MINISTRY OF FOREIGN AFFAIRS
OF DENMARK

2020 DISTRICT HEATING IN THE PRC: DEVELOPMENT AND STATUS

EMRAH ÖZTUNC – SECTOR COUNSELLOR ENERGY

ROYAL DANISH EMBASSY IN BEIJING

June 24th, 2020

WHY DISTRICT HEATING AND HEAT TRANSMISSION IS GOOD?

1. ENSURE OPTIMAL USE OF SURPLUS HEAT FROM POWER PLANTS FOR CITIES
2. FIGHTS POLLUTION FROM INDIVIDUAL HEAT SOURCES INSIDE THE CITIES
3. CREATE MORE JOBS (POWER PLANT CONSTRUCTION, OPERATION AND MAINTENANCE)
4. ENERGY CAN BE STORED FOR LATER USE

WHAT IS DISTRICT HEATING?

Do not regard district heating as fuel!

It is a system that can collect surplus heat and renewable energy and combine it with other energy systems!

DISTRICT HEATING VS. INDIVIDUAL HEATING

District Heating

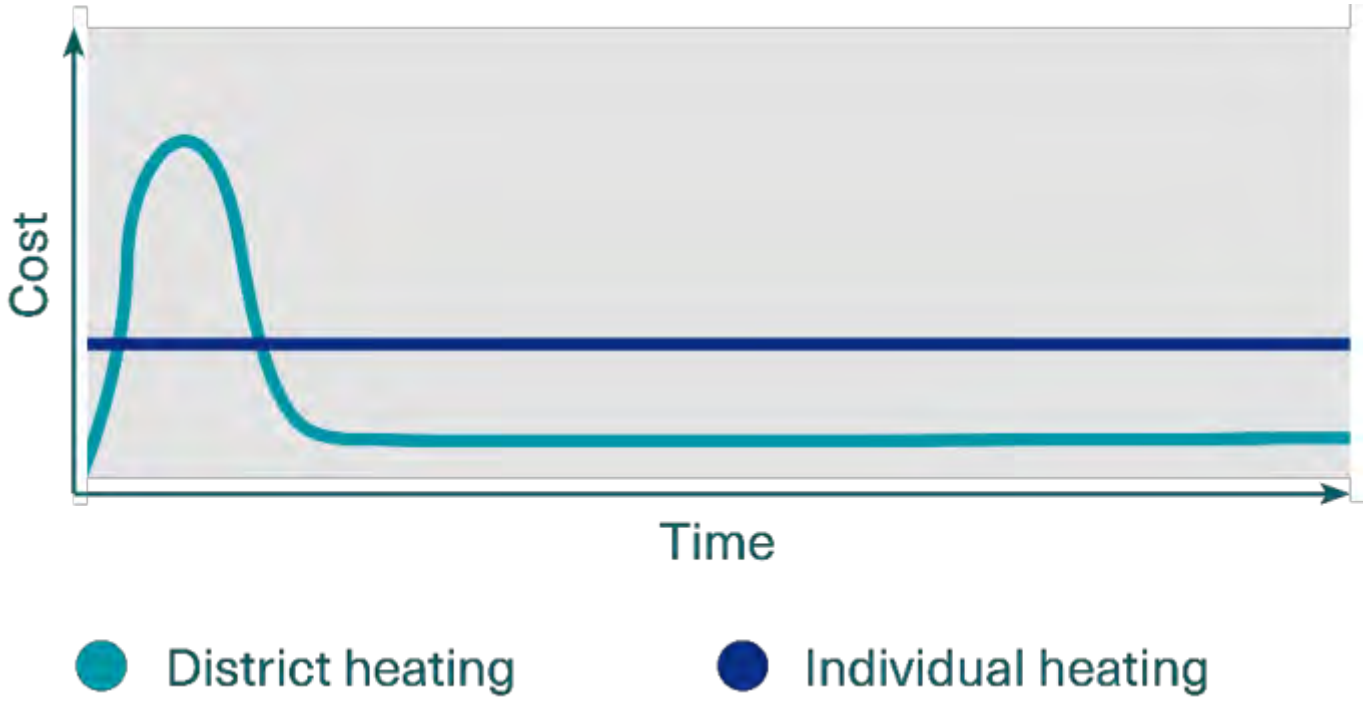
- Cheap (on long-term) ☺
- High security of supply ☺
- Green transition without interfering with homeowners ☺
- Adds flexibility to power generation ☺
- All sorts of heat sources can be used ☺

