The 2000 Watt Society:
an innovative tool for a sustainable city planning

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The two sides of the same coin

Main efforts

securing the supply side,

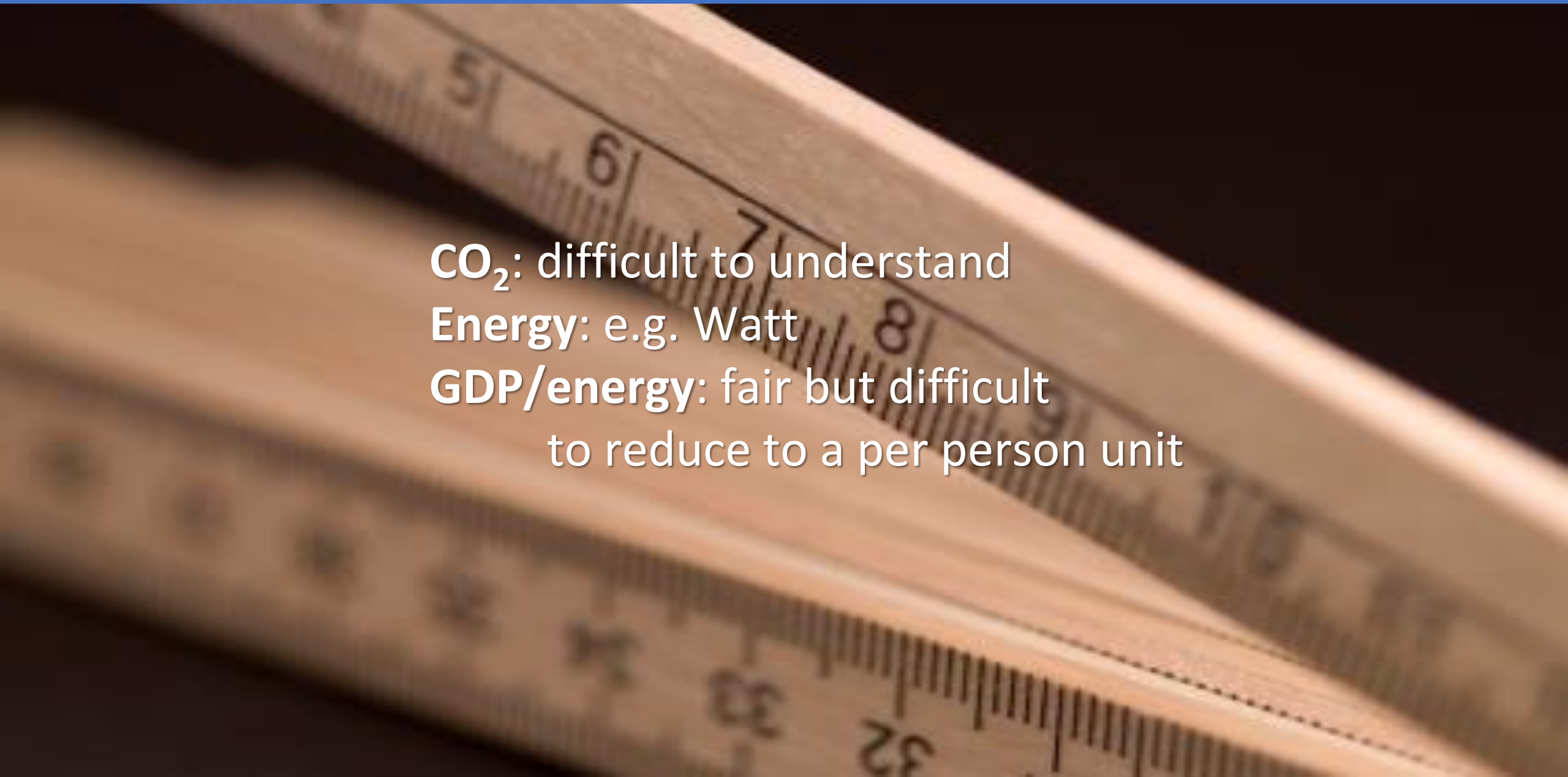
e.g. Germany “Energiewende”, energy outlooks

Little efforts

demand side!

