

**ENERGY RETROFIT WORKSHOP  
GUIDELINES FOR NZEB AND RETROFITTING**

**Tuesday, April 30, 2019 – Grand Caribbean Suite, The Knutsford Court Hotel**

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# Save the world with better buildings

Climate change: Temperature rise of 3-5C by 2100, sea level rise 1-4 feet.

Key to solution: Transport and buildings

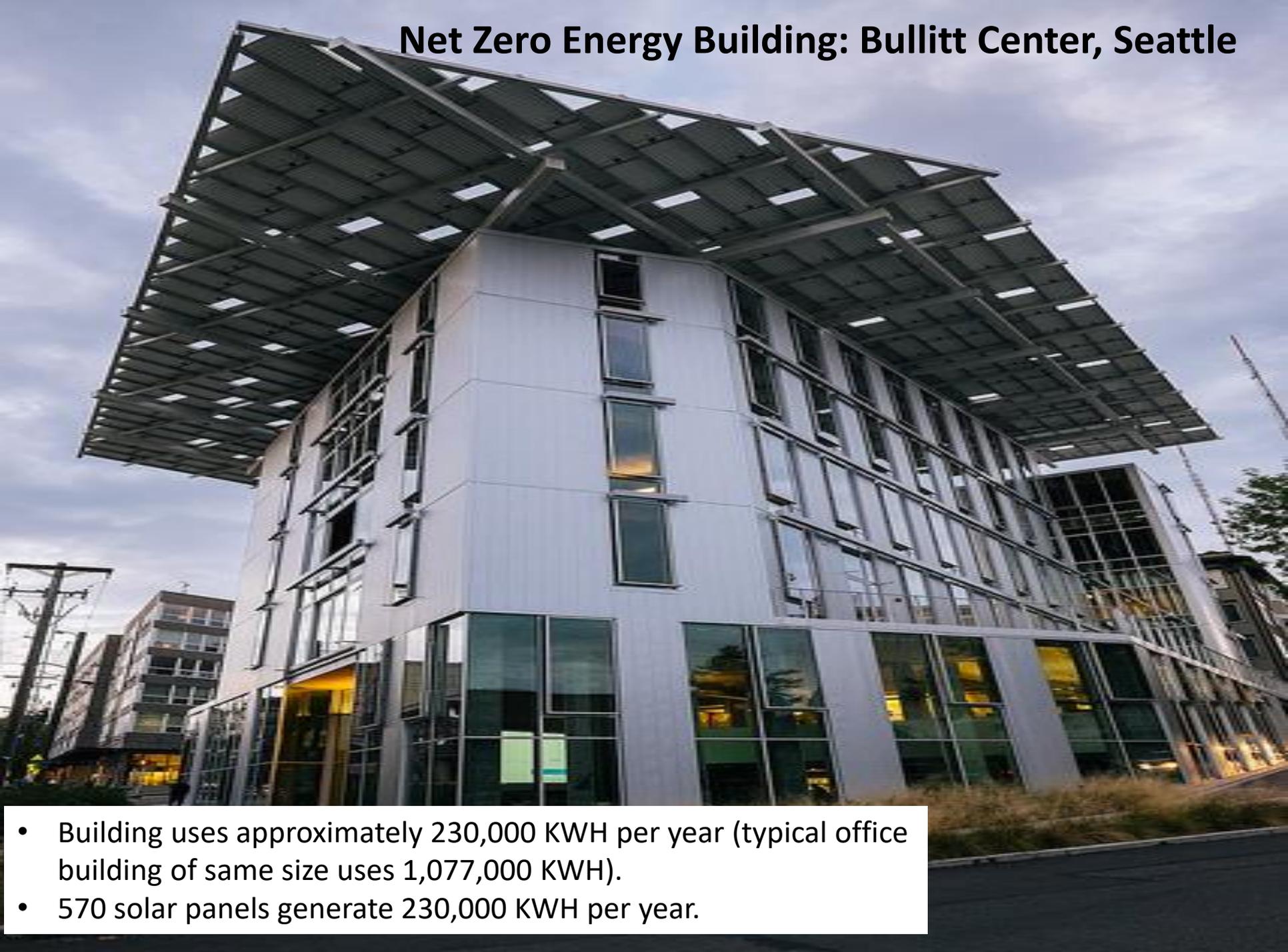
**Transport:** driverless vehicles. Most vehicles used 5% of time. Automated vehicles double capacity of roads, reduce cost per load by 75%, can reduce fleet by 80%.

