

Workshop - Mitigation in the building sector

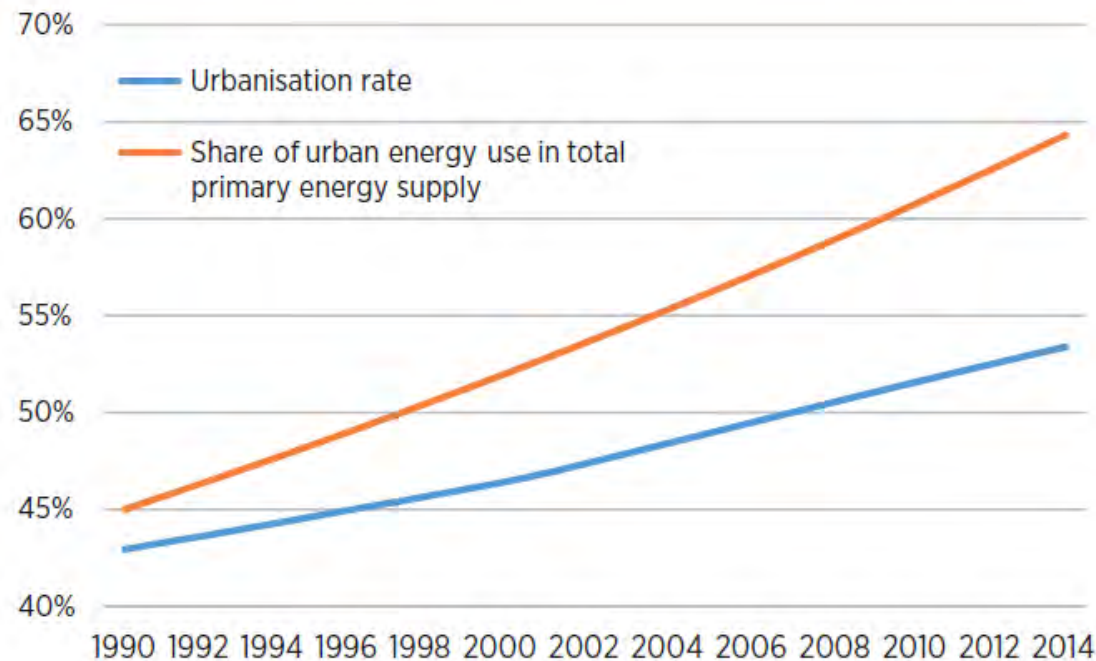
Opportunities to decarbonize the building sector through renewables

Bonn, Germany
31 July 2017

Strong growth in urban energy use

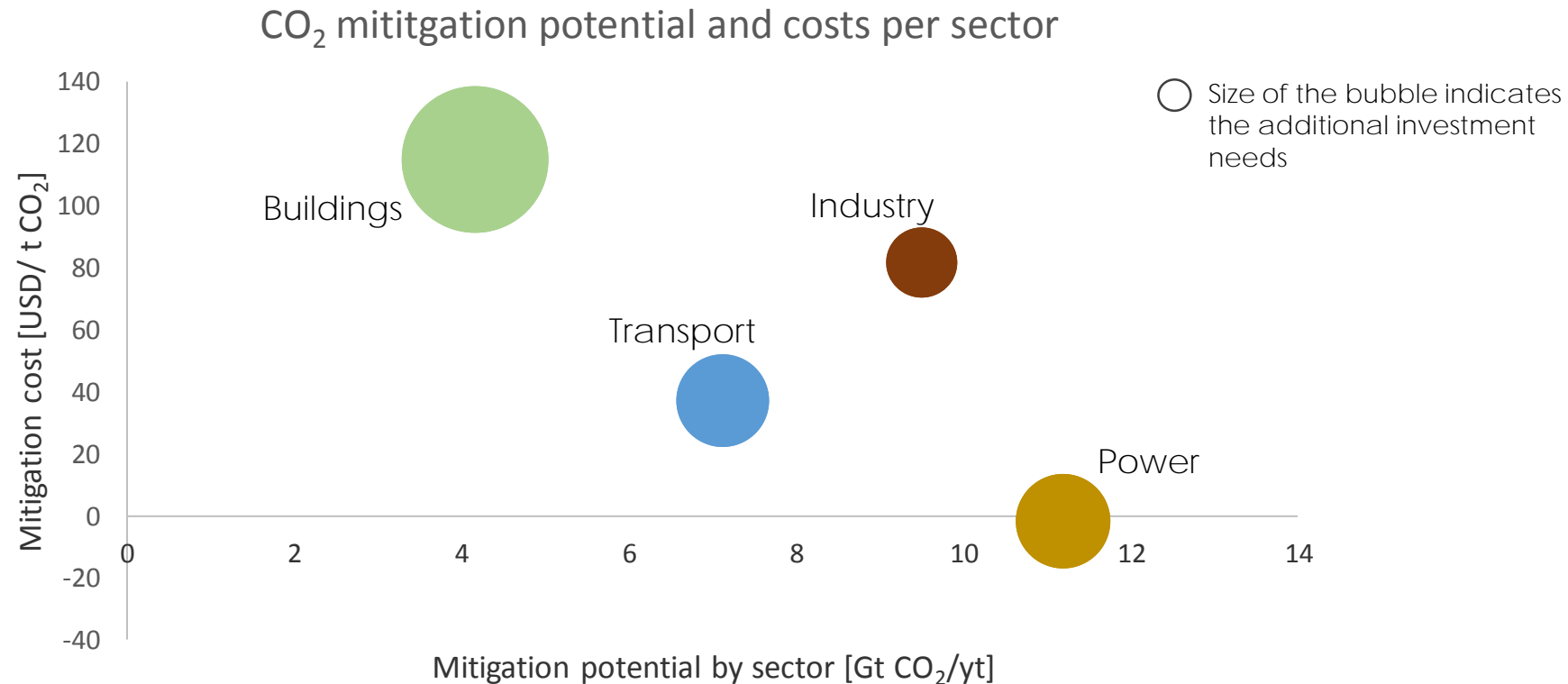
- More than half of all people live in cities and this share is rising
- 65% of energy use is concentrated in urban areas

Figure 1: Global urbanisation rate and share of urban energy use in total primary energy supply, 1990-2014



More than 90% of urban citizens is exposed to significant air pollution from energy use

Mitigation potential and costs by sector



Largest investments for decarbonisation will be needed for buildings.

