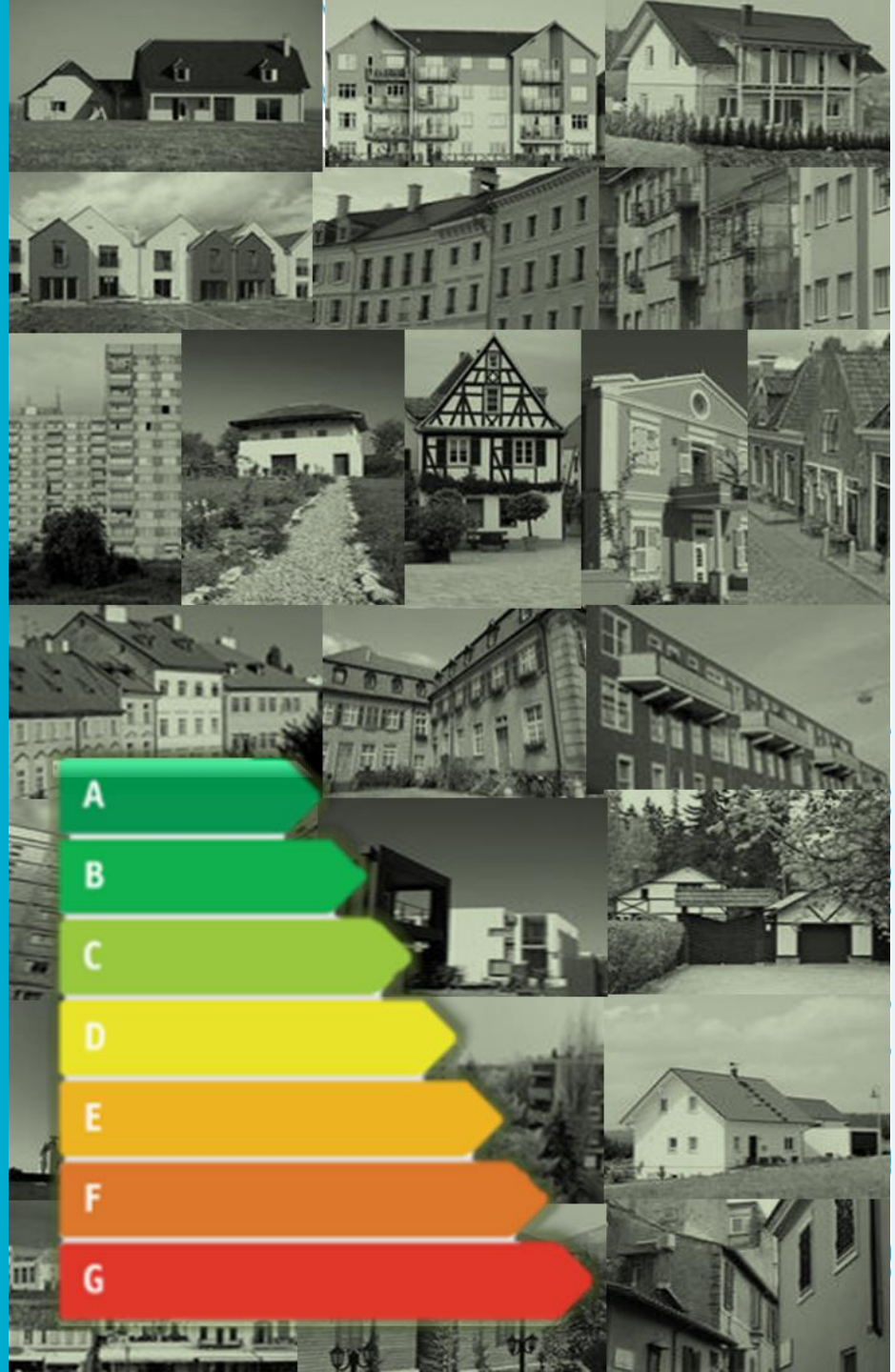

SBE 16
Istanbul, 13 October 2016

Improving the Energy Performance of Buildings towards the Nearly Zero Energy Concept

Oliver Rapf
Executive Director
Buildings Performance Institute Europe

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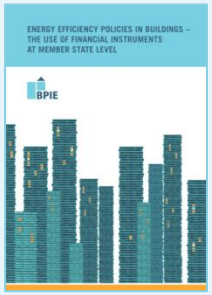
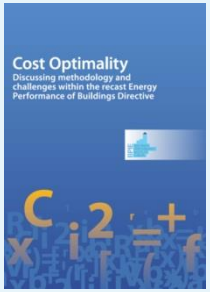
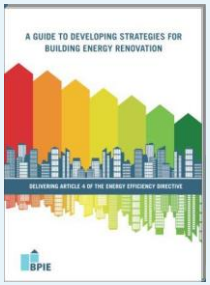
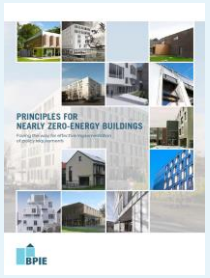
About the Buildings Performance Institute Europe









www.bpie.eu
www.buildingsdata.eu

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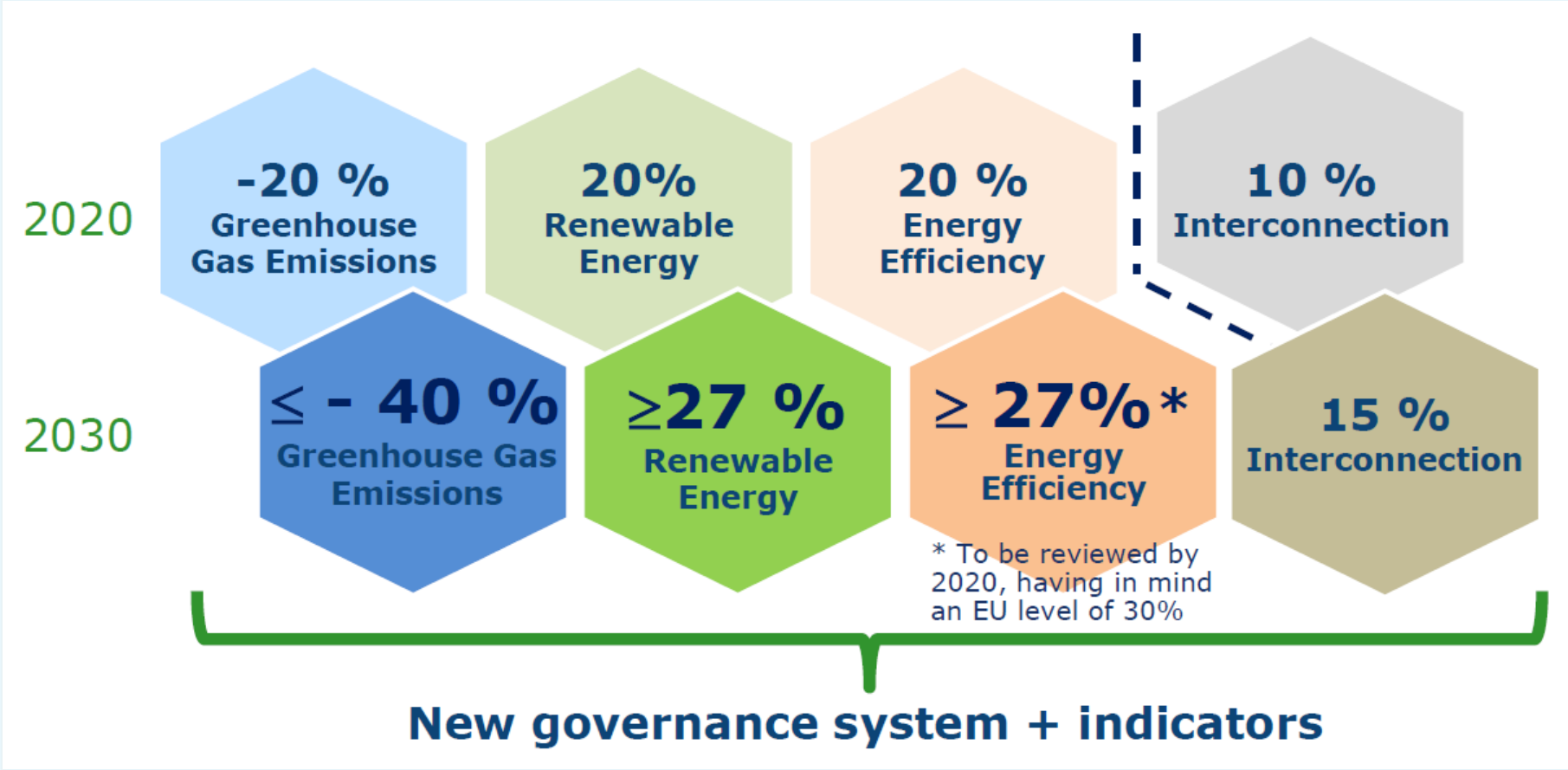
Content of this presentation