Individual Heating

- Minimal governmental intervention ☹
- Cost efficient in some areas 😐
- Hard to convert fuel ☹
- Burdens the rest of the energy system! ☹

DISTRICT HEATING VS. INDIVIDUAL HEATING

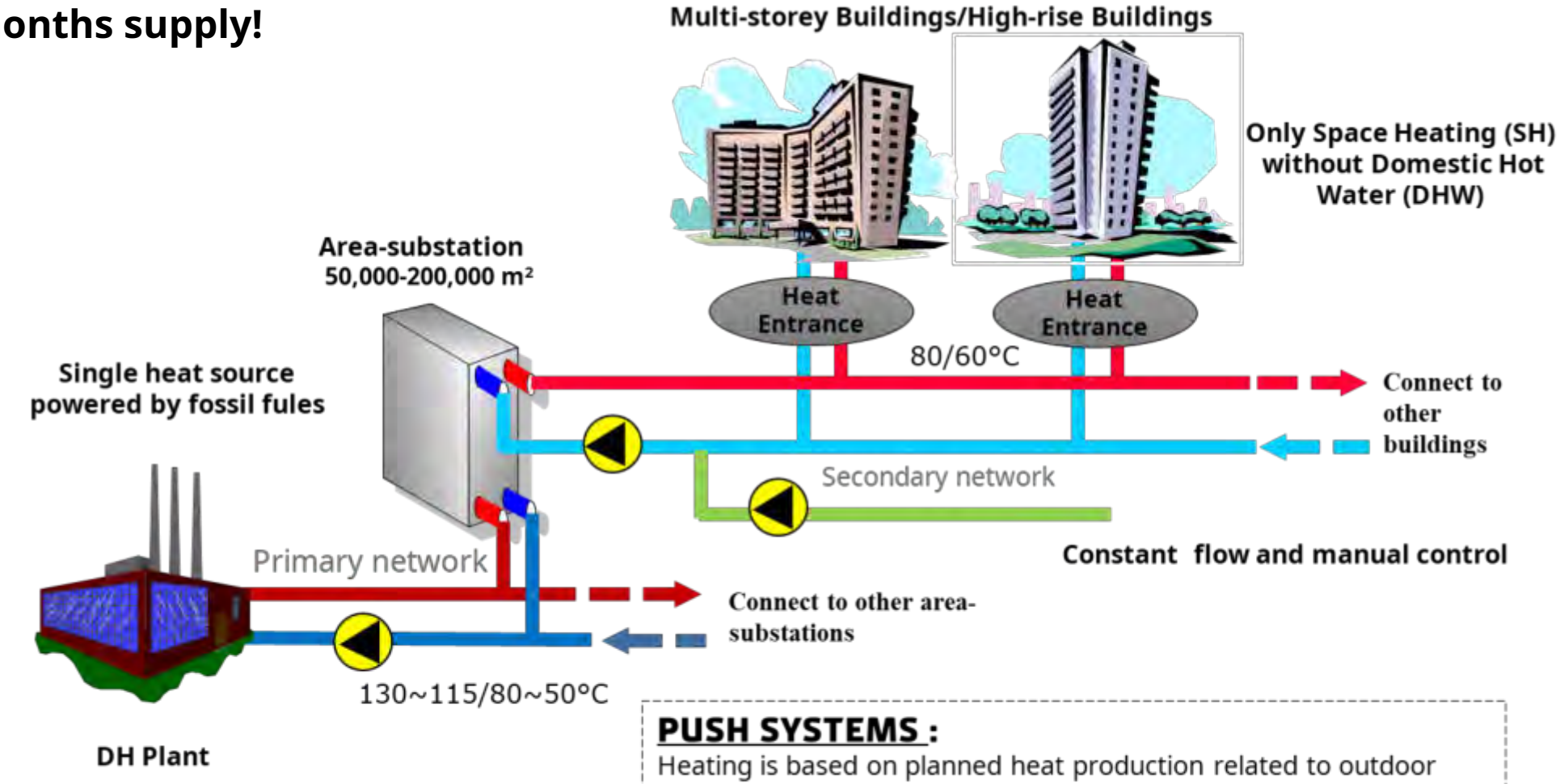
- **Short term**, District Heating is a large investment!
- **Over time**, District Heating investments better pays off!