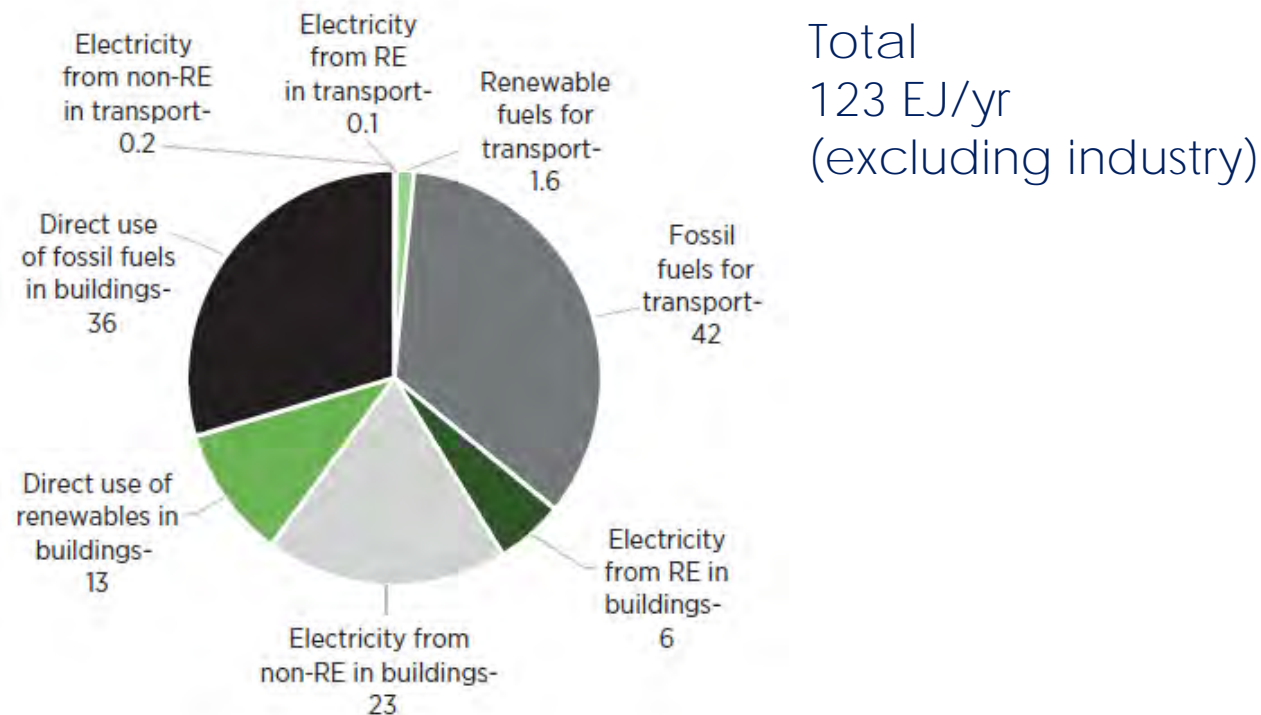
Renewable energy in cities: market and technology perspective

- Energy efficiency has been a focus area for cities for some time, but this is not enough
- Significant RE deployment opportunities exist that can contribute to achieving the Paris Climate Agreement
- IRENA has identified three priority areas for accelerating renewables in cities
 - Renewable energy in buildings
 - Sustainable options for transport
 - Creating smart integrated urban energy systems
- Bottom-up analysis based on energy use of 3 500 cities, distinguishing growth rates, population density, climate differences

Renewables account for 20% of urban energy use today

- 1/3 transport energy, 2/3 building energy
- Today most RE use in buildings, and much less in transport
- Direct RE use and renewable electricity purchases