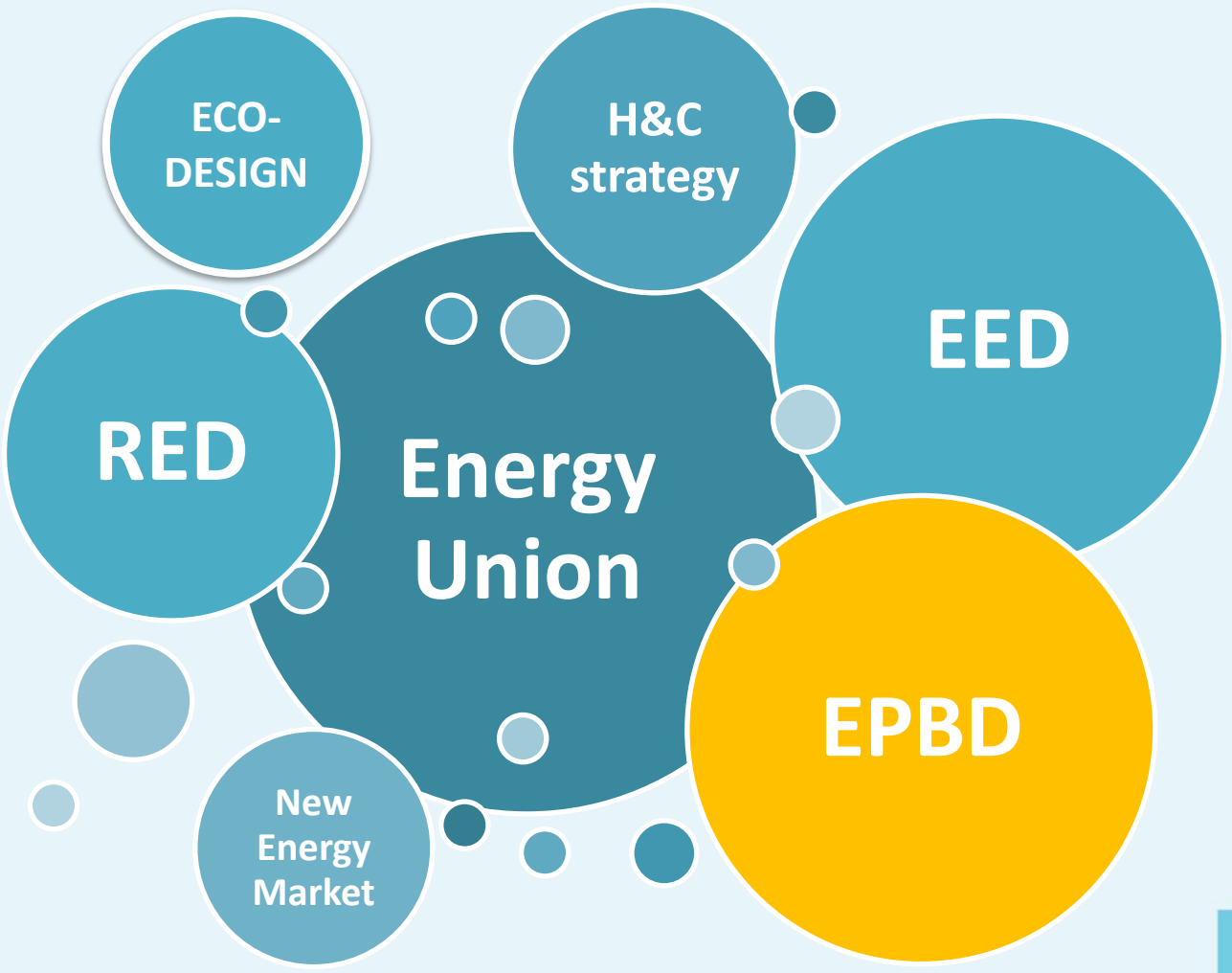
- The NZEB concept
- How do EU countries implement nZEBs?
- Beyond nZEBs…
- Conclusions

2030 framework for climate and energy policies



Source: DG Energy

Building related EU policy framework



Minimum building performance requirements

- **Minimum energy performance requirements** for new buildings are a key element in European building codes
- The European Commission has introduced requirements to set standards in all Member States through the 2002 EPBD
- In 2002 no guidance on the ambition level was provided
- The recast of the EPBD in 2010 included a provision that national energy performance requirements should be set with the view to **achieving cost optimum levels**
- Member States to **use and apply a methodology** to calculate cost-optimal levels for their specific country
- Compare cost-optimal levels with the national requirements set in national building regulations

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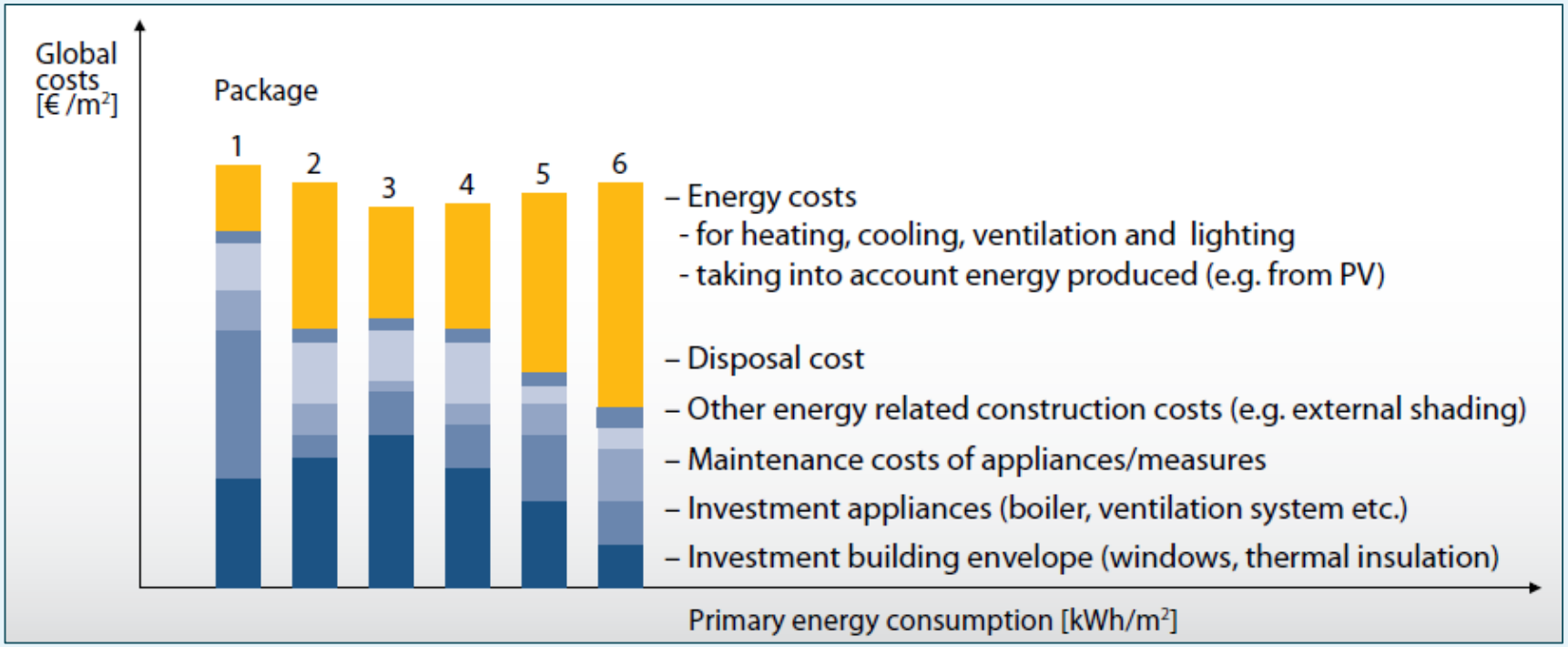
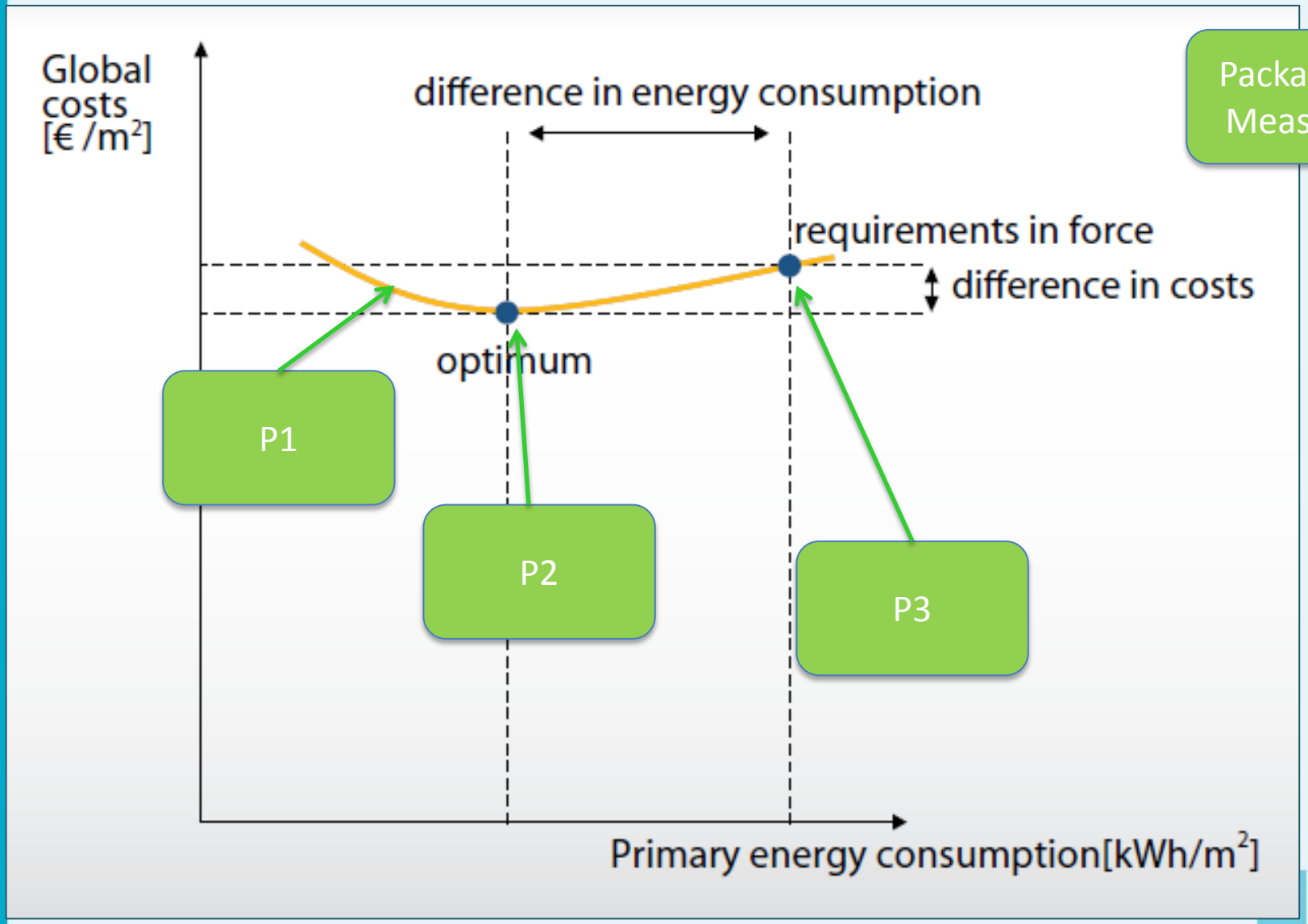
Cost optimal building performance requirements