except perhaps reduction of CO_2 emission

.....a common yardstick for demand



CO_2: difficult to understand

Energy: e.g. Watt

GDP/energy: fair but difficult to reduce to a per person unit

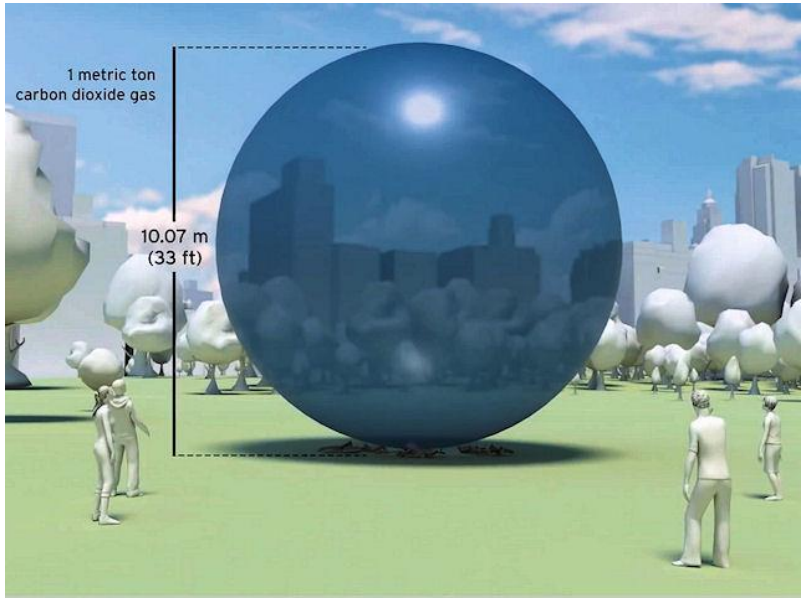
A few basics on energy and power

2000 Watt per person correspond to:

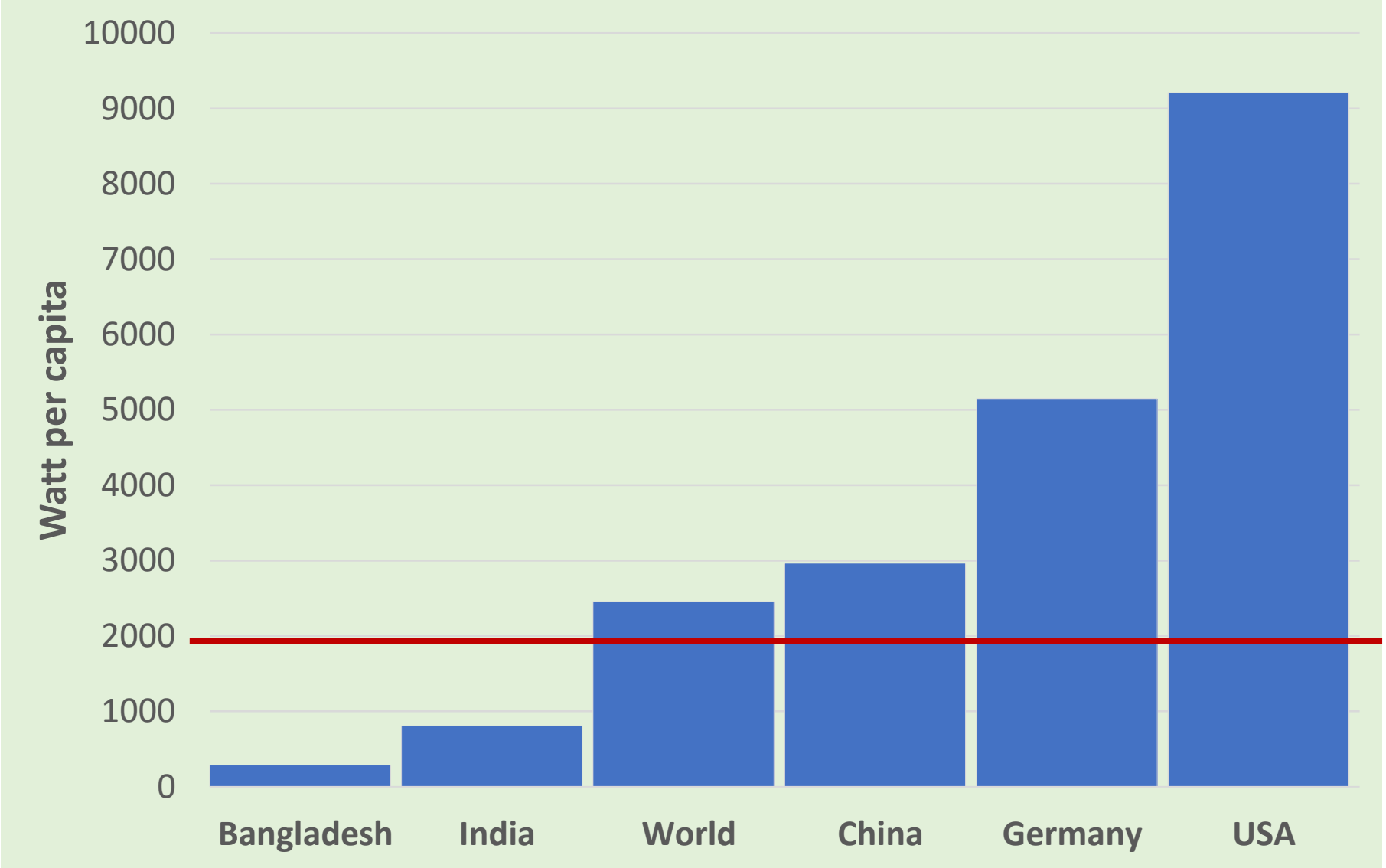
- 1 kWh every half hour or 17‘520 kWh per year
- consumption of 1‘700 liter of oil (gasoline) per year
- 100 continuously lit 20 Watt bulbs