*Danish Energy Agency

TYPICAL DISTRICT HEATING SYSTEMS IN THE PRC

4-6 months supply!



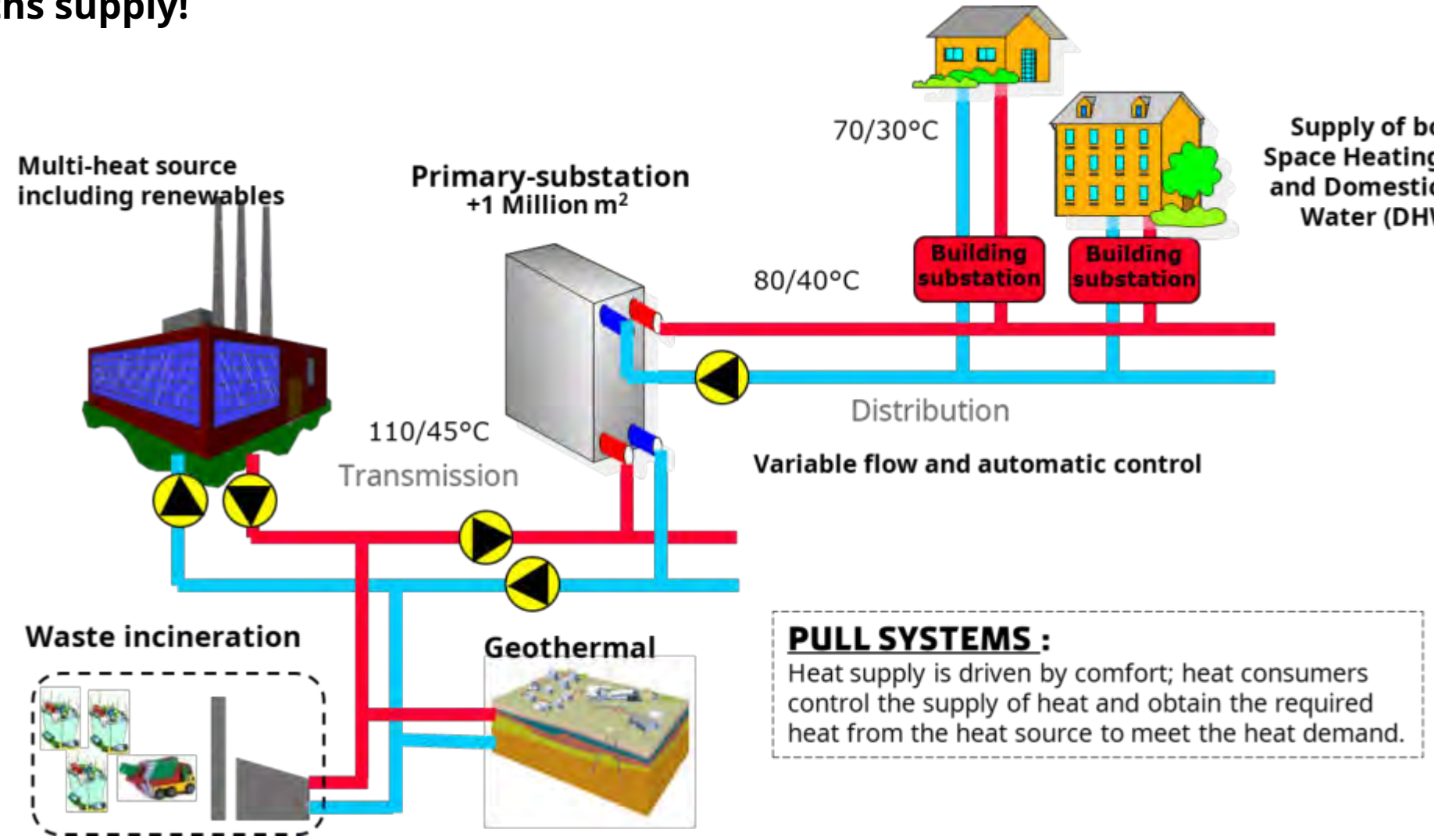
PUSH SYSTEMS :

Heating is based on planned heat production related to outdoor temperature and the end-user has limited or no control over the heat supply. The purpose is to ensure that the room temperature reaches the standard temperature of 18-20°C.