- Example cost calculations for different packages



Cost optimal building performance requirements



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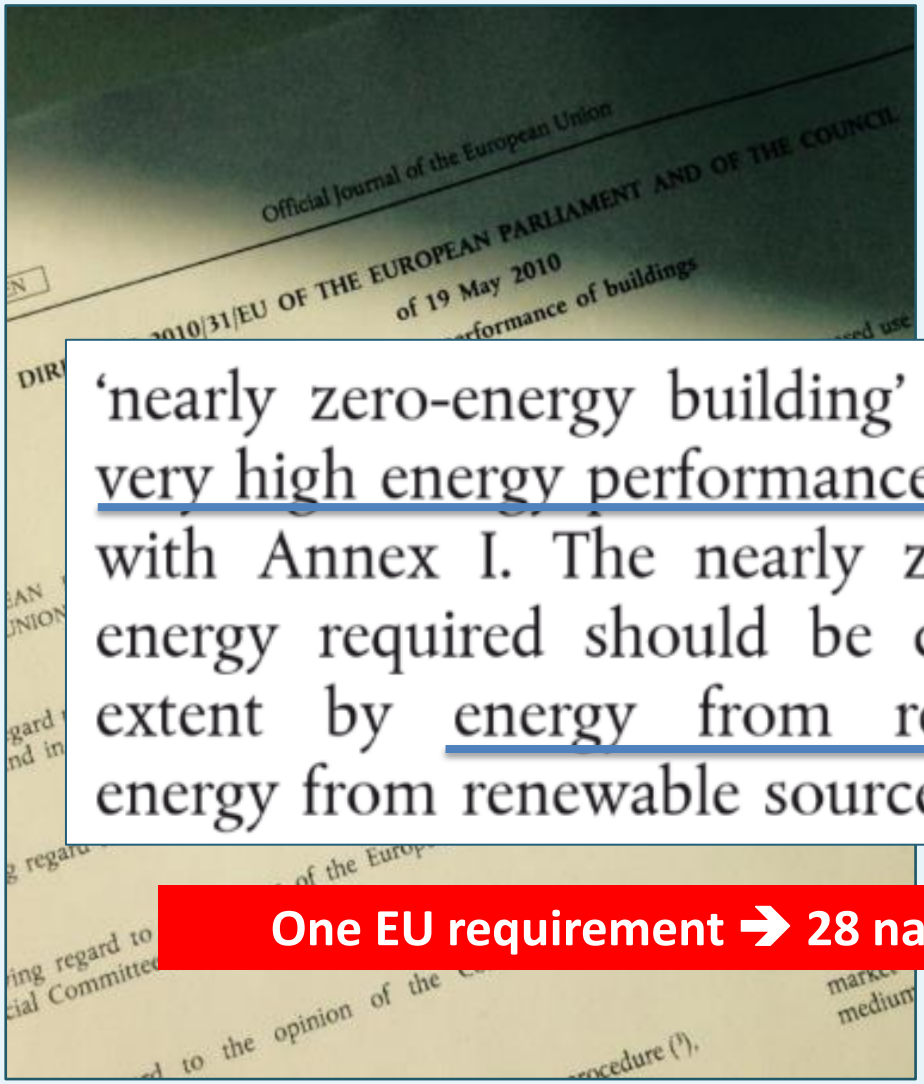
Nearly Zero Energy Building in the Energy Performance of Buildings Directive



'nearly zero-energy building' means a building that has a very high energy performance, as determined in accordance with Annex I. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;

One EU requirement ➔ 28 national implementation rules !

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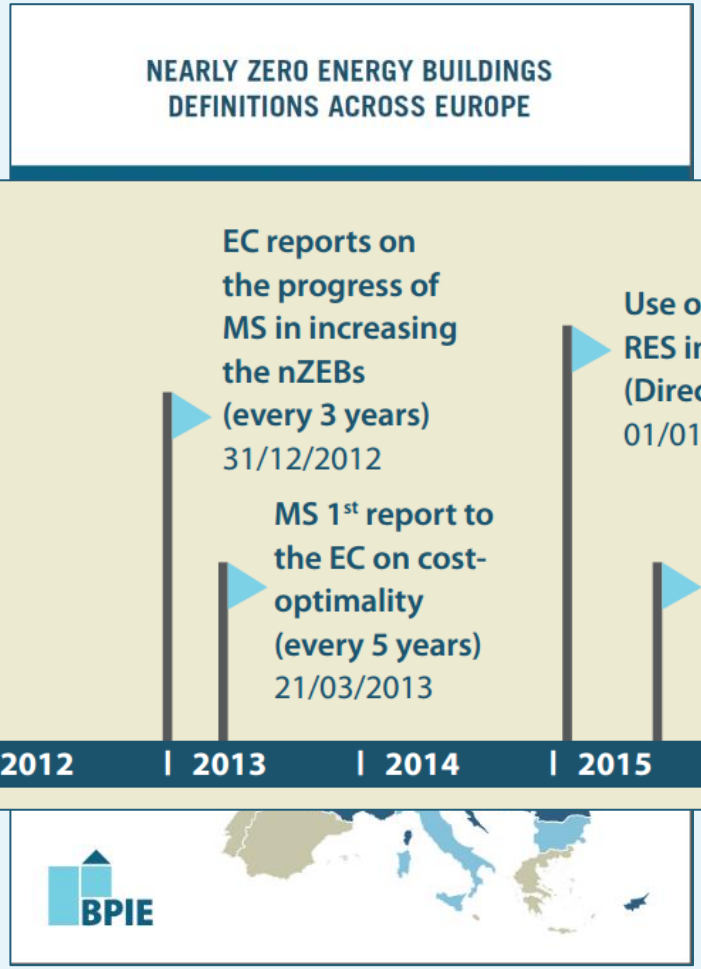
Factsheet on NZEB definitions



www.bpie.eu/nzeb_factsheet.html

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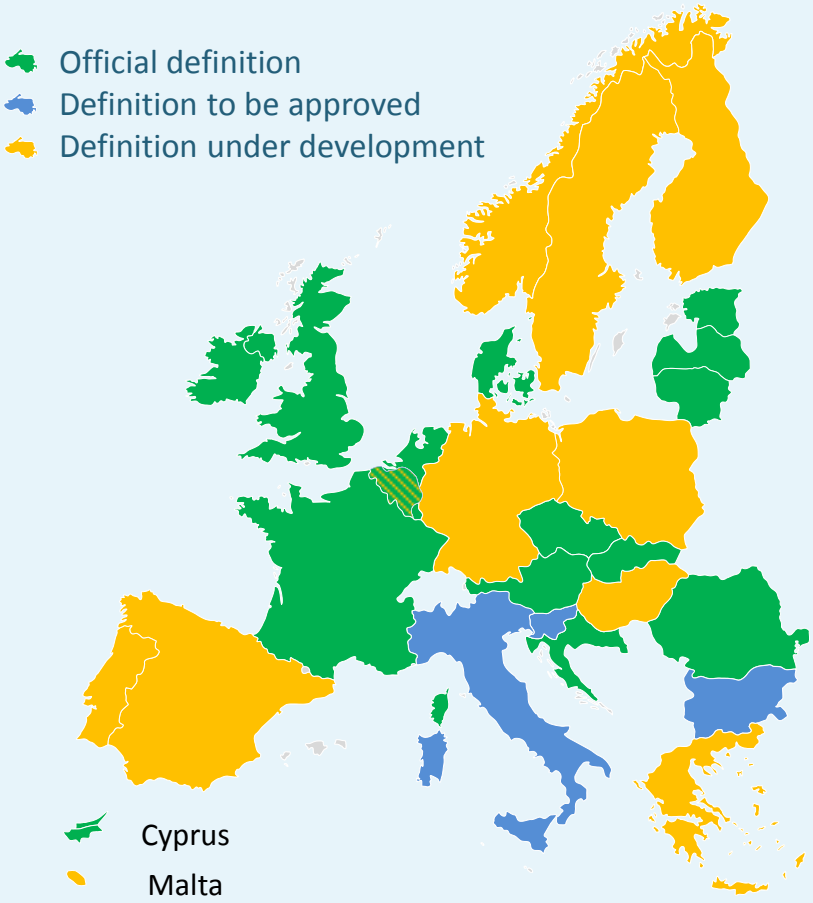
NZEB implementation in Europe – Status 2014