**Buildings:**

ZEB or EP building: energy efficient, renewables to meet demand, power storage or grid as back-up. Upgrade buildings to EU standard would displace >20% of world energy demand; ZEB would displace 40%, EP more.

But stock takes 30-100 years to turn over, need retrofit.

# Net Zero Energy Building: Bullitt Center, Seattle



- Building uses approximately 230,000 KWH per year (typical office building of same size uses 1,077,000 KWH).
- 570 solar panels generate 230,000 KWH per year.

# Why is change so hard?

- 2009 McKinsey: invest \$520bn (better insulation for buildings, more efficient appliances), would give savings of US\$1.2tr in USA by 2020.
- Would have paid back \*2 by now.
- Why didn't it happen?
- x Hard to persuade homeowners or businesses to act.
- x Even harder to persuade governments to enact supportive policies.
- Usually easier to do nothing.

Four key areas for action:

- **Information about energy use:** Rating systems. EU labeling for appliances, (A = efficient, G= not), UK has energy ratings for houses.
- **Standards:** US regulation that refrigerators and dishwashers meet minimum efficiency standards; 1987 – 2000 program cost US\$15bn, saved US\$50bn.
- **Finance:** If renter pays utility bills, building owner has no incentive to upgrade building. UK introduced Landlord's Energy Saving Allowance, give owner tax incentives to upgrade buildings; USA allowed home-owners to pay for upgrades over time via property taxes.
- **Supportive government policies.**

# Where has this worked? Example: Denmark

Early 1970s: Denmark got almost all its energy from imported oil.

Oil crisis led to 2 major decisions: develop indigenous resources (including oil and gas), green energy transition to eliminate fossil fuels. Later added commitment to energy efficiency.

Goals for energy savings; mandatory but market-based; stricter building codes; energy labeling.

Smart grid aggregates many small-scale generating resources (wind turbines, solar panels, biodigesters, CHP facilities) into 'virtual power plant'; gives reliability and predictability.

Now coordinating power supply >50% renewable, can accommodate surges of wind power; in summer of 2015 wind generated 140% of demand. Exported across EU.

Denmark's grid is the most reliable in Europe; about ten times more reliable than U.S. electricity supply.