Figure 4: Breakdown of urban energy use in buildings and transport by

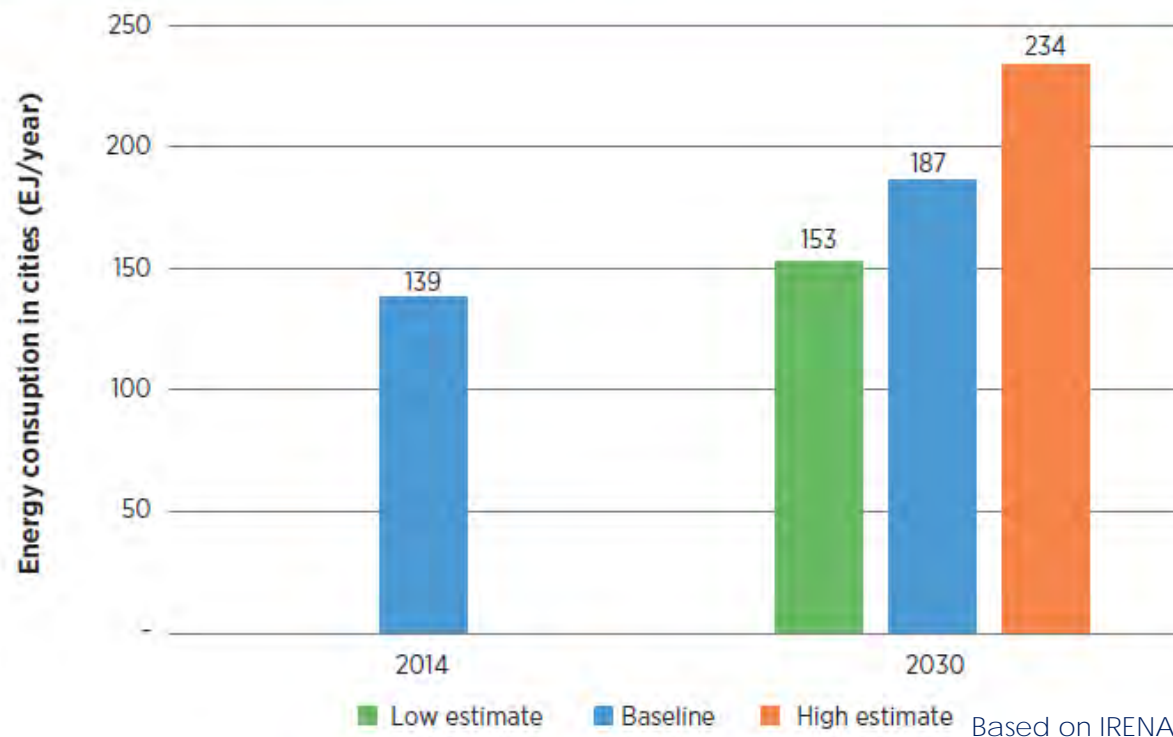


Continued growth in cities' energy

use to 2030

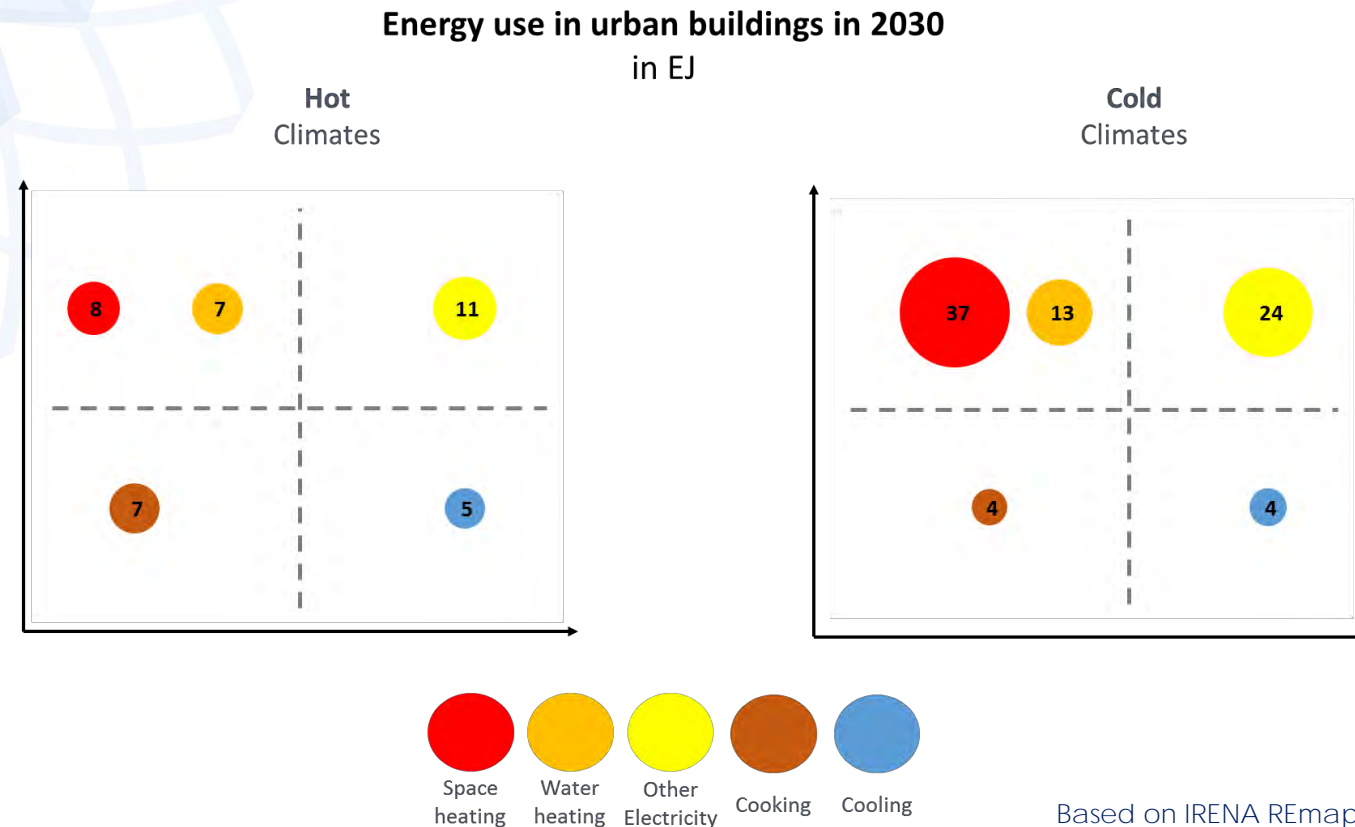
- REmap analysis shows wide range in 2030 energy demand outlook
- Cities will account for 70% of the total primary energy supply by 2030

Figure 9: Energy use in buildings and for transport in cities, 2014 and 2030



Heating ~50% of urban building energy use in 2030

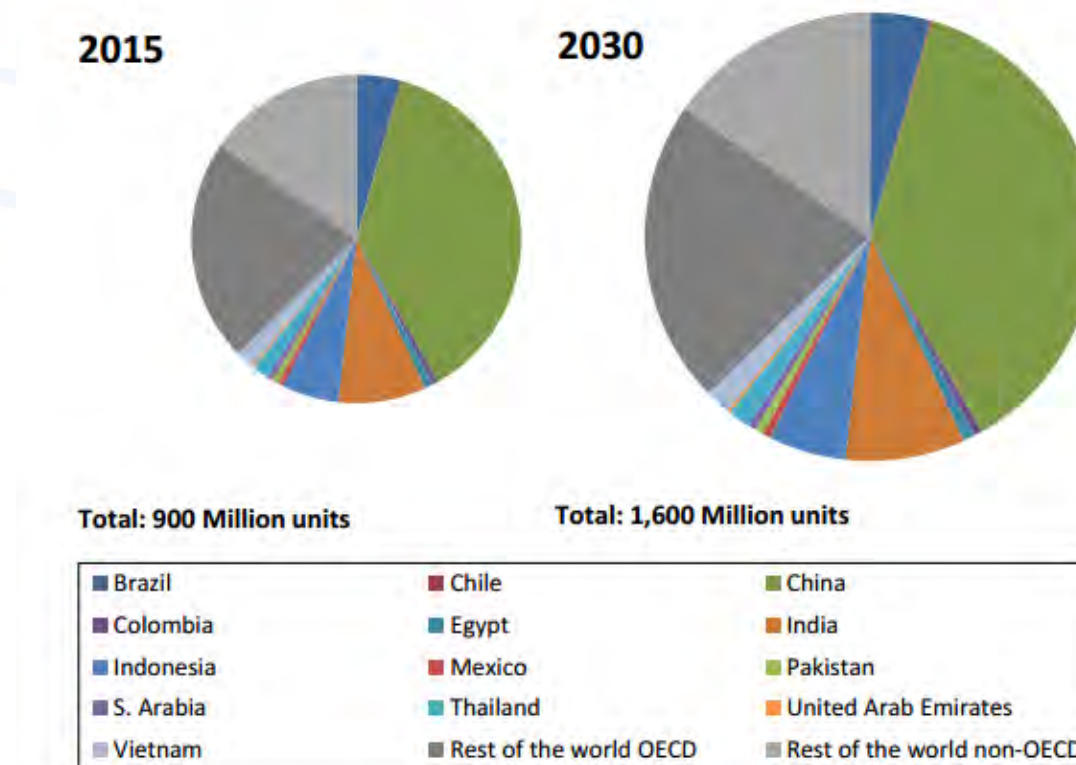
- Large part of global urban energy demand will continue to be for space heating in cold climates, much of which in existing buildings