Large variations on NZEB definitions

- 16 MS definition for new buildings
- 8 MS definition for existing buildings
- 8 MS share of RES explicitly stated
- Large range maximum primary energy (20-170kwh/m2)
- Some MSs: additional requirements

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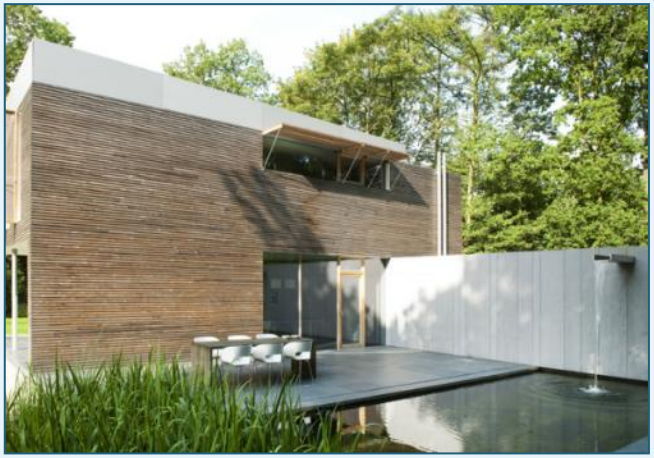
New buildings: NZEBs are no longer rocket science



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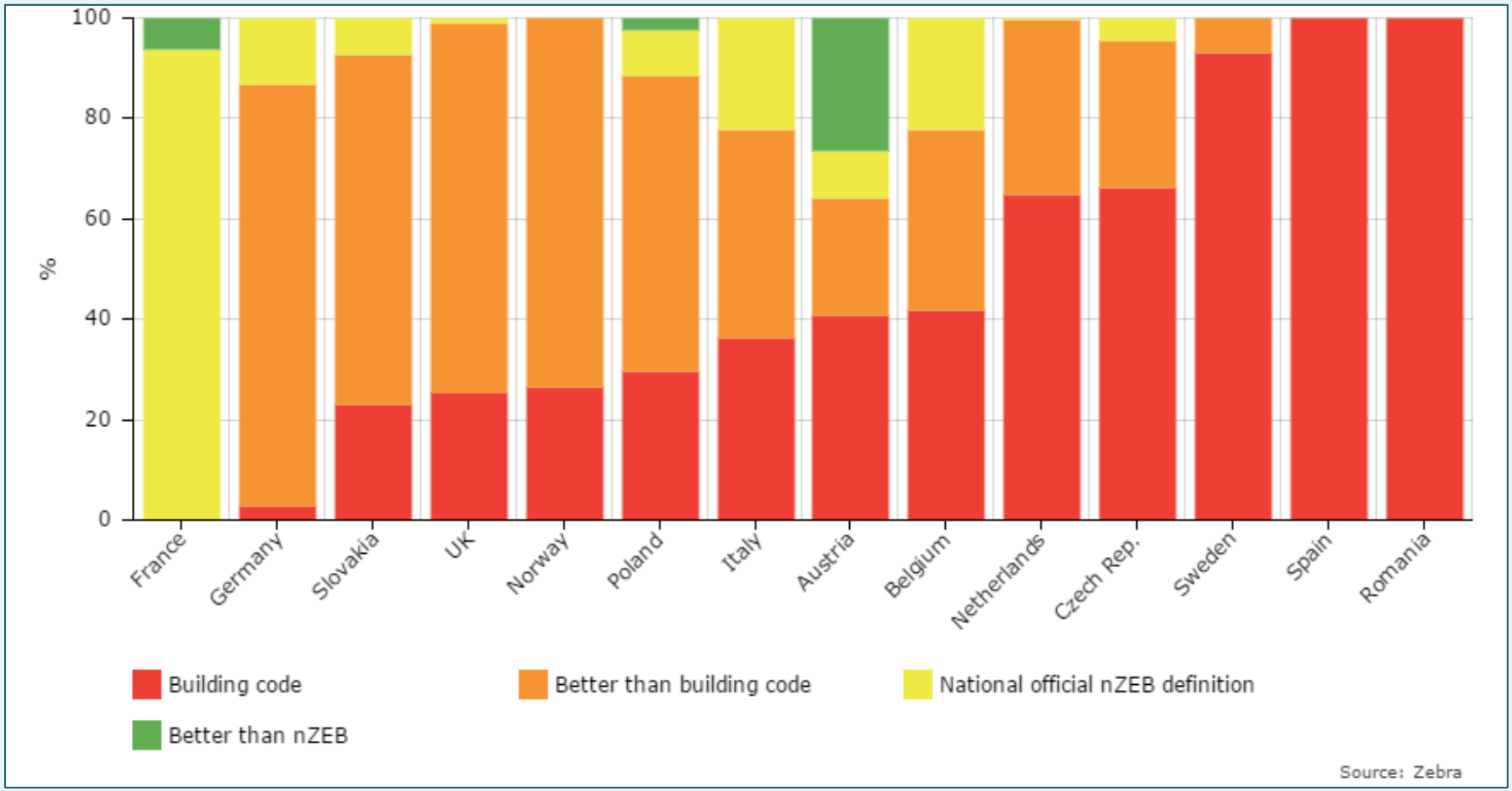
NZEB as a paradigm shift

No more rocket-science, but…

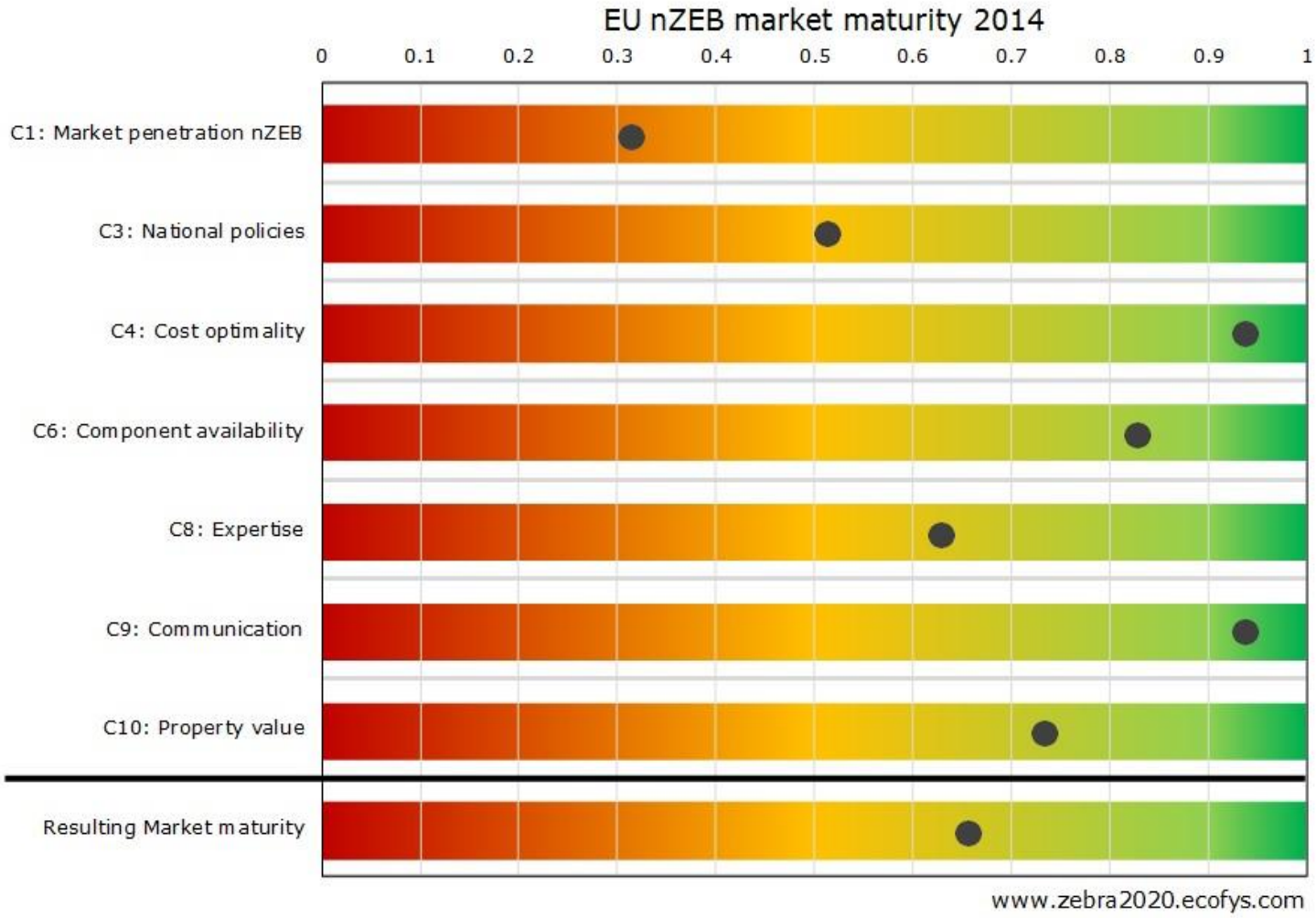
- Low-energy buildings are complex systems and need holistic approaches
- Need for service-oriented ‘one-stop-shop’ business models
- Quality, compliance and control are essential
- Occupants advice is necessary

ZEBRA 2020 project

- Distribution of new constructed dwellings in the year 2014 according to different building standards



Maturity of the EU nZEB market for 2014



Source: www.zebra2020.eu

New NATO building

NATO will have a sustainable and environmental friendly new headquarters, with low environmental impact and optimized energy consumption. The new building provides for:

- reduced heating, cooling and ventilating power thanks to thermal insulation, thermal inertia and effective solar protection of glazing.
- optimized energy consumption thanks to geothermal and solar energy use, co-generation of electricity and heating and advanced lighting systems.