Conversion to CO_2

- Approx. 500 Watt exclusively from oil corresponds to 1 ton of CO_2 per year

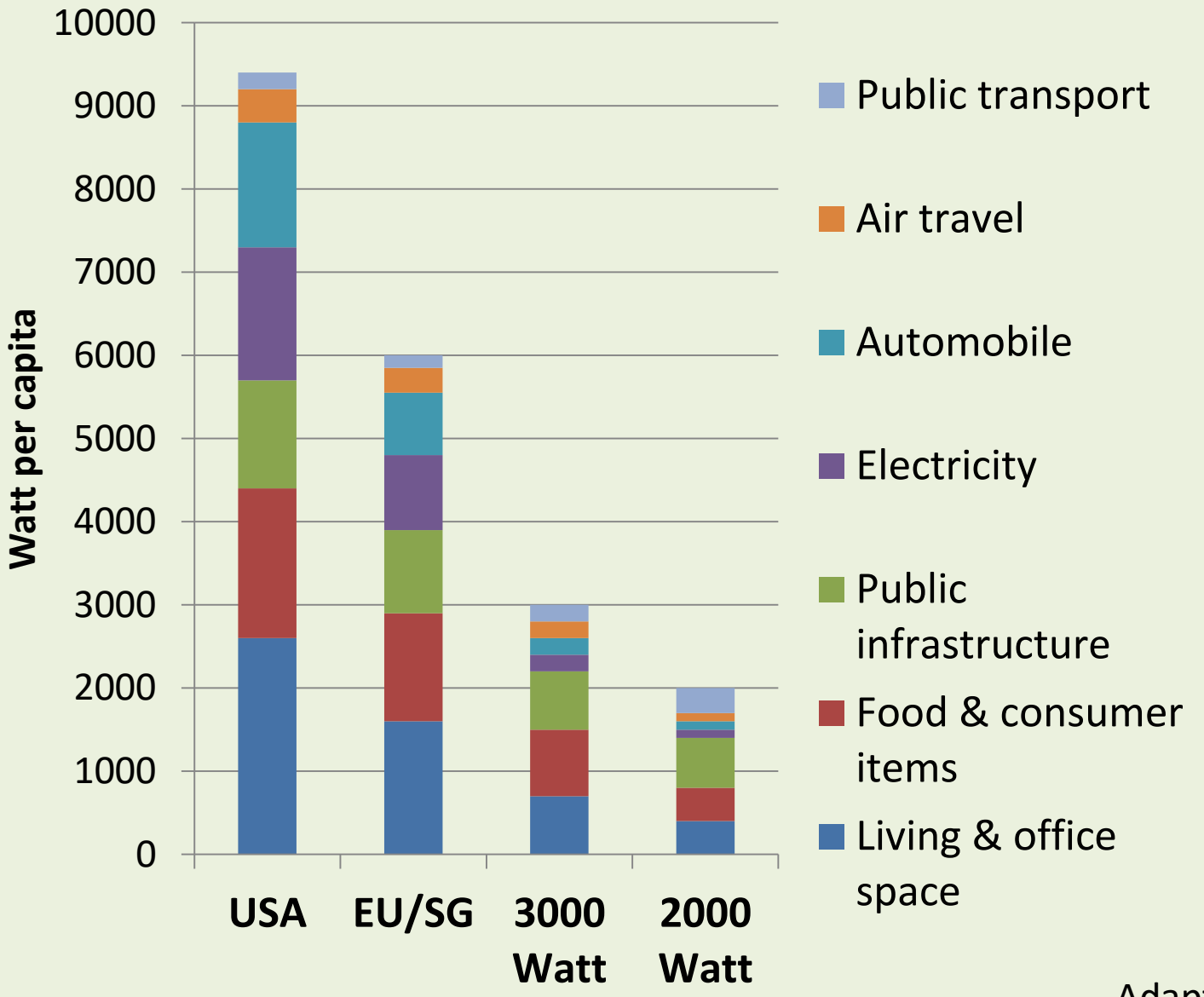


Energy per capita



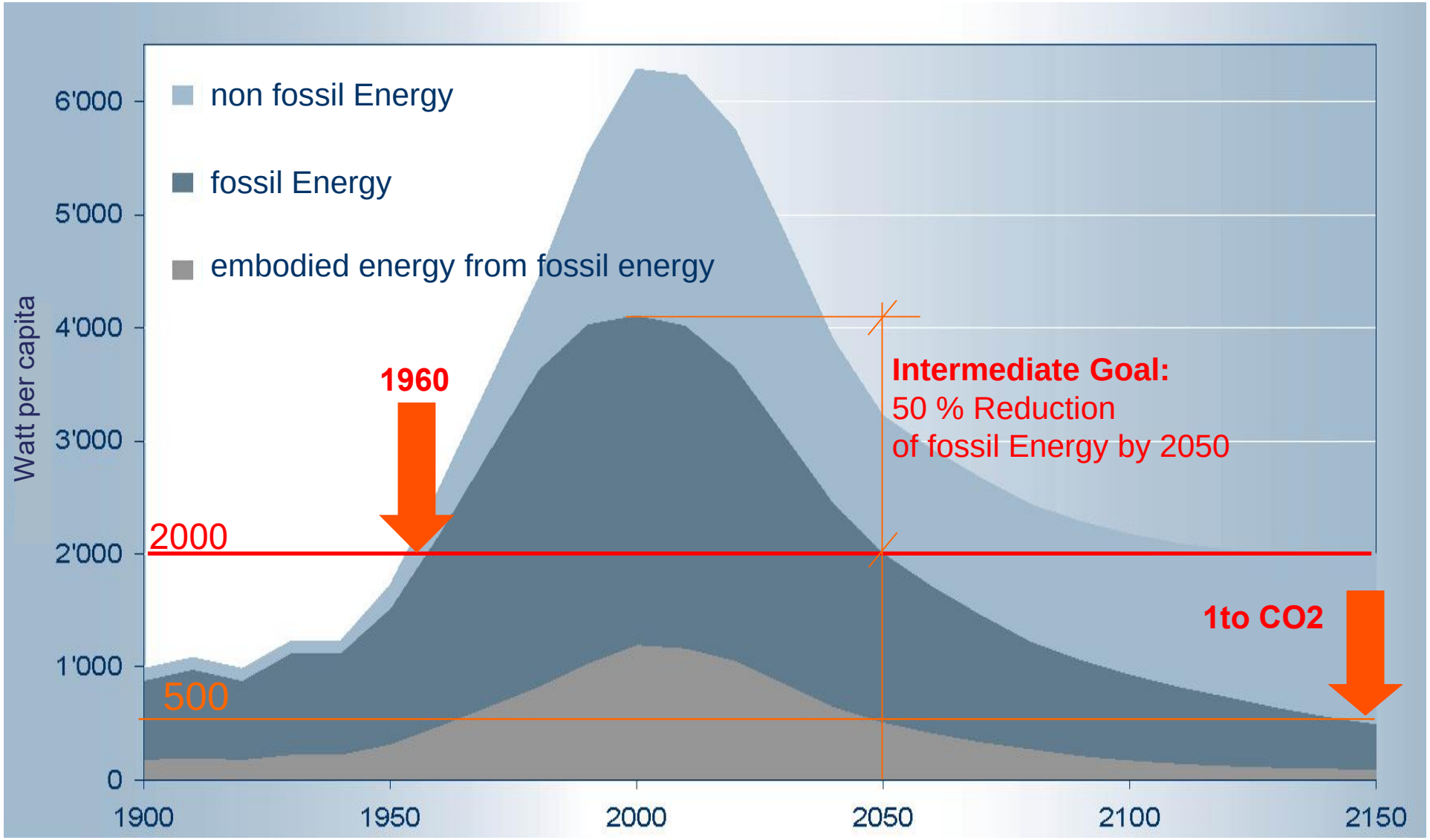
data.worldbank.org 2018

2000 Watt in the daily life



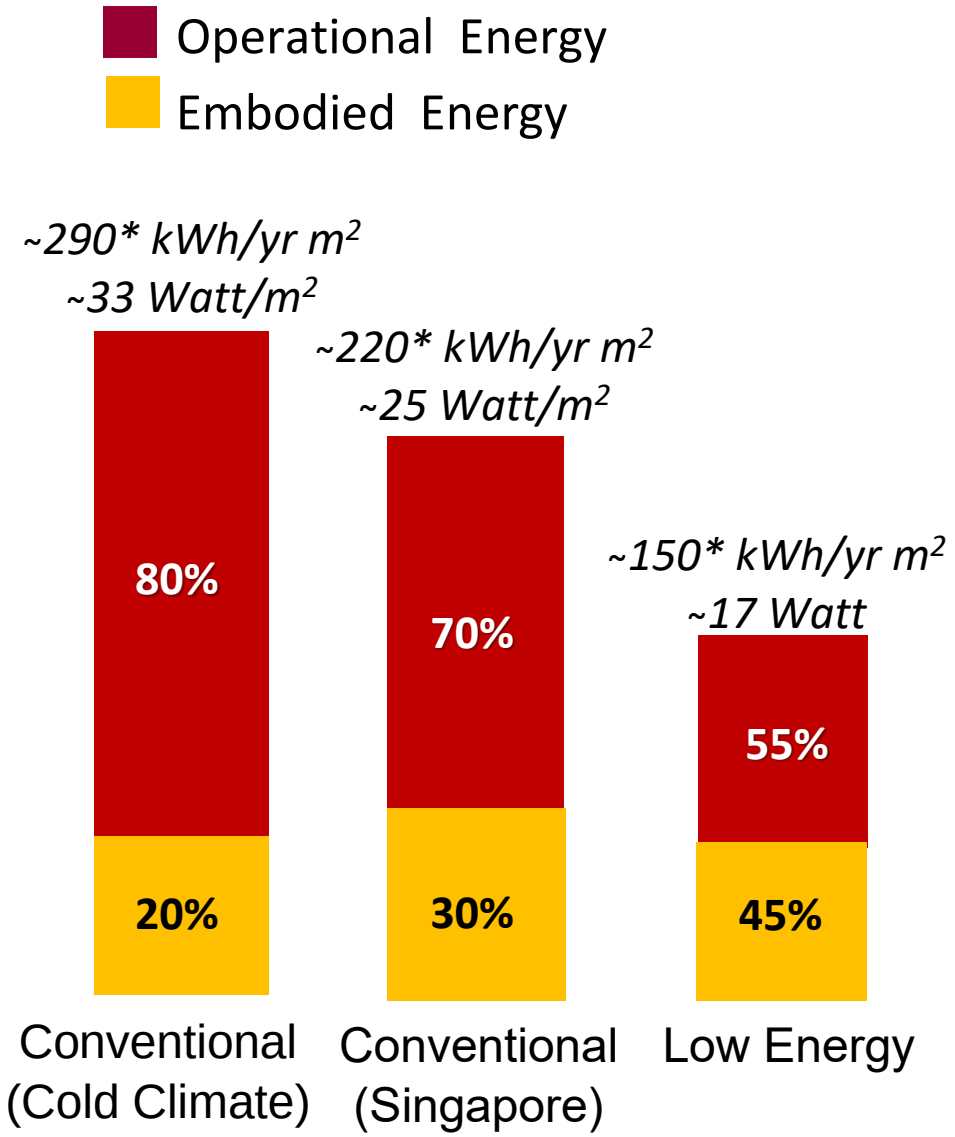