Source: Dr. Lipeng Zhang, DTU/Danfoss

TYPICAL DISTRICT HEATING SYSTEMS IN DENMARK

12 months supply!



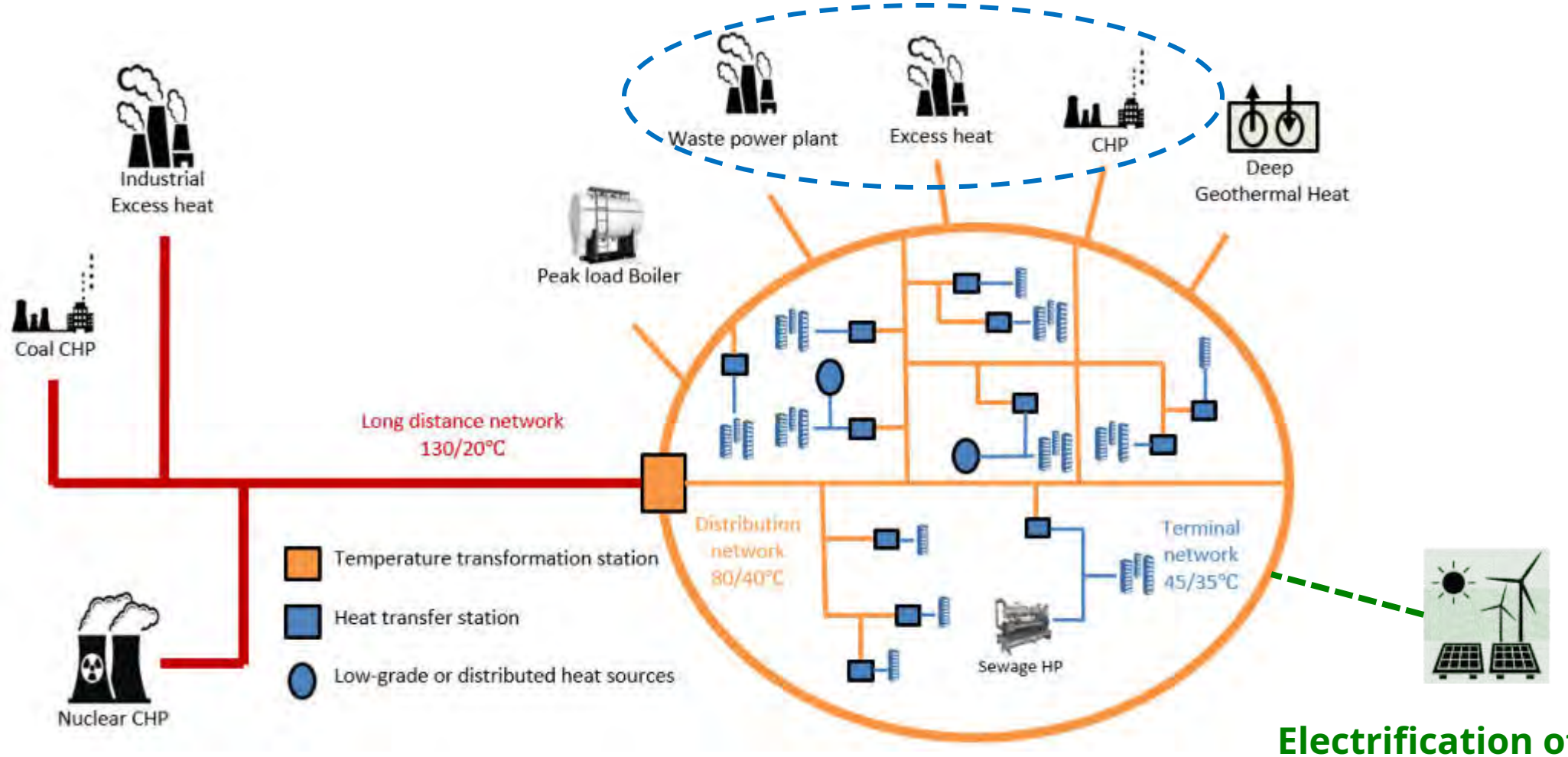
PULL SYSTEMS :
Heat supply is driven by comfort; heat consumers control the supply of heat and obtain the required heat from the heat source to meet the heat demand.