Innovative examples from MS

Case studies for exemplary nZEBs

Non-residential building (1/2)

Building Information	
Type	School
Year of completion	2011
Surface	1379m^2
Location	Babenhausen (Bayern)

Total Primary Energy Requirement (heating, domestic hot water, electricity)	91 kWh/m^2/yr
Annual heating demand	12 kWh/m^2/yr
Heating load	13 W/m^2

Financial Aspects	
Construction cost	2,600 €/m^2

Case studies for exemplary nZEBs

Non-residential building (2/2)

Building Envelope	
Construction method	Masonry construction
Exterior walls	**U=0.145 W/(m²·K)**; 25-30 cm concrete + 24 cm insulation WLG 035 (thermal conductivity) 035 + 40mm rain-screen cladding panel
Floor in contact with the ground	**U=0.153 W/(m²·K)**; 10 cm lean concrete + 20 cm perimeter insulation WLG 040 + 20 cm base plate + 40 mm insulation WLG 040
Roof	**U=0.141 W/(m²·K)**; 22 cm hollow core slab + 20 cm polyurethane (PUR, WLG 028) + 50 mm gravel
Glassing surfaces	**U_w=0.79W/(m²·K) , U_g=0.5 W/(m²·K)** g-value= 49%; triple glazing windows filled with argon
Air-tightness	0.37h^{-1}

Systems	
Mechanical ventilation with heat recovery (HR)	• Central ventilation system for administration rooms, classrooms and corridors. • Decentralised ventilation system for toilets (HR 78%). • Upstream-air heat exchanger systems for preheating the inlet air.
Heating system	Gas boiler system
Hot water	Electric boiler or electric water heater

Case studies for exemplary nZEBs

Non-residential building (1/2)

Building Information	
Type	Sports hall (fitness room)
Year of completion	2013
Surface	614 m^2
Location	Waganowice (Gmina Słomniki, southern Poland)

Total Primary Energy Requirement (heating, domestic hot water, electricity)	98 kWh/m^2/yr
Annual heating demand	15 kWh/m^2/yr
Heating load	10 W/m^2

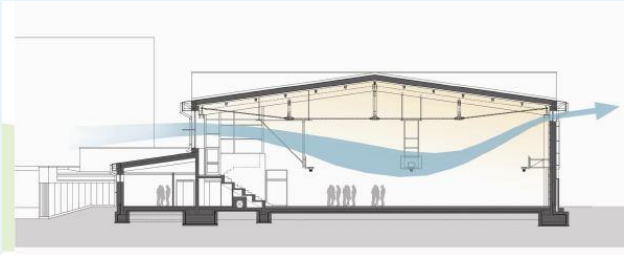
Financial Aspects	
Construction cost	1,238 €/m^2 (5,068 zł/m^2)

Case studies for exemplary nZEBs

Non-residential building (2/2)

Building Envelope	
Exterior walls	**U=0.1 W/(m²·K)**; 300 mm polystyrene
Roof	**U=0.08-0.09 W/(m²·K);** 400mm mineral wool
Floor in contact with the ground	**U=0.1 W/(m²·K)**
Glassing surfaces	**U_w=0.8 W/(m²·K)**
Air-tightness	0.6h^{-1}

Systems	
Ventilation	Mechanical ventilation with heat recovery >75% and summer ventilation
Heating system / Domestic hot water	Air source heat pump for heating and DHW (heat distribution: underfloor heating)



Recommendations to accelerate the nZEB market transition

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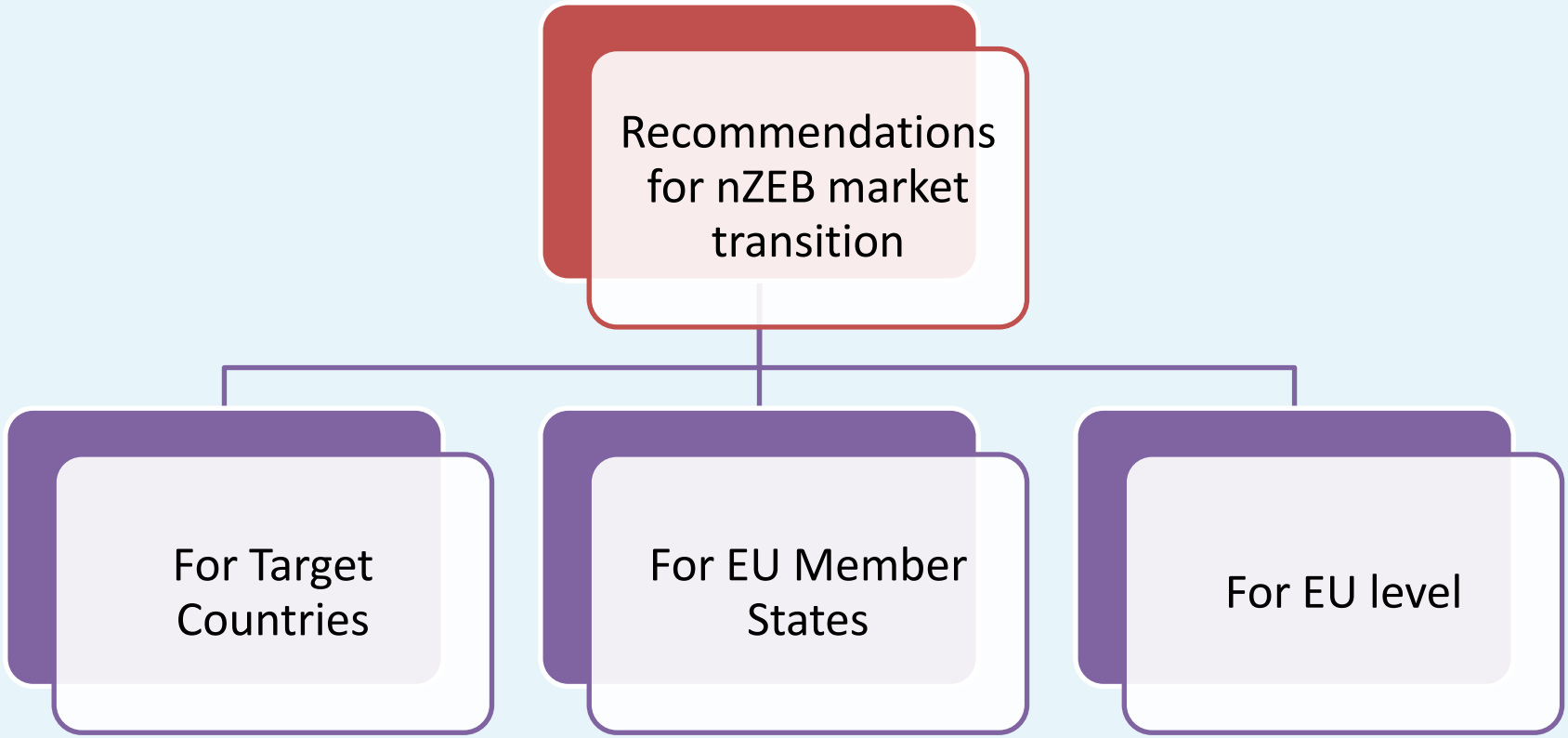
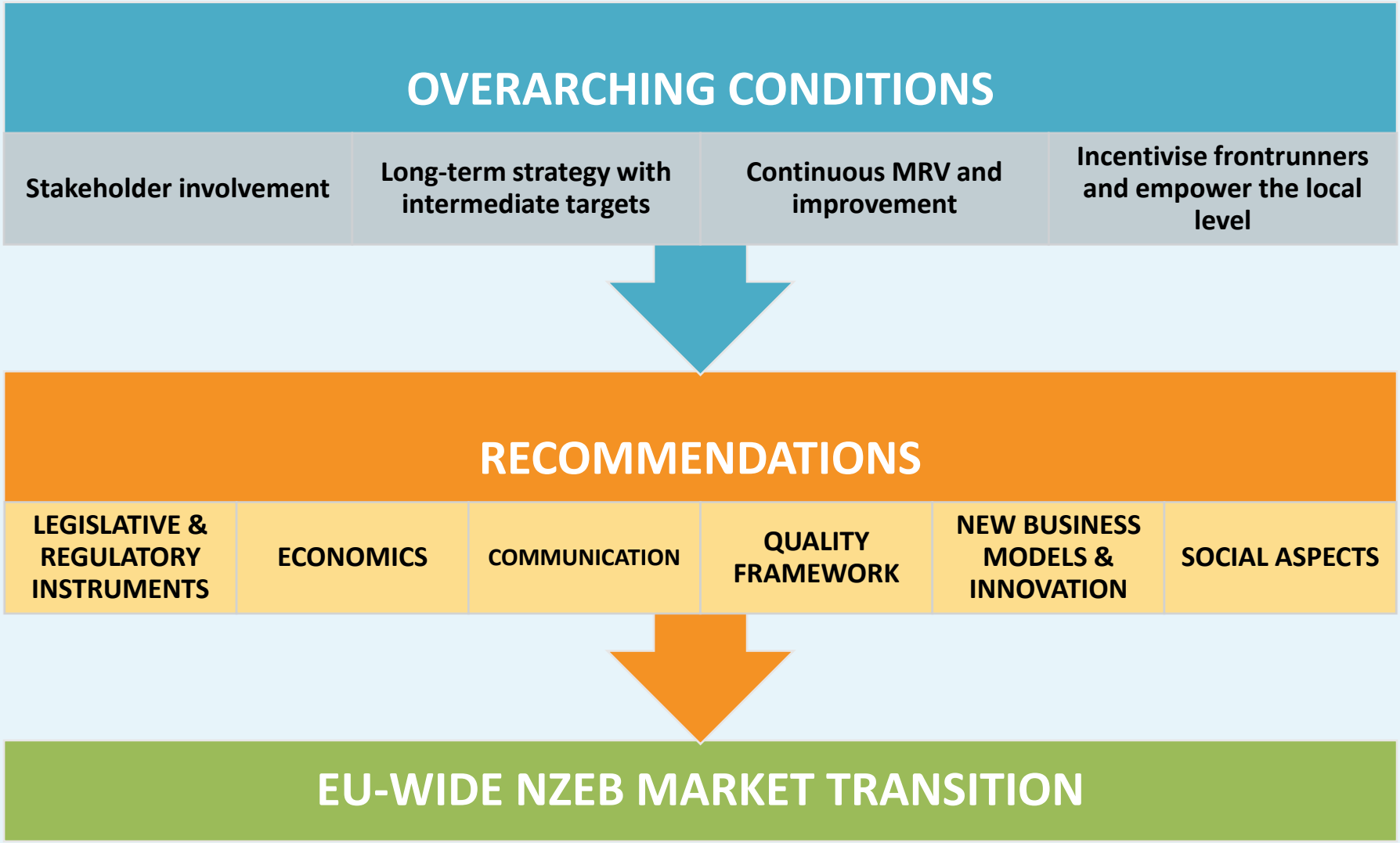