Adapted from *novatlantis*

Reaching the 2000 Watt Society



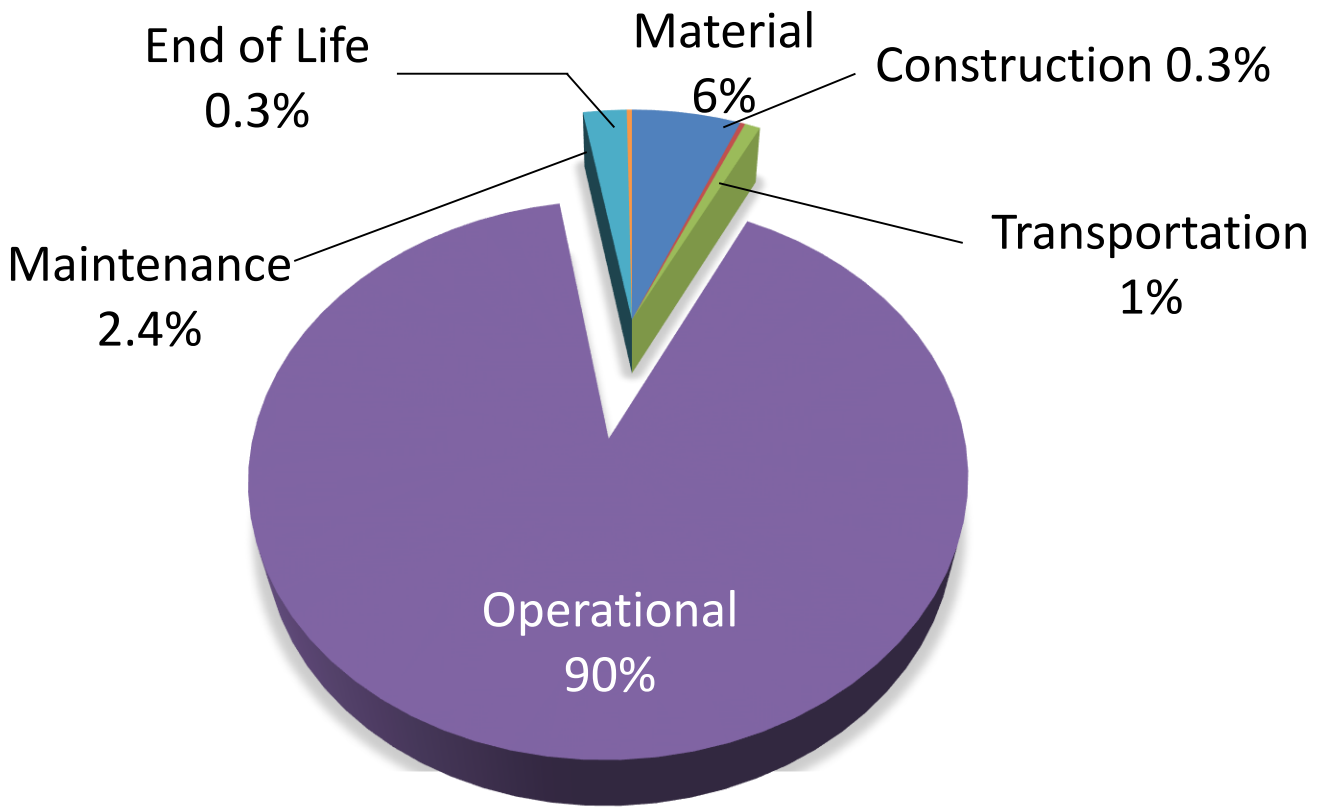
From: Stulz R & Sigg R, 2018

Buildings: operational and embodied energy



*Average with high variance

Case NTU

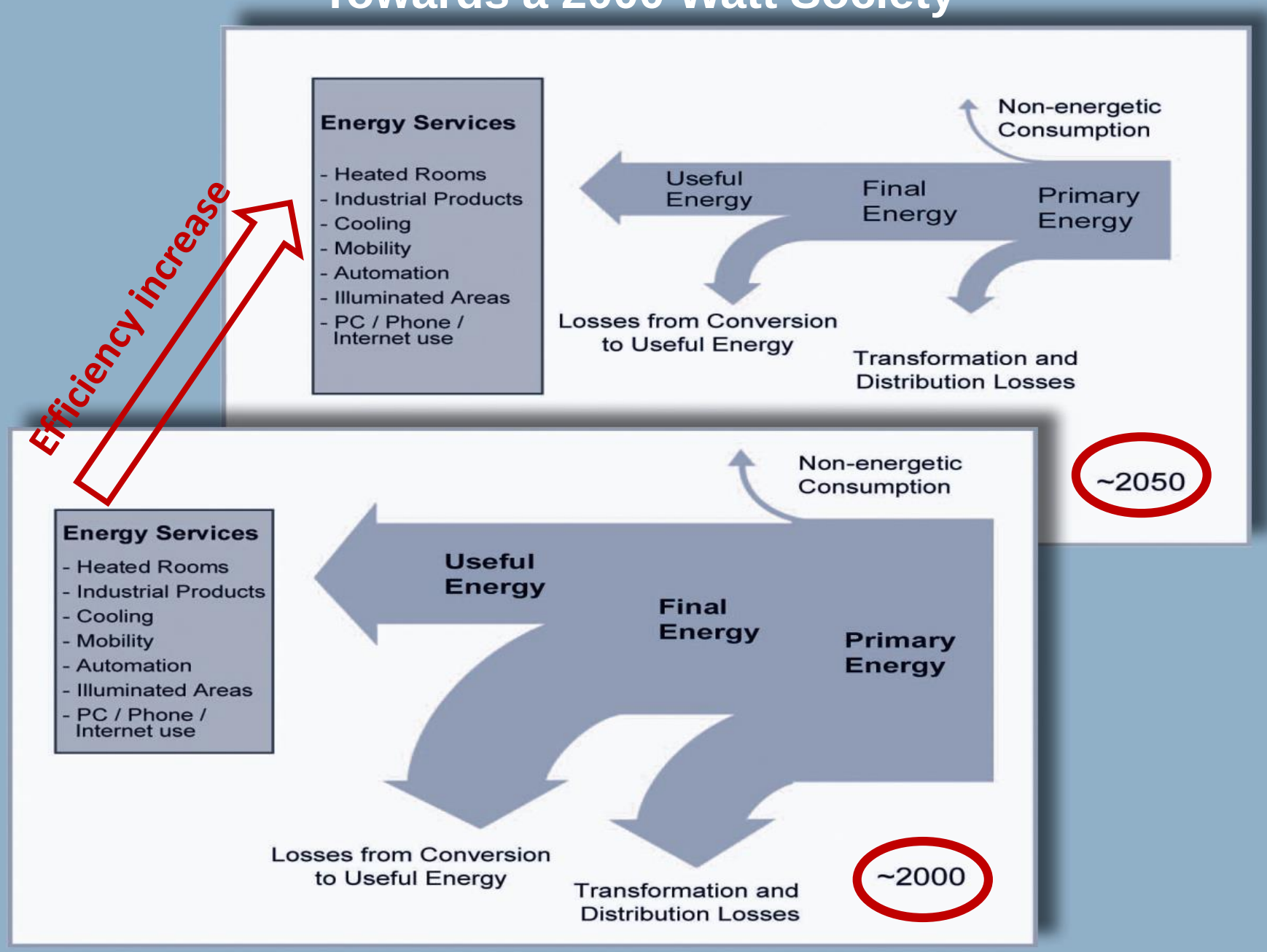


Based on a 40 year lifetime

- Average Life Cycle Energy: 12,210 kWh/ m²