Based on IRENA REmap estimates

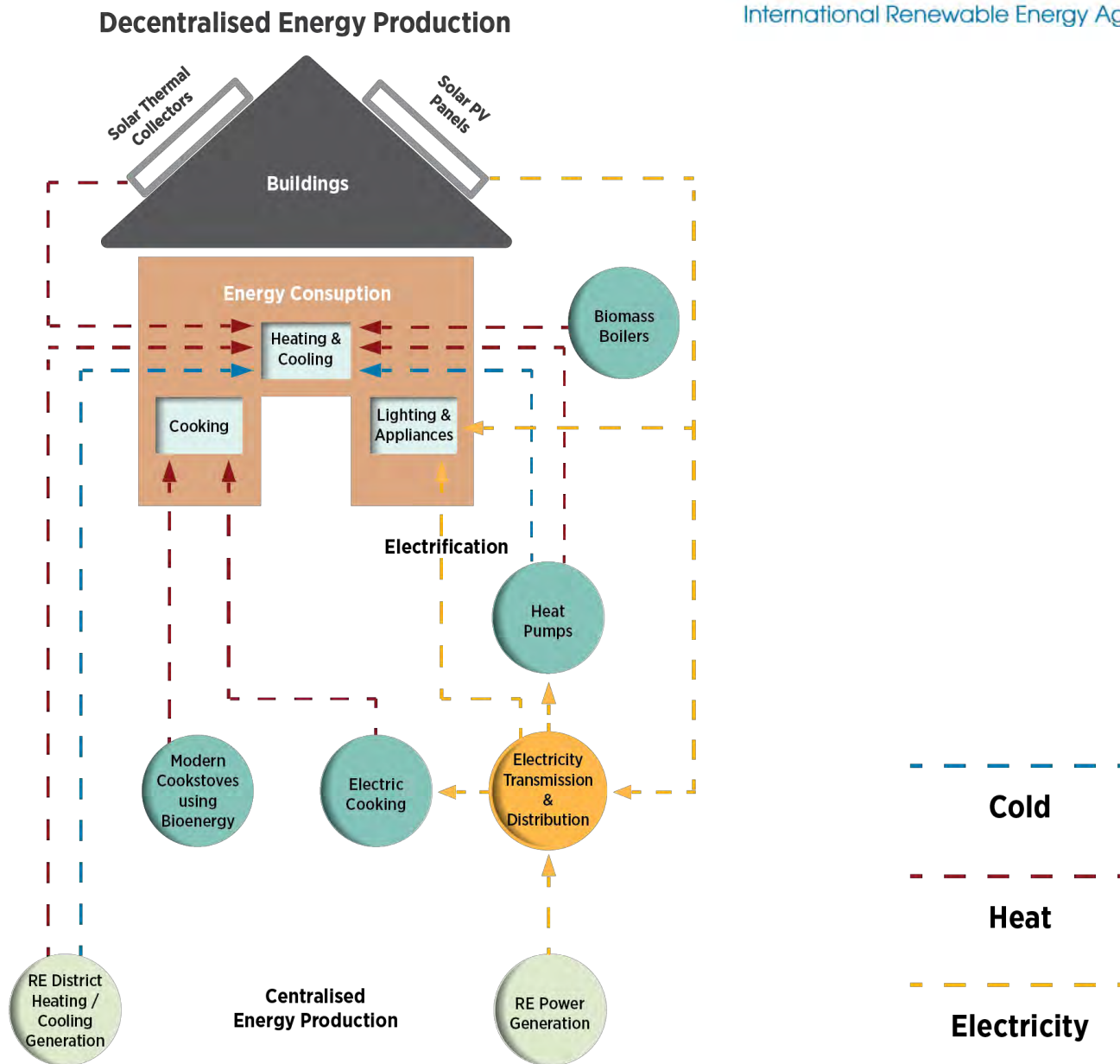
Large increase in energy use for cooling

- Number of A/C units to increase to 1.6 bn in 2030, from 0.9 bn today
- Cooling will represent 8% of buildings energy use in cities by 2030



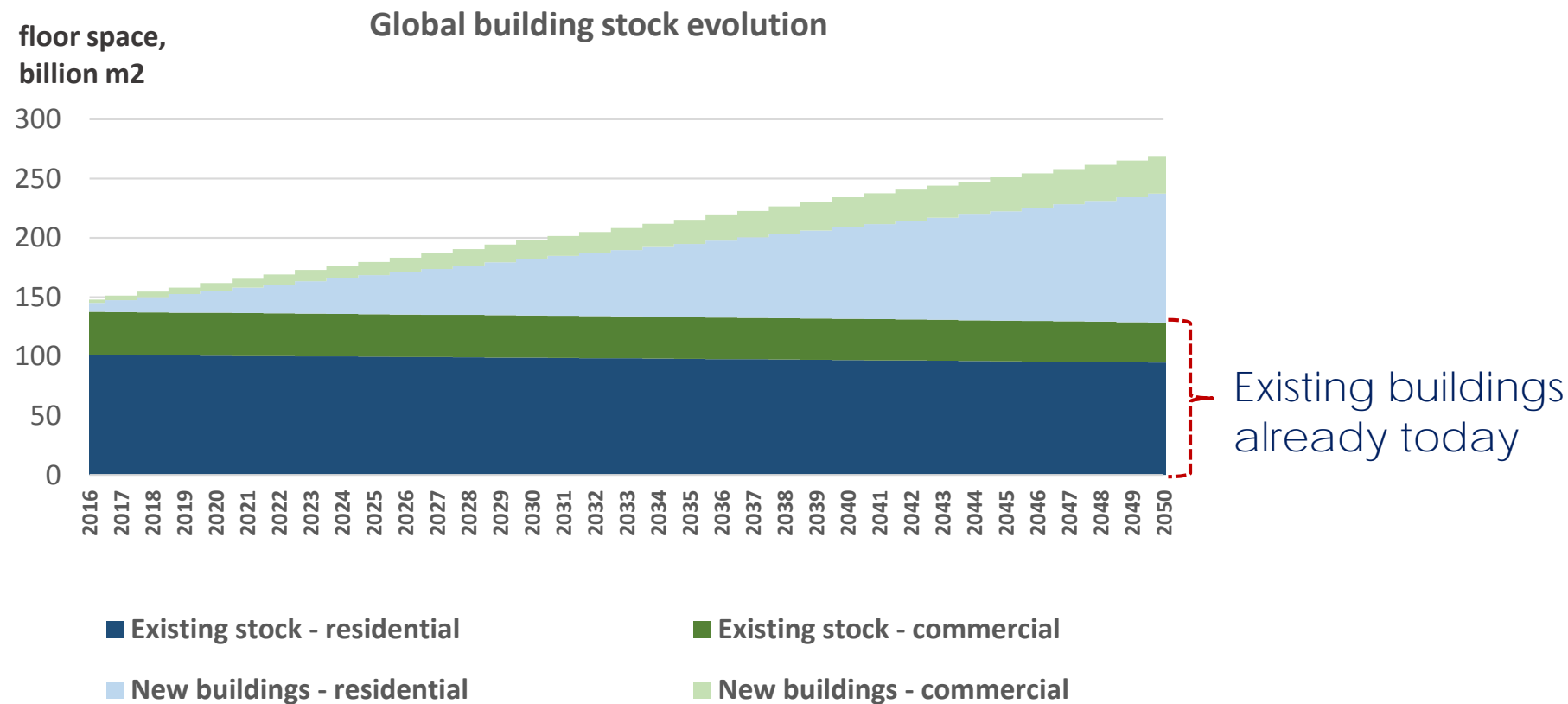
Options to expand renewables use in urban buildings