Recommendations for nZEB market transition
For Target Countries
For EU Member States
For EU level


OVERARCHING CONDITIONS
Stakeholder involvement
Long-term strategy with intermediate targets
Continuous MRV and improvement
Incentivise frontrunners and empower the local level
RECOMMENDATIONS
LEGISLATIVE & REGULATORY INSTRUMENTS
ECONOMICS
COMMUNICATION
QUALITY FRAMEWORK
NEW BUSINESS MODELS & INNOVATION
SOCIAL ASPECTS
EU-WIDE NZEB MARKET TRANSITION

Long list of recommendations…

A1 - Regulate building performance minimum standards through the building code
A2 - Improve the usage of Energy Performance Certificate, including a robust compliance system
A3 - Define a long term vision to guide the transformation of buildings as integrated parts of the society and the wider energy system
A4 - Provide building owners and investors with tailored advice according to specific renovation roadmaps
A5 - Encourage nZEB with public procurement processes
A6 - Implement standard methodologies for secure data gathering and assessment
A7 - Set long term voluntary targets for existing buildings
A8 - Mandatory upgrades for non-residential buildings, in case of new lease and tenancy
B1 - Incentivize the market uptake of nZEBs through active price signals
B2 - Stimulate the market uptake of Energy Performance Contracting by renovating the public buildings in an ESCO-framework
B3 - Financial support for (holistic or step-by-step) renovation according long term benchmarks
B4 - Adapting new financing products that look long term and entitle nZEB investors with preferential mortgages
B5 - Clever legislation can mitigate the problem of split-incentives
C1 - Brand nZEB buildings as part of a positive sustainability narrative
C2 - Promote demonstration projects to exemplify the benefits and viability of highly performing buildings
C3 - Promote market uptake of nZEB buildings with information campaigns and easy-grasping guidelines
C4 -Facilitate effective knowledge sharing via adequate communication tools
D1 - Develop and consolidate quality frameworks for nZEB techniques and technologies
D2 - Training building professionals with "NZEB and beyond" qualifications preparing them to build and upgrade the building stock for the future
D3 - Set up a detailed data collection of training programmes and cross-learning initiatives
D4 - Enhance the proficiency of certifiers in order to increase the reliability of Energy Performance Certifications
D5 -New technologies (IoT) allow us to collect and analyse performance data in a more effective way that was not possible some years ago
D6 - Improve coherence within and among states through better coordination
D7 - Install "One-Stop-Shops" for high energy performance buildings to reduce complexity and hassle
E1 - Foster the uptake of industrialised renovation through increased market confidence
E2 - Encourage new business models to aggregate demand to provide sufficient scale
E3 - Enable the market to embrace the new features of buildings as micro-energy hubs (nZEB2.0)
E4 - Incentivize the frontrunner entrepreneurs exploring new business models
E5 - Involve and empower local authorities in pilot projects
F1 - Explicitly define energy poverty and set up monitoring mechanisms
F2 - Include the benefits of alleviating (energy) poverty in nZEB decisions
F3 - Specify and increase support measures for vulnerable target groups customized to their profile
F4 - Move from fuel subsidies to energy efficiency measures
F5 - Improve all social housing to nZEB standards, in order to provide comfortable and affordable housing
F6 - Fighting air pollution to be an integrated part in NZEB

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Need for skilled workforce

- **The better energy performance, the more important quality**
- Can the consumer rely on the building products and services?
  - Maximum lifetime?
  - Expected performance?
  - Healthy and safe?

'Smart thermostat left me with no hot water and put my home at risk of fire'

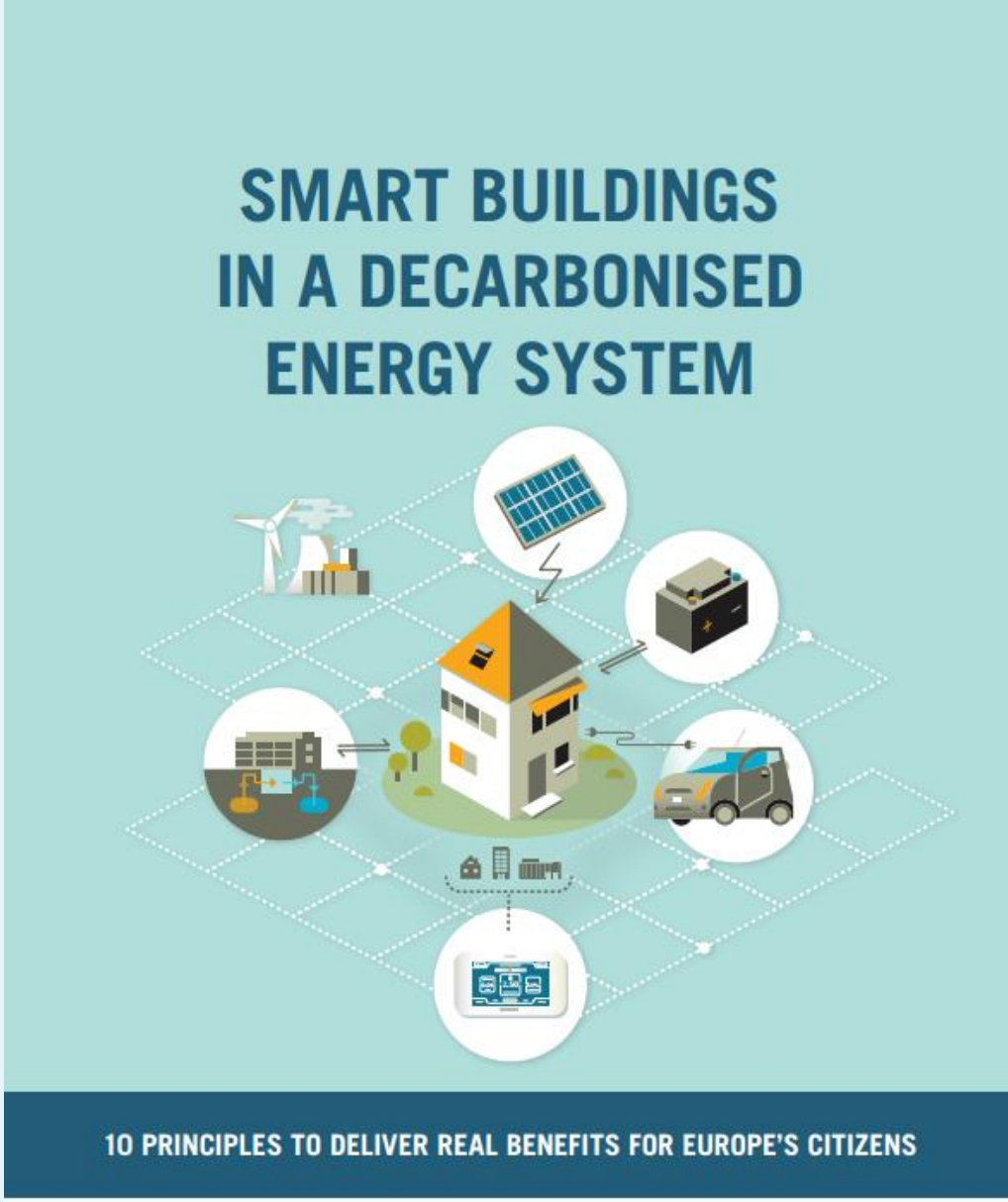
Smart thermostats for boilers are the future, according to their advocates. But for the Stowe household in Suffolk, the latest eco device was a disaster

Bill Stowe suffered endless problems after the installation of a Nest smart thermostat system. Photograph: Martin Godwin

Last year, npower installed the latest smart central heating thermostat in Bill Stowe's home, but he claims that rather than saving him money its botched installation caused a catalogue of problems and warns other households to think carefully before going ahead.