- Average Operational Energy: 11,033 kWh/ m²
- Average Embodied Energy: 1177 kWh/ m²
- Included materials mainly concrete, steel, glass & s.o.

From: Chang C.C. *et al.* NTU 2019

Towards a 2000 Watt Society



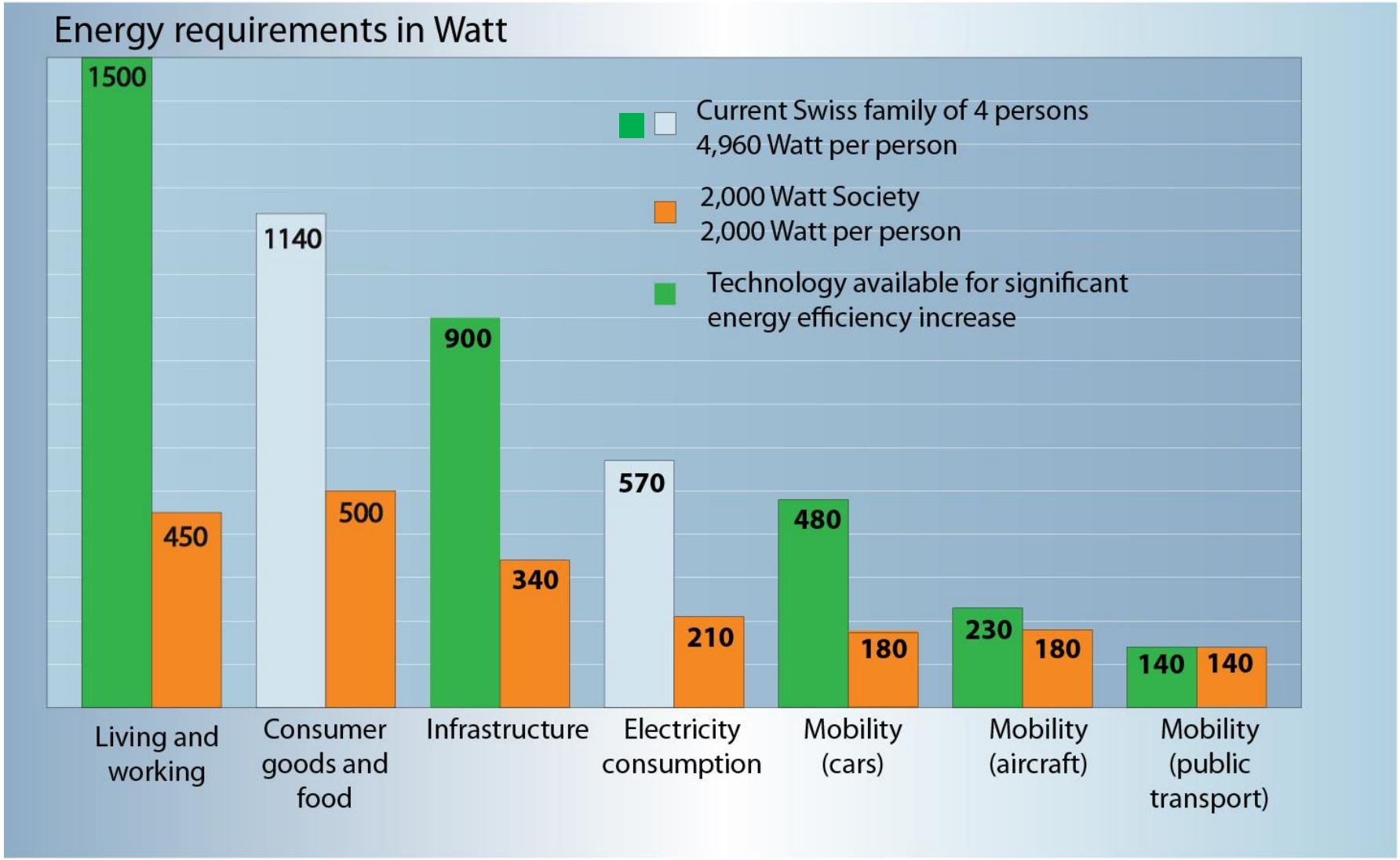
From: Novatlantis White Book (2004), E. Jochem, Ed.