- Heating/cooling
 - Electrify heating - Heat pumps
 - Solar water heating and solar cooling
 - Biomass boilers
 - Renewable district heat/cooling
- Replace traditional biomass with modern renewables or electricity for cooking
- Renewable electricity supply
 - Rooftop and building integrated PV
 - Buy renewable electricity from the grid
- Renewables for transportation
 - Electric vehicles
 - Biofuels
 - Modal shift



The challenge of the existing building stock











- In 2050, half of the building stock consists of buildings that already exist today
- In many regions standing stock will dominate for decades: a retrofit priority



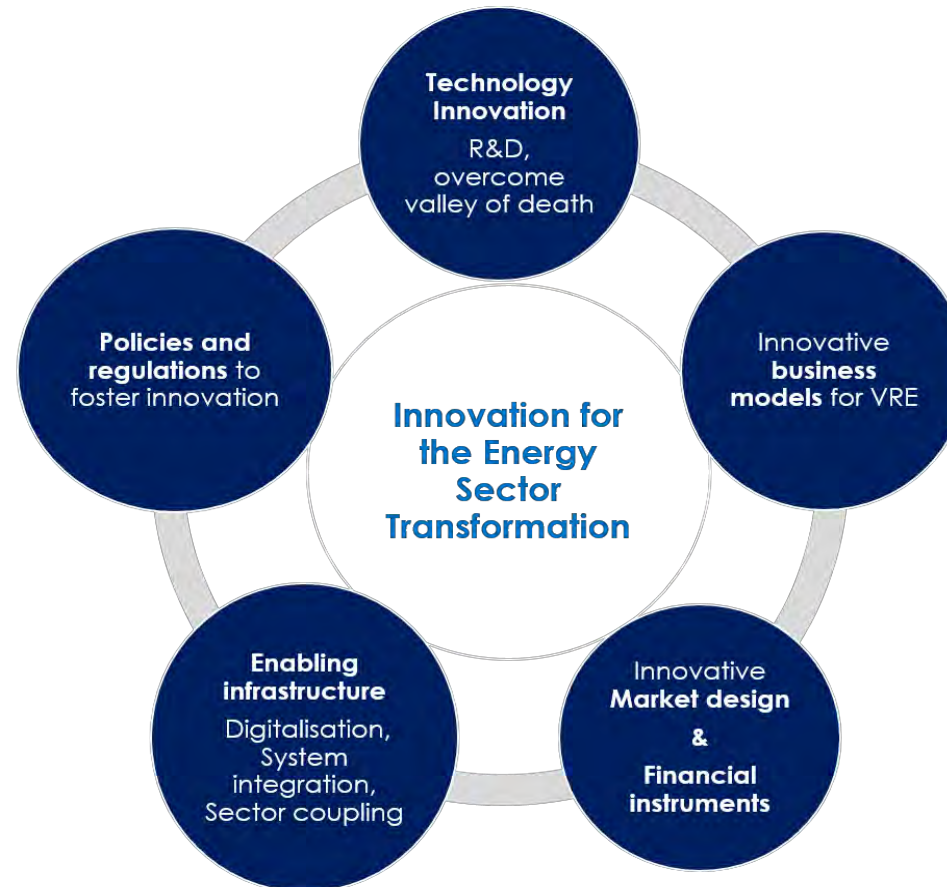
Priorities to expand renewables use in urban buildings

- Risk of stranded assets:
 - Loss in construction value of inefficient buildings that need to be deeply retrofitted (preliminary estimates indicate stranded assets in building will greatly exceed those in other sectors)
- For established cities:
 - Ensure renewables friendly renovation of the existing building stock
 - Especially in cities with high population density and existing piping systems, cost-effective to expand RE in district heating
- For emerging cities:
 - Focus on strengthening building codes, scaling up NZEB
 - For new city developments (e.g. malls, offices) in hot climates, oftentimes efficient to include in plans (RE) district cooling systems

Technology options for building sector

| | CO ₂ abatement potential compared to the Reference Case in 2050 (Gt CO ₂ /yr) | Growth index installed capacity 2015–2050 2015 = 1 | Compound annual growth rate 2015–2050 (%/yr) | Innovation speed | Innovation opportunities |
|--|--|---|---|--|---|
| Buildings | | | |  | |
| Zero energy buildings | 0.2 | 100 | 28.6 |  | Need for more stringent regulation |
| Energy renovation existing stock | 0.5 | 3 | |  | |
| District heating/cooling with renewables | 1.0 | 6 | |  | Strengthen renewable energy component |
| Clean cooking using renewables | 0.2 | 17 | 8.5 |  | Roll-out at scale; enabling policy frameworks |
| Solar assisted water/space heating systems | 1.9 | 19 | 8.7 |  | Roll-out at scale; enabling low temperature building energy systems |
| Heat pumps | 0.4 | 58 | 12.3 |  | Roll-out at scale; enabling low temperature building energy systems |
| | | | |  On track  Lagging but viable  Not viable at the current pace | |