Stowe, who lives with his wife and daughter in Harwich, Suffolk, was offered the £250 Nest smart heating controller for free when he signed up to a special npower gas and electricity tariff last December. But he claims that problems resulting

Beyond nearly Zero Energy Buildings…..

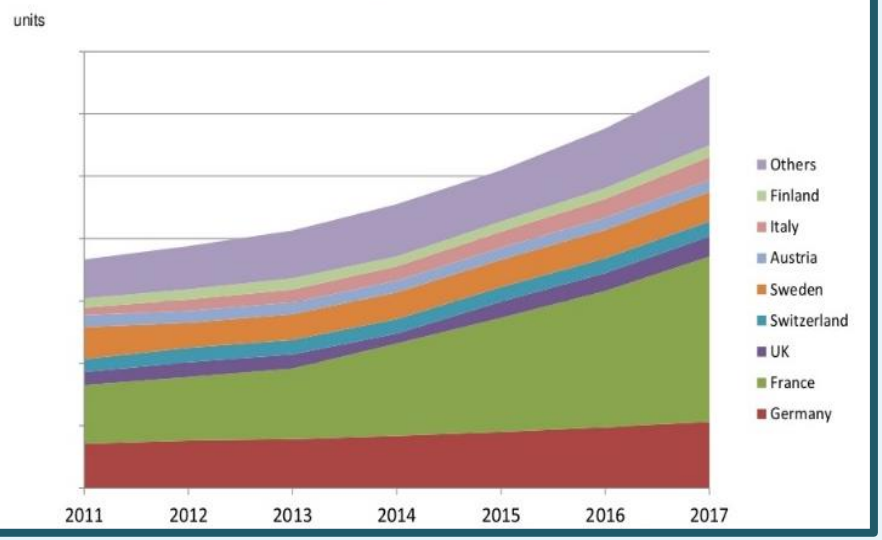


Driver of change #1: imbalance of the power market

Source: National Geographic

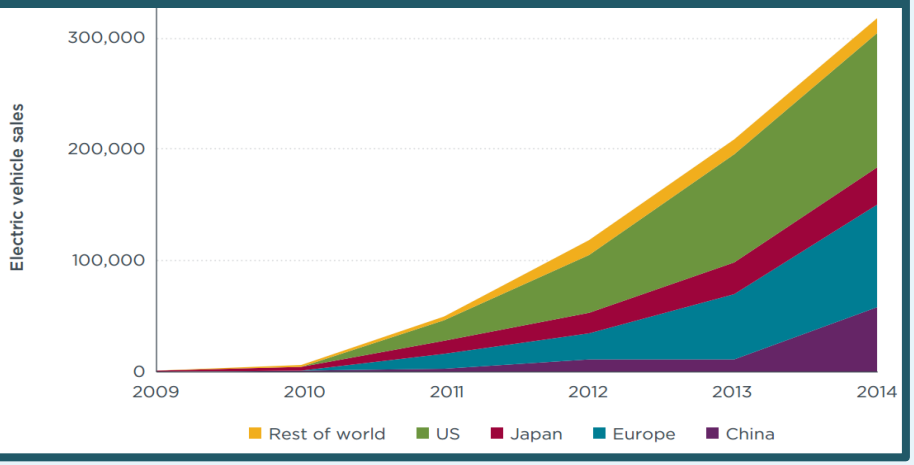
Driver of change #2: power-load growth

Total heat pump sales per country in Europe, units



Source: BSRIA, 2015

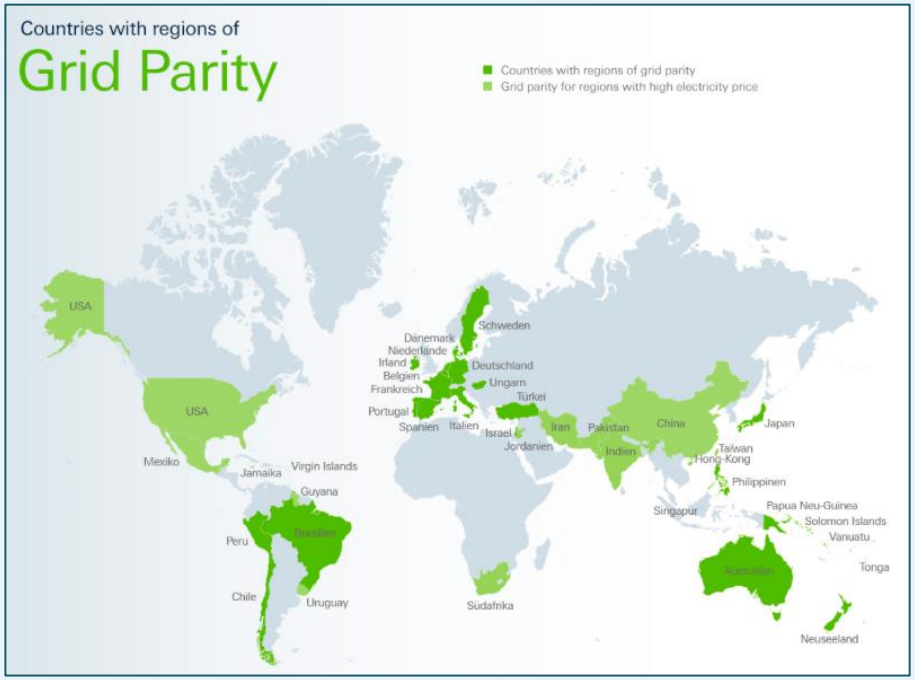
Annual global electric vehicle sales

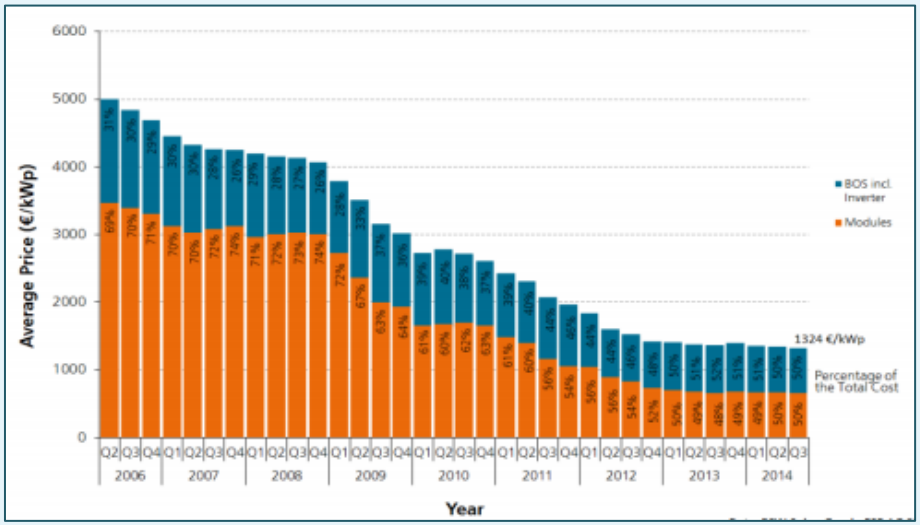


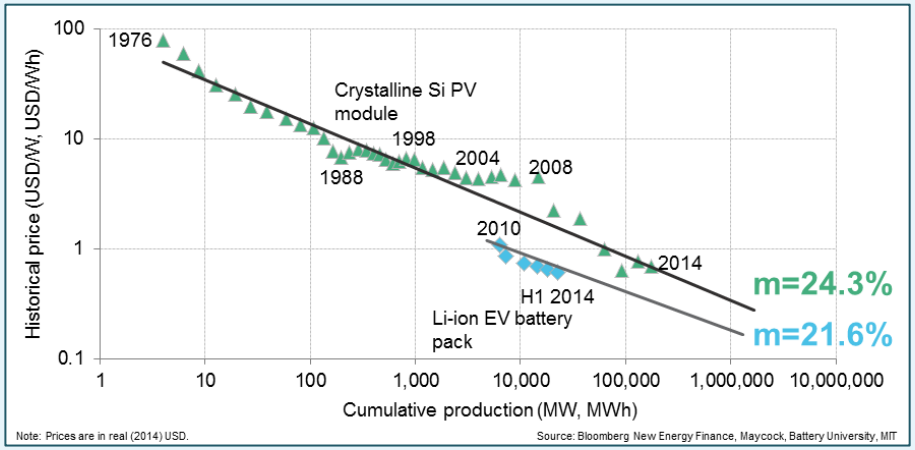
Source: Mock & Yang, 2014

Driver of change #3: viability RES & storage

- Deutsche Bank: “Over 50% of Countries Under Review are Likely at Grid Parity Today”
- Tipping point for combination of PV systems and batteries in Europe to come around 2020