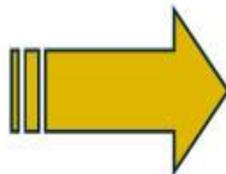
1990

# Denmark

2014

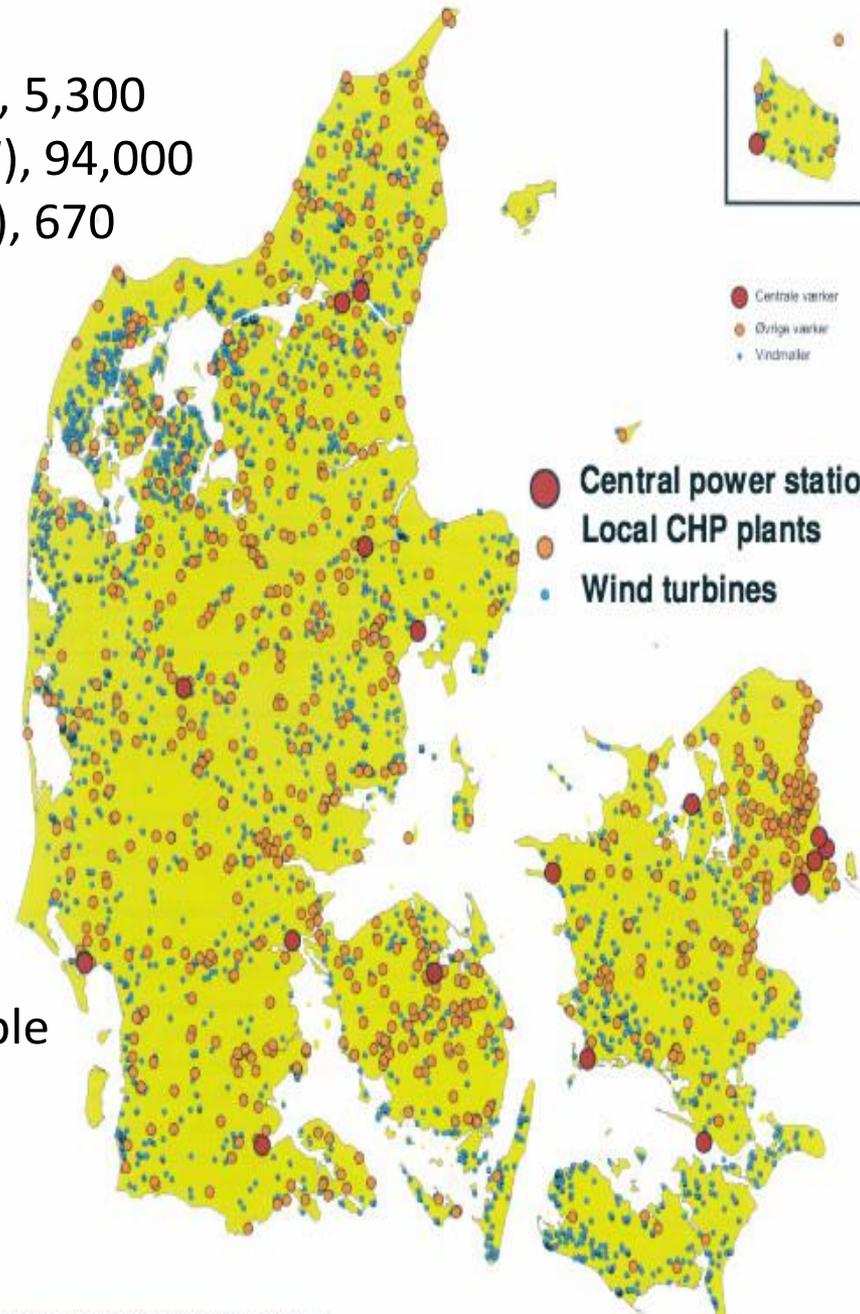
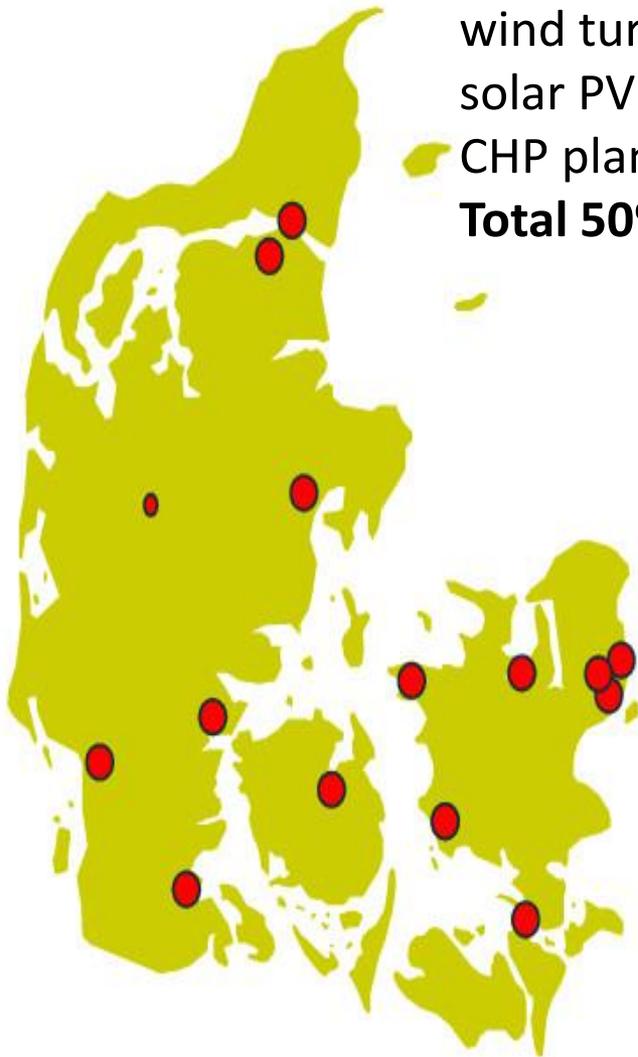
20 central power stations, 5,300 wind turbines (5,070 MW), 94,000 solar PV panels (785 MW), 670 CHP plants (2,300 MW).

**Total 50% renewable.**



Goals: 100% electricity renewable by 2035.  
100% of total energy renewable by 2050.

15 central power plants (oil)



● Centrale værker  
● Øvrige værker  
● Vindmøller

● Central power stations  
● Local CHP plants  
● Wind turbines

Thank you !