Source: Dr. Lipeng Zhang, DTU/Danfoss

COMPARISON DISTRICT HEATING – THE PRC AND DENMARK

Parameter	The PRC	Denmark
Heating Season Length	4-6 Months	12 months
Domestic hot water in supply	No	Yes
Billing systems	Floor area based (m^2) - Not metered!	Consumption based (kWh or GJ)
Supply Temperatures	Very High – High	Low – Ultra Low
Utilization of Surplus heating from power plants?	Irregular / Lacking	Fully integrated CHP
Biomass use in the heating systems? (e.g. agriculture)	Minor degree	Widely used
Waste-to-Energy – helps cities handling waste	Minor degree	Over capacity
Requires lost of investment for new utilities and refurbishment projects	SOE's lack funding / rely on external or gov.	DH Companies self invest / own economy

HOW TO INTEGRATE MULTI-SOURCES INTO THE NETWORK?

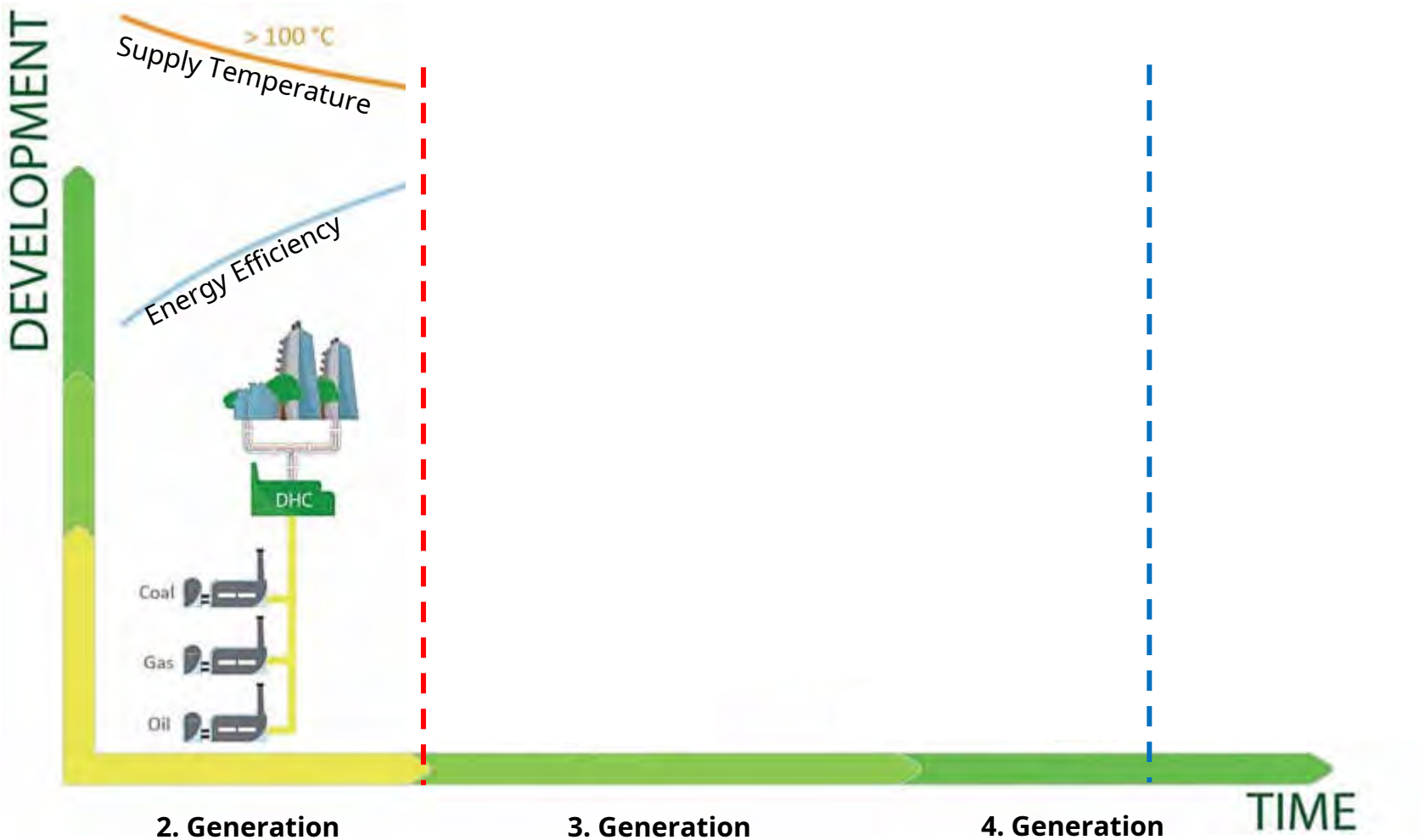


Electrification of DH is the future!

Long distance transmission pipes are very expensive! (Careful planning is crucial)

Building smaller "decentralized" plants closer to cities based on green fuels! (DK model)

WHICH GENERATION OF DISTRICT ENERGY ARE WE IN?



2. Generation
(1930-1980)

3. Generation
(1980-2010)

4. Generation
(2010-2050)

Source: Euroheat & Power

The PRC

Denmark

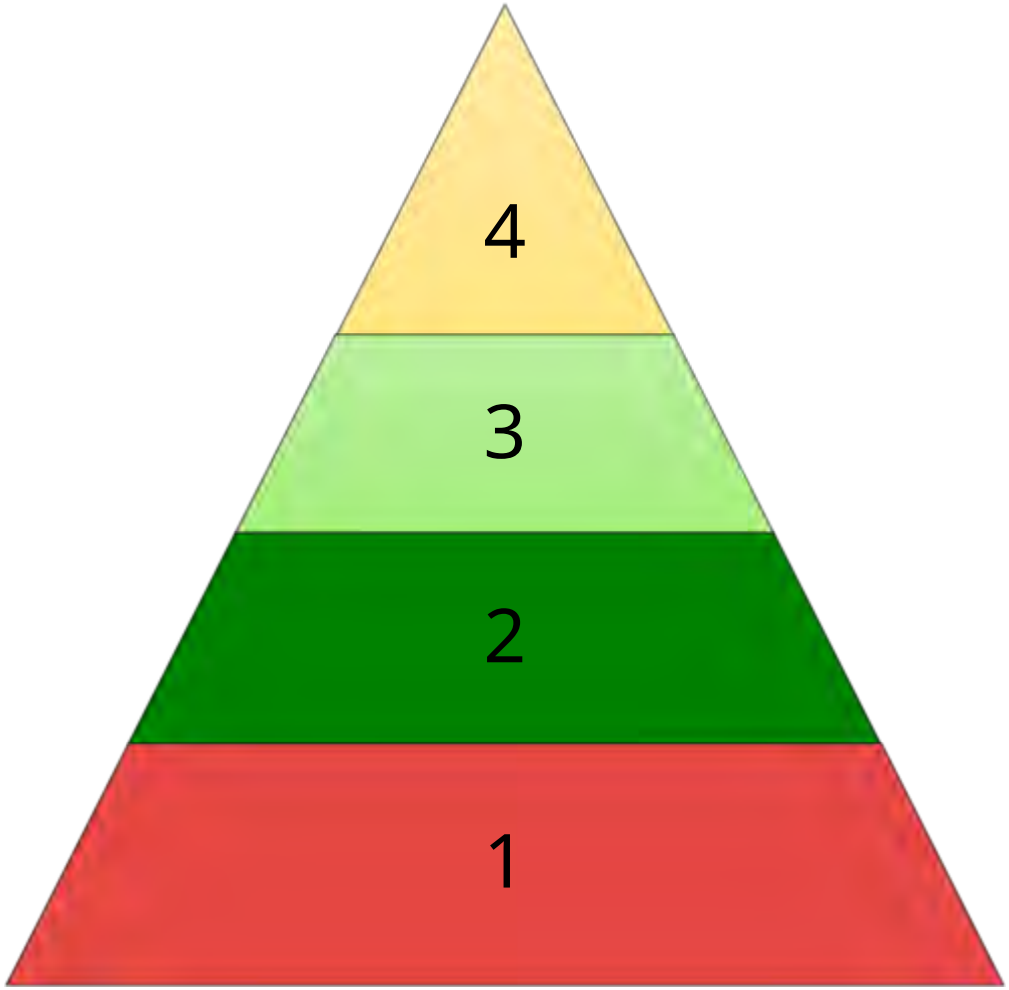
PRIORITIES IN GOOD DISTRICT HEATING MANAGEMENT!