Holistic innovation approach



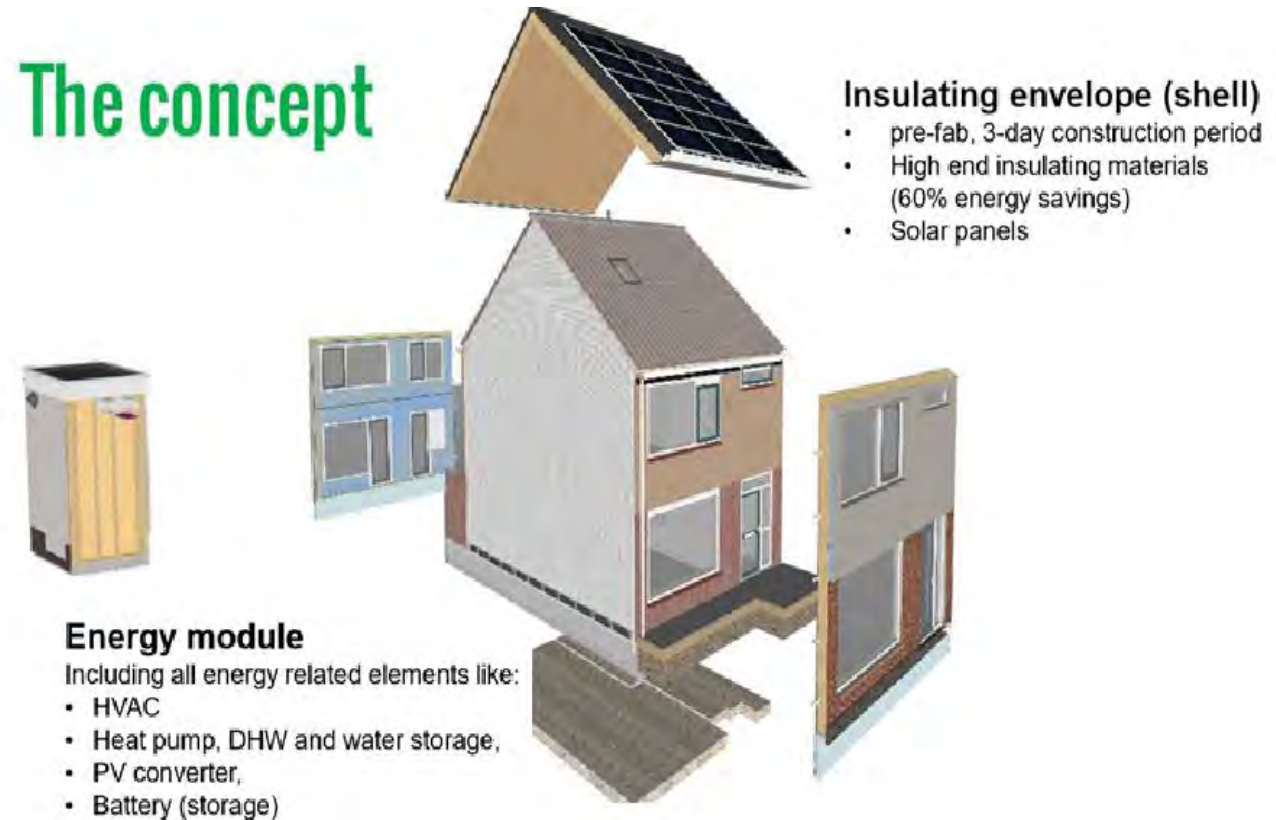
The technology to push a global renewable power transition in the next two decades is already here, but more innovation is needed in enabling infrastructure, system operation, and business models to scale up deployment

Energy neutral houses

Nul op de meter ('zero on the meter') is a Dutch national project initiated by the government to renovate already existing houses and apartments industrially so that they are energy neutral.

- It is a holistic systemic deep renovation concept using smart services resulting in energy-neutral housing by reducing energy consumption and maximizing the use of renewable energy.
- The houses are made energy neutral with the use of a heat pump, PV-panels, an air ventilation system with heat recycling, plastic window frames with triple glazing and façade isolation of 30 cm thick.

The concept

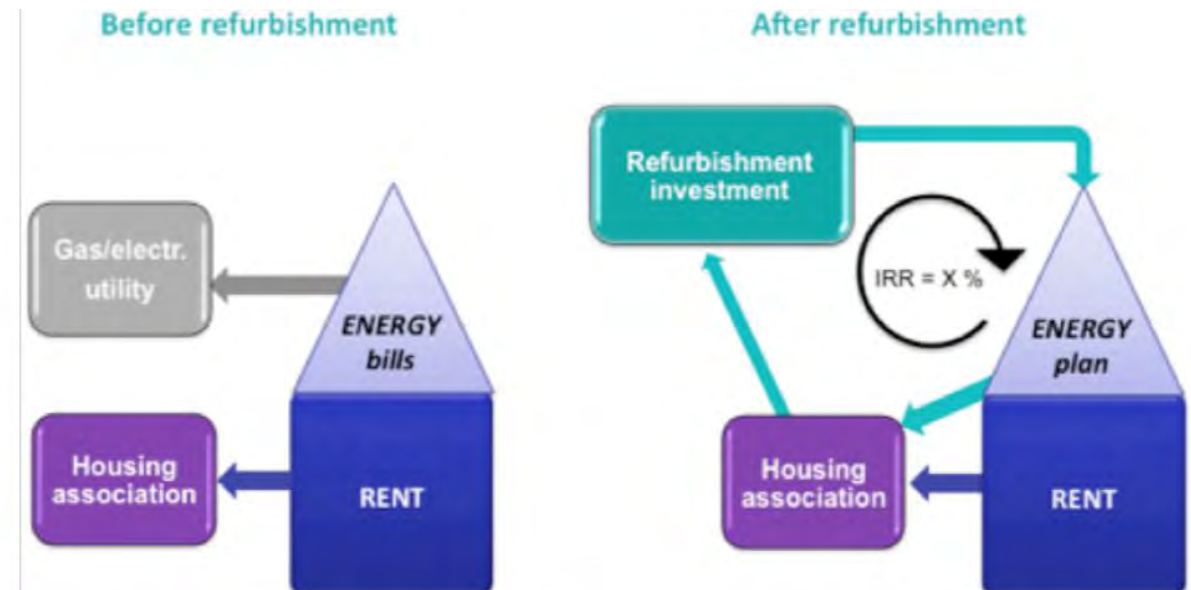


Source: Stroomversnelling.nl

Energy neutral houses business model

The business model: from an energy bill to an energy plan

- Instead of paying their energy bills to the utility, the tenants pay a similar amount (service fee) to the housing corporations that own the houses. With this money, the corporations pay building companies to retrofit the houses, which after renovation have net zero energy costs.
- The building companies have for this project developed renovation procedures that are highly cost-effective.



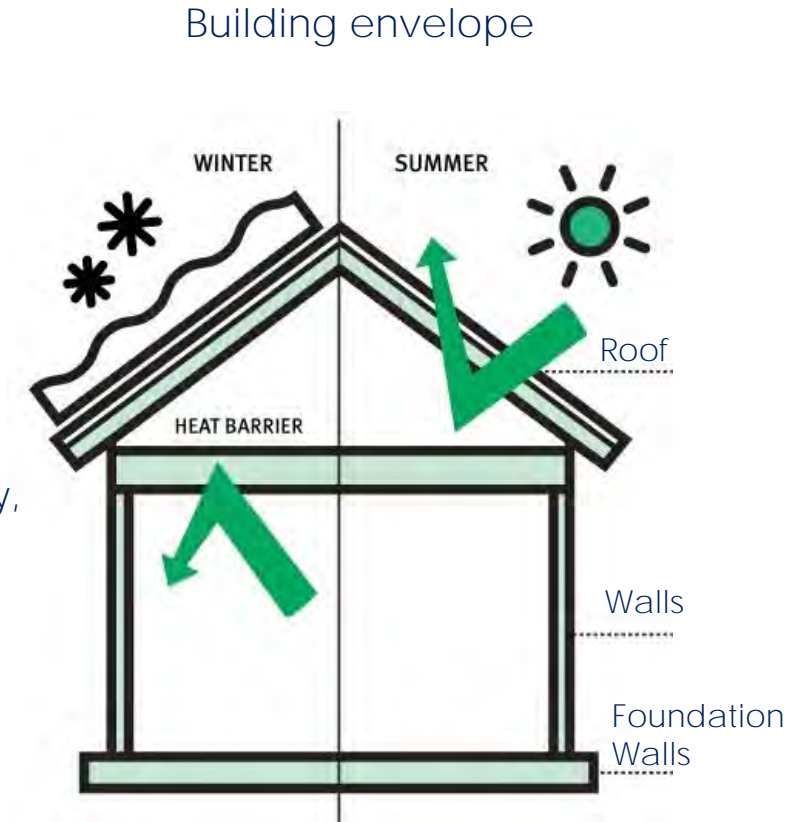
Conversion of the energy bill to a monthly energy plan (service fee) to pay the investment. Total cost of living should stay the same