Potential for energy efficiency improvement (based on existing technologies)

Area	Reduction potential (%)
Light	20
Motors	25
Glass & Bottles	30
Airplanes	45
Cars	50
Building heat	75
Buildings	80

From: Novatlantis White Book (2004), E. Jochem, Ed.

Low hanging fruits

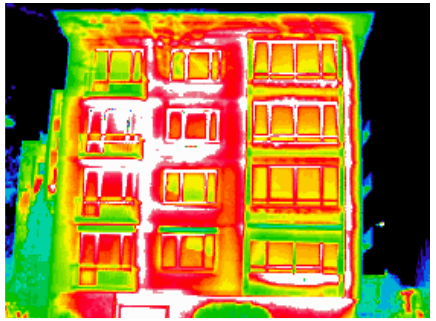


2000 Watt Society means among others...

22 miles per gallon (Gasoline, Diesel)

82 miles per gallon (gas, H_2)

Present buildings
10* litres heating/cooling oil equiv. per m^2/yr



3 litres heating/cooling oil equiv. per m^2/yr

1-way
350 kg/yr/person (waste)

Reuse Recycling
150 kg/yr/person (waste)

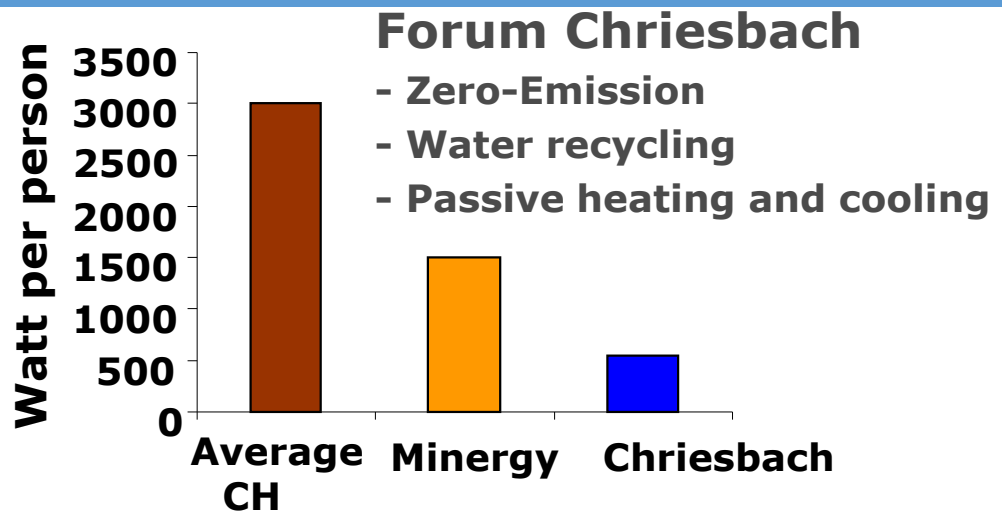
*10 l oil equiv./yr correspond to ~12W

Road obstacles and road blocks and

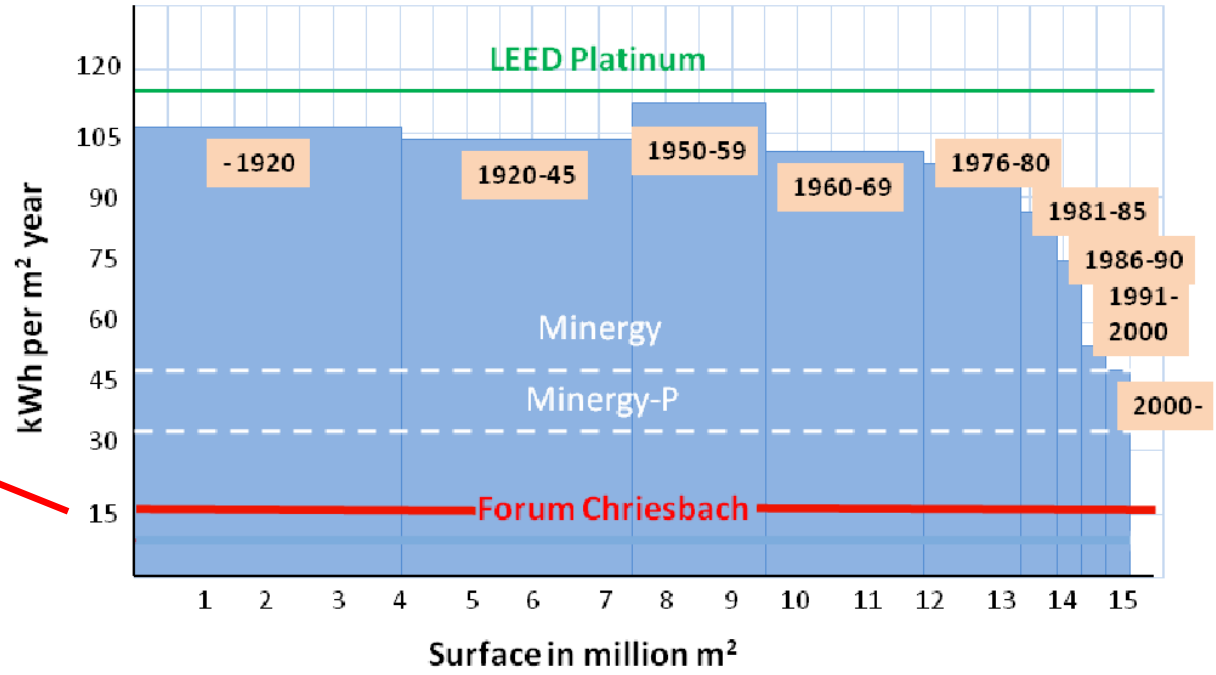
- Show me……
- Change aversion
- Aversion against new regulations
- Indifference
- Yes, but…
- etc.