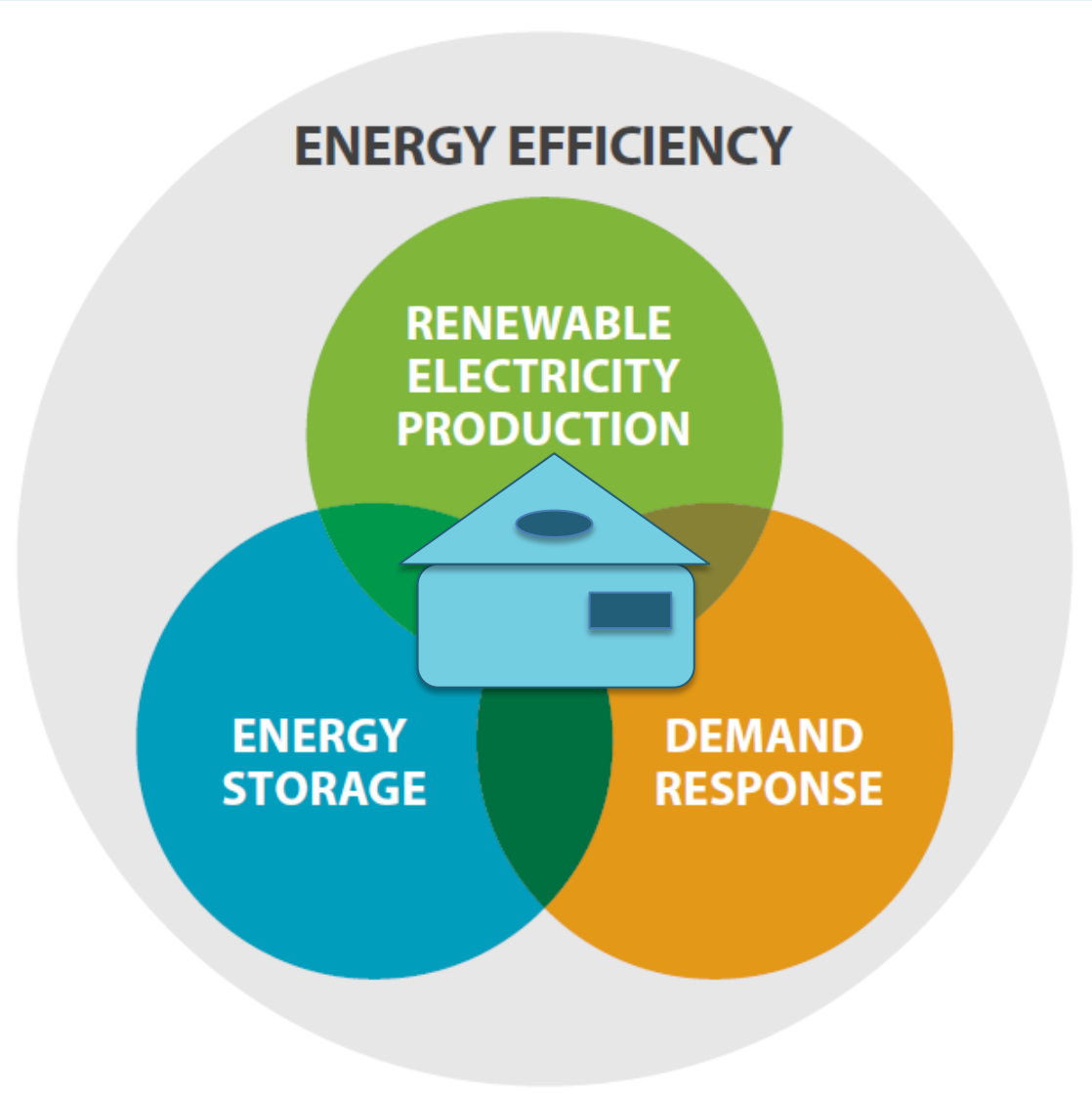






Driver of change #4: Internet of Things

Buildings are becoming micro-energy hubs



Ten interrelated principles of buildings functioning as micro energy-hubs

PRINCIPLE 1

Maximise the buildings' energy efficiency first

PRINCIPLE 4

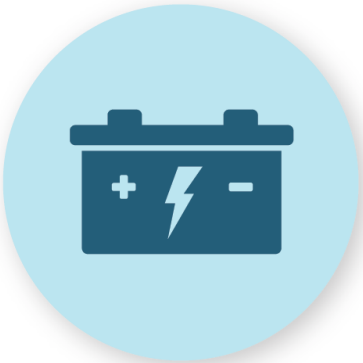
Incorporate demand response capacity in the building stock

PRINCIPLE 2

Increase on-site or nearby RES production and self-consumption

PRINCIPLE 5

Decarbonise the heating and cooling energy for buildings



PRINCIPLE 3

Stimulate energy-storage capacities in buildings

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Ten interrelated principles of buildings functioning as micro energy-hubs (2)

PRINCIPLE 6

Empower end-users via smart meters and controls

PRINCIPLE 9

Build smart and interconnected districts

PRINCIPLE 7

Make dynamic price signals available for all consumers

PRINCIPLE 10

Building infrastructure to drive further market uptake of electric vehicles

PRINCIPLE 8

Foster business models aggregating micro energy-hubs

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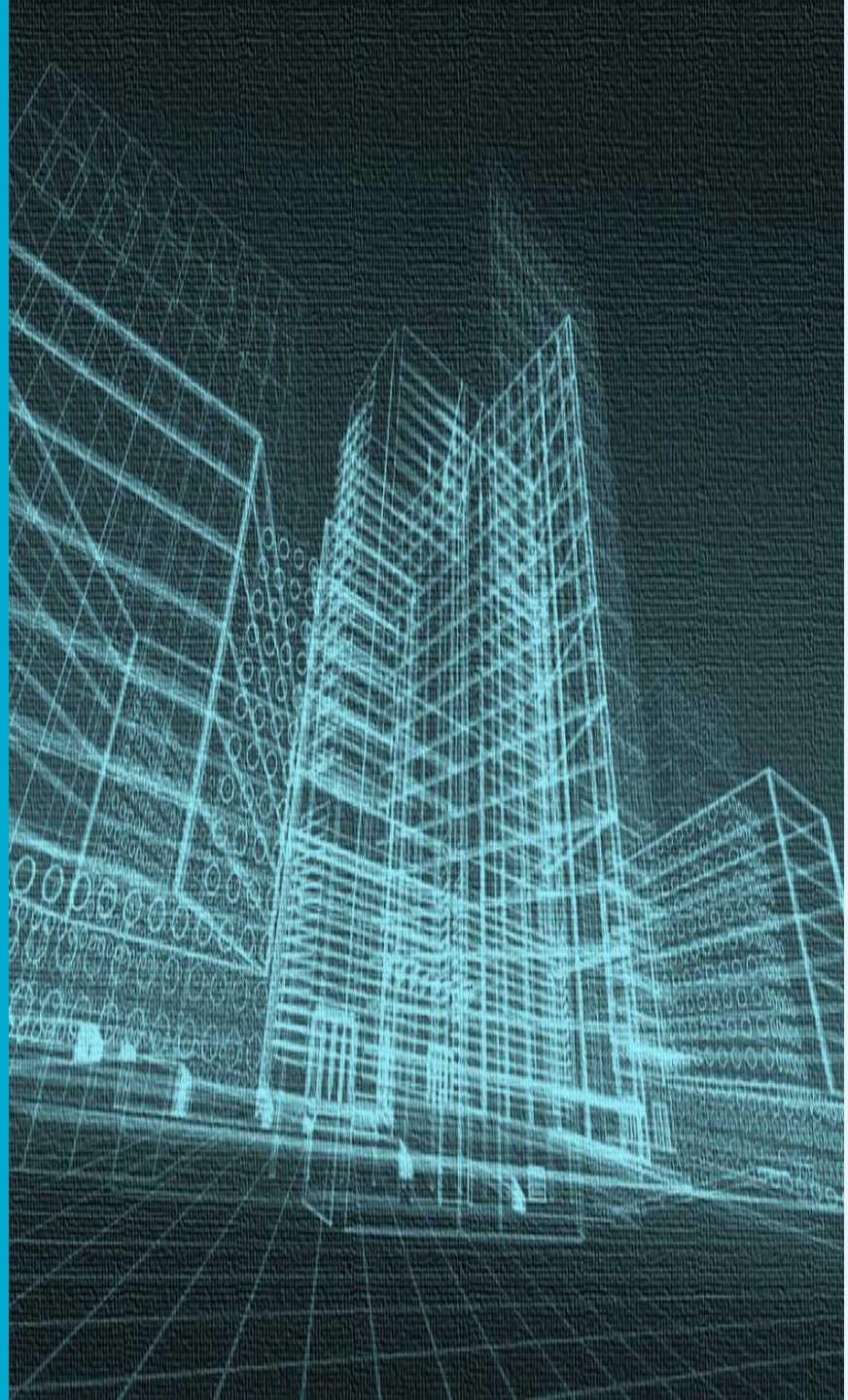
The future: buildings as micro energy-hubs



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Thank you for your attention!

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