Source: *Stroomversnelling.nl*

Credit lines for investing in energy-saving improvements at home

Kosovo Sustainable Energy Projects (KoSEP) is a credit line offered by European Bank for Reconstruction and Development (EBRD), with support from Norway and the EU

- €12 million credit: to date €11.8 million have been disbursed largely in the residential sector, to over 3 100 households in Kosovo
- The improvements introduced include insulation of so called “building envelopes” (outside walls, roofs and floors), efficient windows and external doors, as well as buying energy-efficient washing machines, refrigerators, new boilers and also renewable energy equipment using solar power and biomass
- Recently EBRD has established the Western Balkans Green Economy Financing Facility, credit lines for a total of up to €85 million to participating financial intermediaries in [Albania](#), [Bosnia and Herzegovina](#), [FYR Macedonia](#), [Kosovo](#), [Montenegro](#) and [Serbia](#) to finance more residential energy efficiency and small-scale renewable energy investments.



New regulations for renewable energy in buildings

New buildings in Germany have to use renewable energy for heating

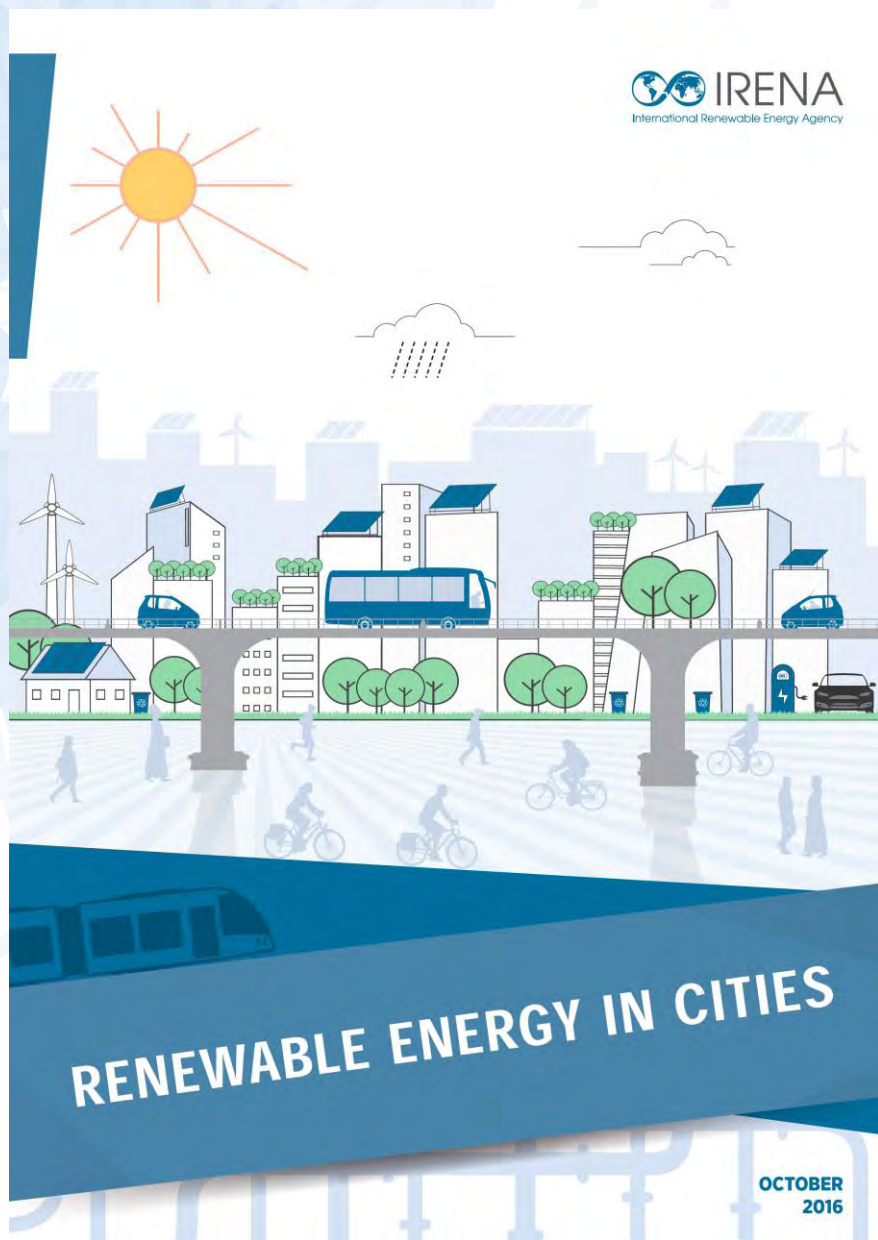
- From 1 January 2016 onward, anyone who wants to build a new building in Germany will have to meet a maximum primary energy requirement that is 25% lower than the previous threshold.
- Biomass +solar thermal is the best option
- Consumption of solar power can significantly improve the primary energy requirements of heat pumps

France decrees new rooftops must be covered in plants or solar panels

- Rooftops on new buildings built in commercial zones in France must either be partially covered in plants or solar panels
- Green roofs have an isolating effect, helping reduce the amount of energy needed to heat a building in winter and cool it in summer.

Role of IRENA in supporting renewables use in cities

- International cooperation
- Increasing knowledge on policy and regulatory frameworks and integrated planning for renewables
- Capacity building at the municipal level
- Providing tools and information on technology solutions
- Identifying best practices and replicable innovative solutions for renewables in cities



THANK YOU

Invitation to engage in our work!