- Opposition of the fossil and nuclear energy providers
- Fear of economic regression
- Worry about loss of freedom
- Political inertness
- Not understanding the concept, etc.

Show me….. building sector



≈ 1.8 W/m²



Adapted from www.forumchriesbach.eawag.ch

Overcoming political inertness

On November 30, 2008, the citizens of the city of Zurich adopted in a plebiscite with a 76 percent majority the concept of the 2000 Watt Society as guideline for the city's planning and future development.

The Zurich case

76% of the people on Zurich's electoral roll voted to:

- Commit to sustainable development
- Reduce its energy consumption to 2000 watts per person per year
- Reduce its annual CO_2 emissions to one-ton per person by 2050
- Promote renewable energy and energy efficiency
- Not renew its investments in nuclear power plants

So far, Zurich has achieved:

- Reduction of primary energy consumption by 1300 watts per person per year since 1990
- Currently 3900 watts per person
- Since 2015, if not chosen otherwise, electricity 100% renewable sources
- In the transport sector, the energy demand decreased by 13% since 1990
- Reduction of the annual greenhouse gas emissions by 1.5 tons per person since 1990
- Distinct reduction of energy consumption and greenhouse gas emissions in the building sector
- Since 1990, the share of renewable energy sources more than doubled from 11% to now 25%

Intep, 2018

What has been achieved?

Implementation: Switzerland

- Cities are the leaders, like Zurich, Basel, Geneva
- Guidelines on national level, incl. building codes

International

- Primarily cities in Austria, France and Germany
- EU: adapting some guidelines, e.g. net zero house standards, emission reduction in mobility, etc.
- North America: Green Building Council (LEED), BioHouse Minnesota zero net energy.

Universities

- International Sustainable Campus Network
- EcoCampuses in many Universities in the US and elsewhere

2000-Watt Gesellschaft

Site 2000 watts

2000 WATT Society

Implement the 2000 Watt Society in the area of mobility

2000 watt SOCIETY
One target. Our community. Stepping up now.

…Switzerland's regions active on four levels

➔ **Individual**

➔ 2000 Watts Lifestyle Stories

➔ **Single Buildings**

- SIA 2040 Guideline

➔ **Neigbourhoods**

- 2000 Watts Site Certificate

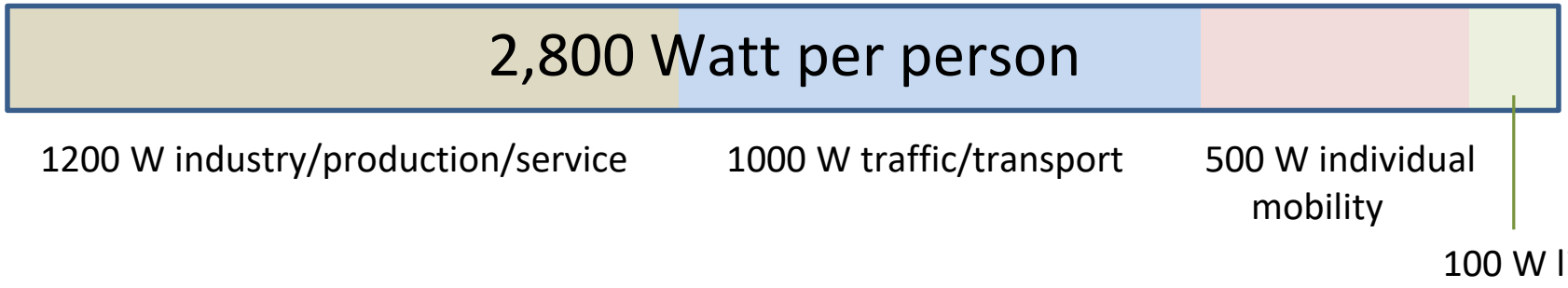
➔ **Towns**

- 2000 Watts EnergyCities

➔ **Cantons, Regions**

- 2000 Watts Regional Calculator

Projects realized “Richti Wallisellen”

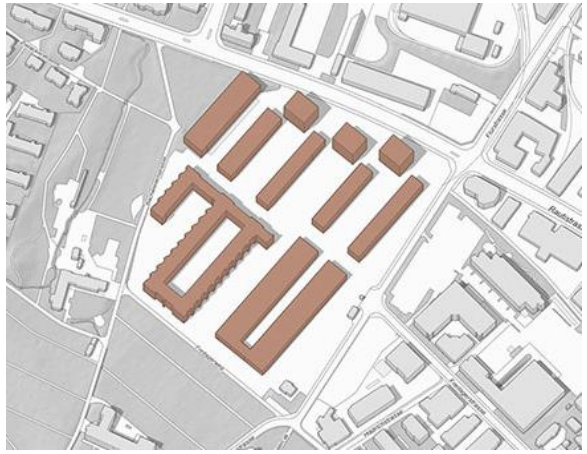


Richti Wallisellen 2000-Watt, large commercial development, total, approx. 1,200 people living, 3,000 workplaces, 12,700 m^2 sales floor

…..other realisations, some examples

The Hunziker Site Zurich
Inhabitants 1200.
Workplaces 150.
Surface per capita 34m^2

Stulz, 2018



Freilager Zurich
Inhabitants 2000
Workplaces 200

Freilager Zürich, 2017

Erlenmatt Basel
Inhabitants 1400
Workplaces ca. 120
Surface per capita 73 m^2

Statistisches Amt Basel, 2016

Projects around the globe

Australian Capital Territory **Canberra** took the leadership to construct a leading-edge efficient and sustainable building-block in Australia. Based on the 2000-Watt Society the capital plans creating a new landmark neighbourhood for more than 5000 inhabitants plus workplaces. This in a joint venture with the City of Zurich and Swiss specialists.