4. Optimizations in consumer installations

3. Optimization in the heat supply and pipes

2. System reliability – constant heat supply

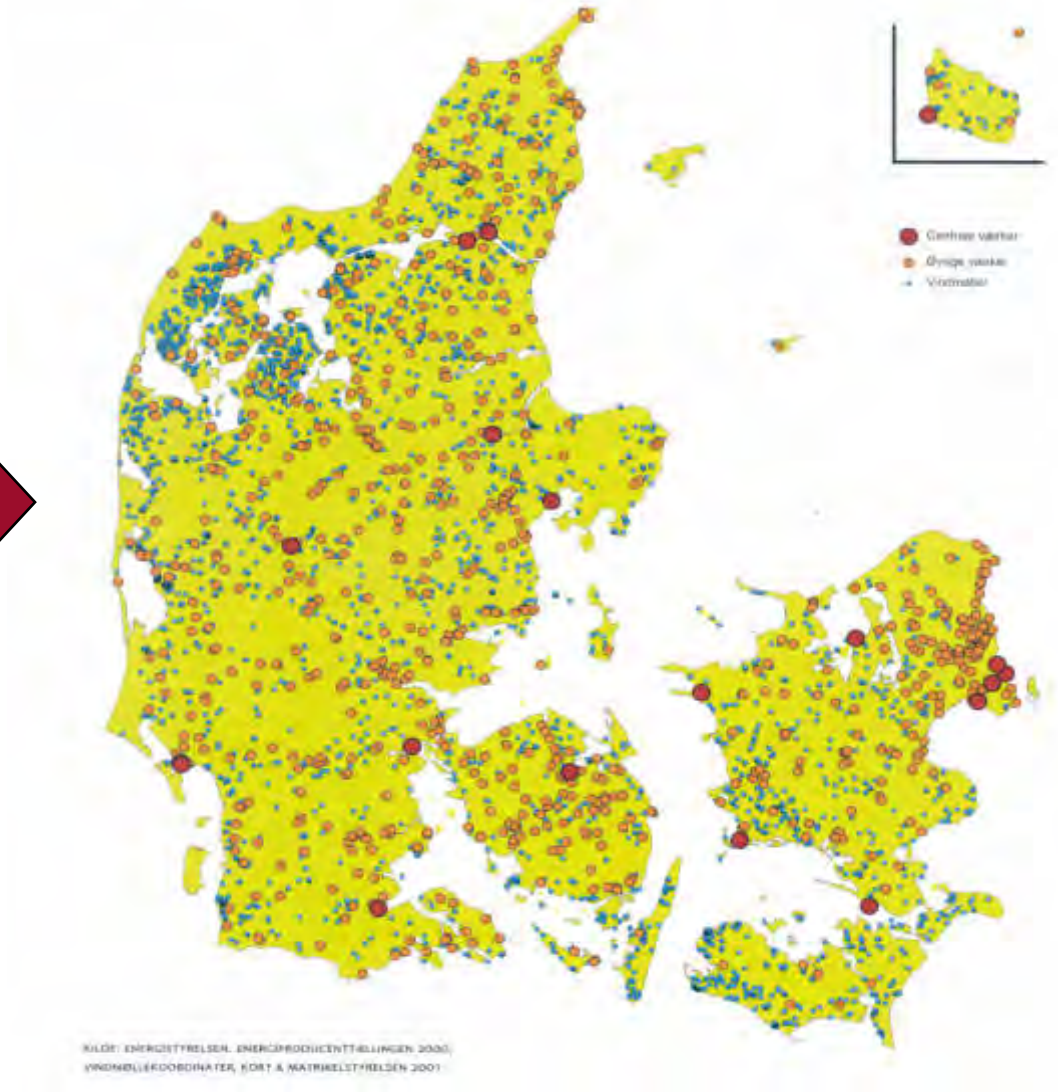
1. Supply security and renovation efforts