Francisco Boshell (fboshell@irena.org)

Download for free:
http://www.irena.org/DocumentDownloads/Publications/IRENA_Renewable_Energy_in_Cities_2016.pdf



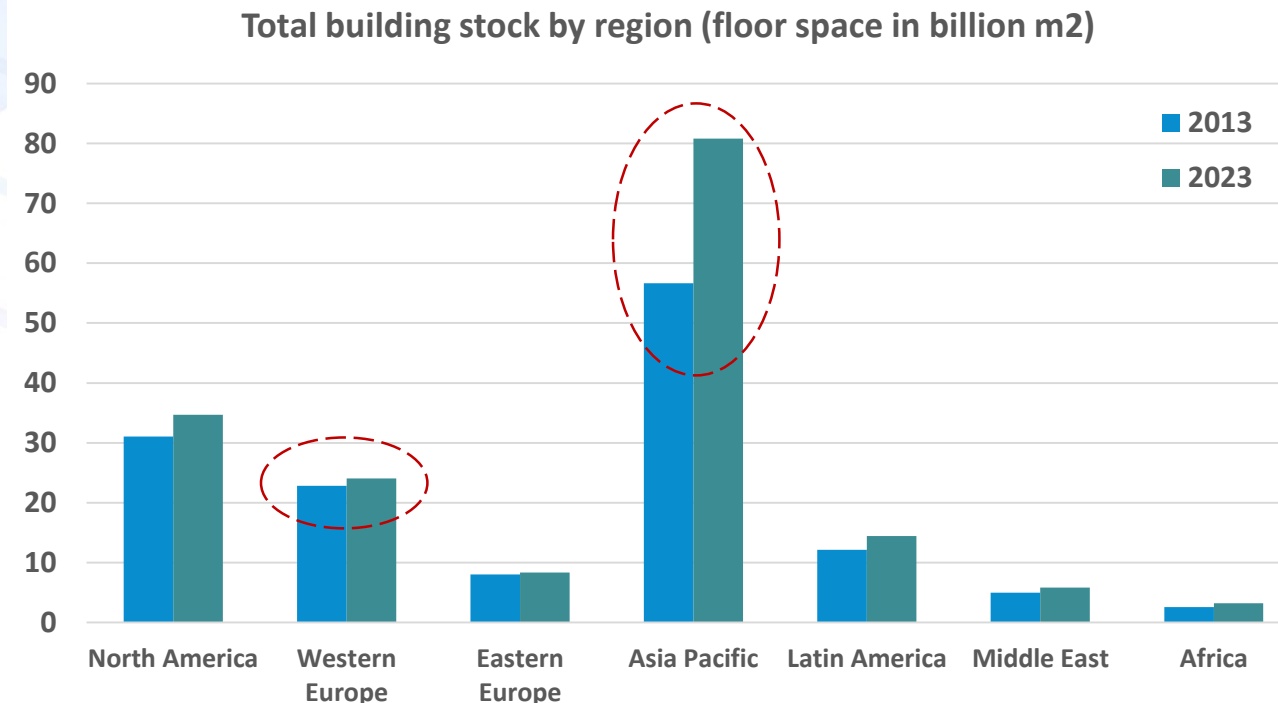
Backup slides

Benefits of renewables to cities

- Welfare and health: Reduce air pollution and noise pollution in cities
- Cheaper energy services
- Mitigate climate change – cities are the main source GHG emissions and main victims of climate change (rising sea levels, severe storms, flooding, heat island effect etc)
- Additional positive effects to the economy;
 - Positive GDP impact
 - Create jobs
 - Improve overall welfare of citizens

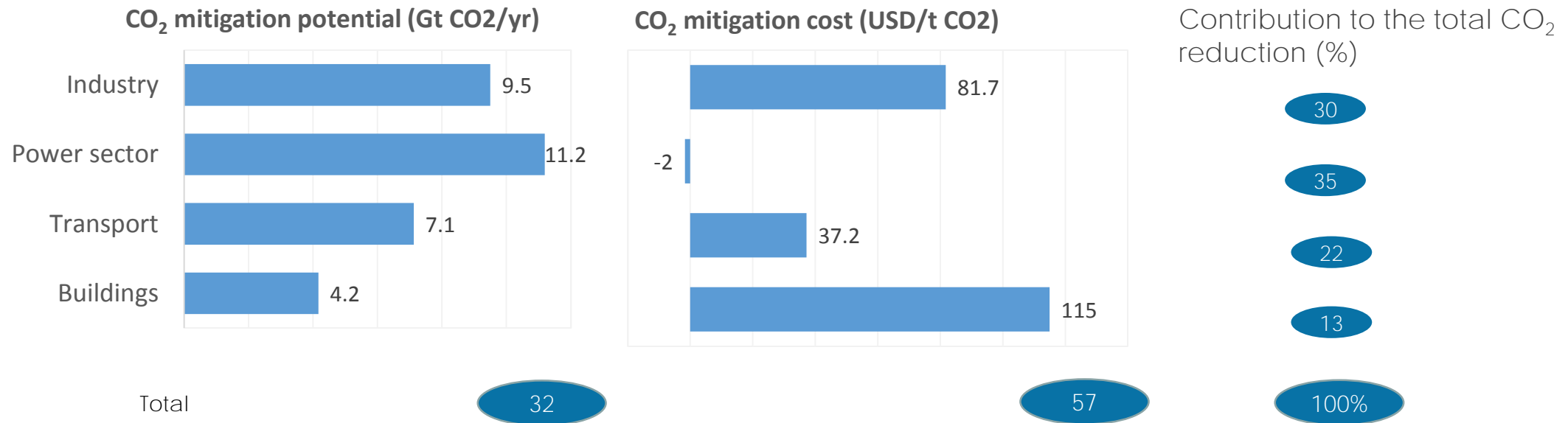
The challenge of the existing building stock

- Limited growth in building stock in Europe / North America
- Majority of global construction will take place in Asia Pacific



Source: Navigant Research

Mitigation potential and costs by sector



- Largest emission reduction potential exists in power and industry sectors
- Average abatement cost of technologies are highest in the building and industry sectors
- Options in the power sector are economically viable and for the transport sector nearly viable
- While power and transport may require continued improvement of available technologies, building and industry sectors may require breakthroughs

End-use sector transition: untapped areas



Energy neutral houses are a reality

The program organizes mass demand for deep refurbishments with the following criteria:



Energy performance guarantee

The E=0 refurbishment package comes with a long year (i.e. 30) energy performance warranty on the house. This can only work if an insurer backs it.



One-week delivery

The installment of the packaged does not require more than one week and allow occupants to continue living in the house for the greater part of the works



Affordability

The ability to finance an investment requires a business case. This implies the investment (largely) needs to be paid for by the resulting energy cost savings.



Attractiveness

The refurbishment packages need to be attractive to occupants. It improves quality of life and the appearance of the house.

Energy neutral houses are a reality

Impact: direct energy savings of 400 GWh/year/M€ subsidy

The program's aim is to make 111 000 Dutch rental flats energy-efficient over the next few years.

The program is already underway: the first 11 000 flats signed the contract 2013.

Initiatives to replicate this program are carried out in France and UK