The **City of Vancouver**, in collaboration with the University of British Columbia and the Provincial Government, used the 2000-Watt Society target to establish a clear energy-framework for the city's mid- and high-rise housing projects. For that it established its own energy code for buildings.

On the pathway to becoming a 2000-Watt Society, **Munich** has established goals for 2050 similar to Zurich.

Intep, 2018

Different stages of building and planning

Paris-Saclay building stage: 430,000 inhabitants; 265,000 jobs; 65,000 students & 15,000 researchers

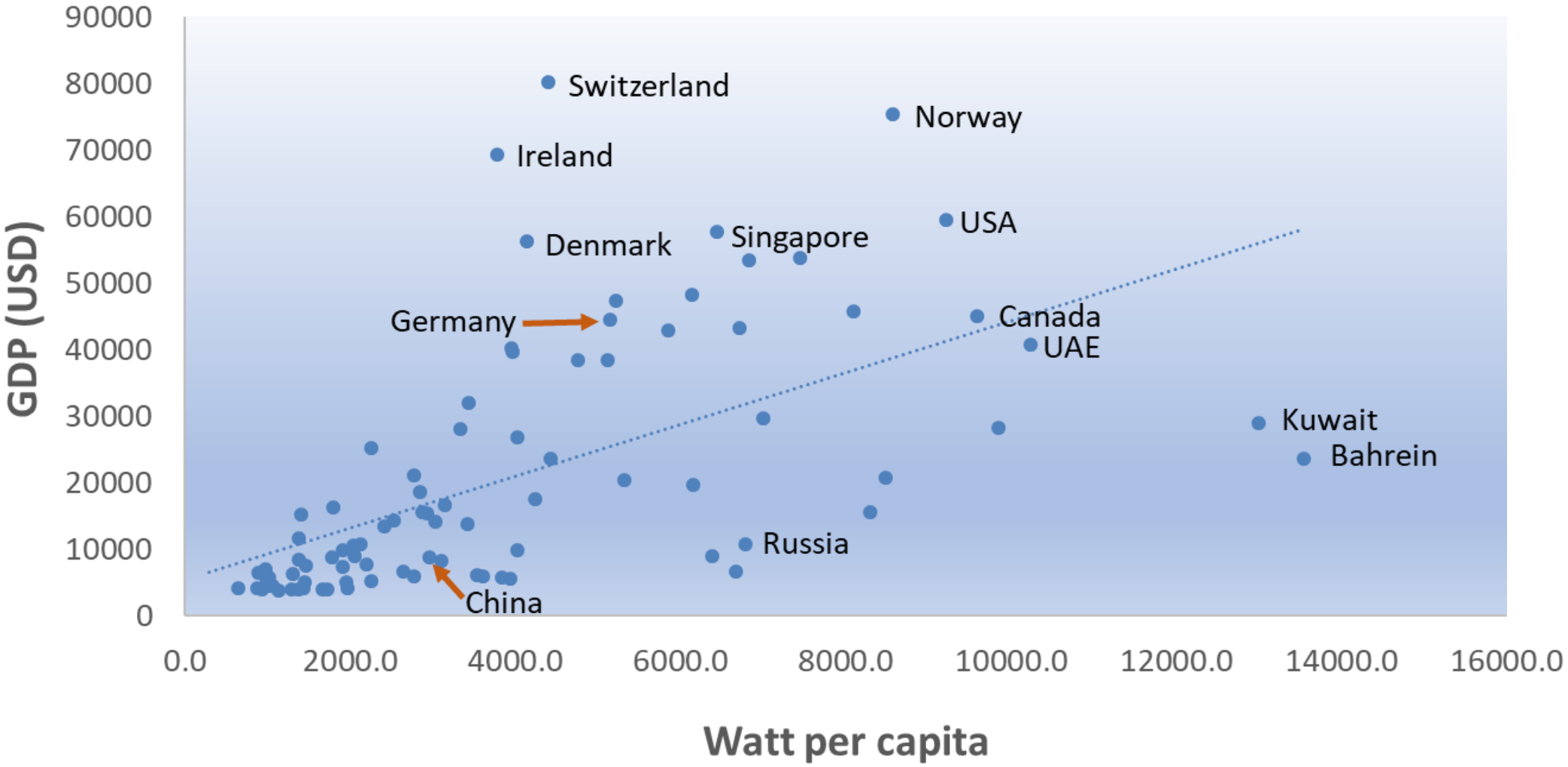
Minneapolis is planning to achieve as First in the USA the goals of the 2000-Watt Society.

PARIS
Ville candidate
Jeux Olympiques de 2024

For the **Olympics in Paris 2024** it is planned to follow closely the experiences of other 2000 Watt sites.

Various sources, 2019

Energy use, wealth creation & innovation



GDP (PPP) 2017: World Bank

Energy data (2018): World Development Indicators *data.worldbank.org*

….and NTU?

Achievements triggered through EcoCampus initiative:

- 5MWp Rooftop Solar PV Implementation (meets 5% of campus energy needs)
- Reducing energy per m^2 by 35%, compared to 2011
- Over 95% of the buildings are green mark platinum
- Awards in 2019: seven Zero Energy Buildings (ZEB), one Super Energy Building (SLEB)

Vision:

- 10MWp PV
- To reach 500 Watt per person, actually ≈ 750 Watt
- Net zero emission, zero water & waste campus
- Iconic, most sustainable building, transportation, and resource use Campus *Future*

….message for the future?

"I like the energy target clarity in the 2000 Watt society too – I agree strongly we always encourage our client to set a measurable target for their buildings".

Richard Kirk, architect of THE ARCH, March 2018

S3

6th Singapore Sustainability Symposium

Grand Hyatt Singapore
8 - 10 May 2019

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