POWER PLANTS IN DENMARK

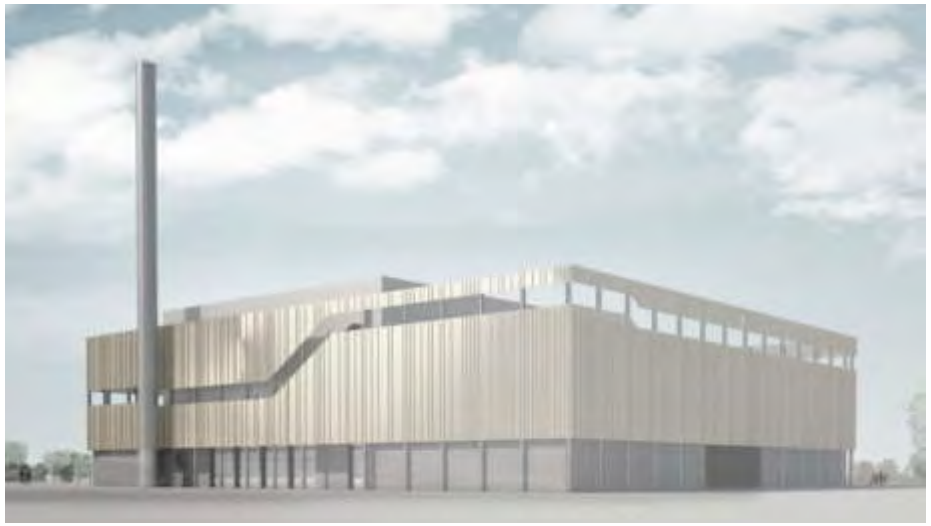
Centralized Plants in 1980s

Decentralized Plants in Denmark in 2005



BRØNDERSLEV "GREEN" DISTRICT HEATING

- Wood chip-fueled CHP plant and sun-fueled CSP plant
- This CHP plant is renewable source of energy and heat (Sun and wood chip boilers)
- High technological Centralised Solar Power (CSP), two top notch 10MW tile boilers and an oil steam-driven electric generator "Organic Rankine Cycle" (ORC) and three big heat pumps.
- reduces the overall environmental impact and the price of heat for the consumers
- High Energy conversion efficiency



*Brønderslev Forsyning

BIOMASS POTENTIAL IN THE PRC

The market potential is extraordinary…

…And the unused resources are abundant

- 600-800 Million Metric ton crop residue biomass pr. Year.
- 1/4 of crop residue is burned in the field after harvest is wasted.

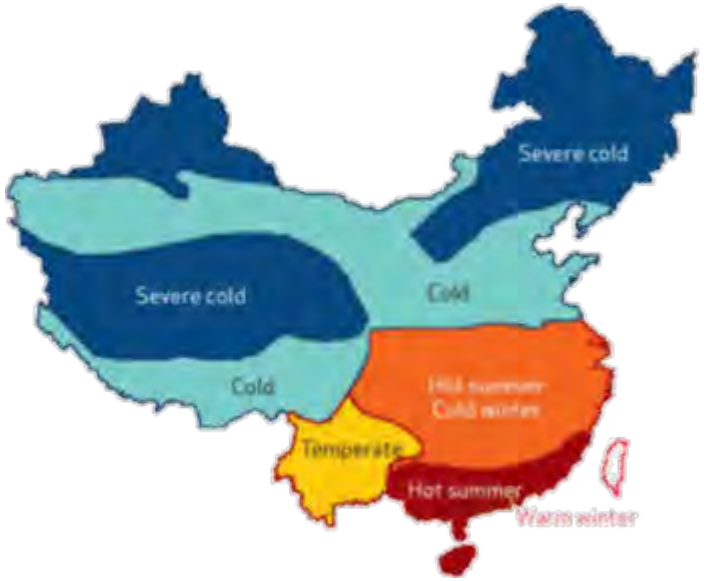
Sources: Wang, Ouyang & Hao (2015), J, Chen (2019)

RURAL AREAS IN THE PRC

Yangshuo/Guiling – Guangxi Province

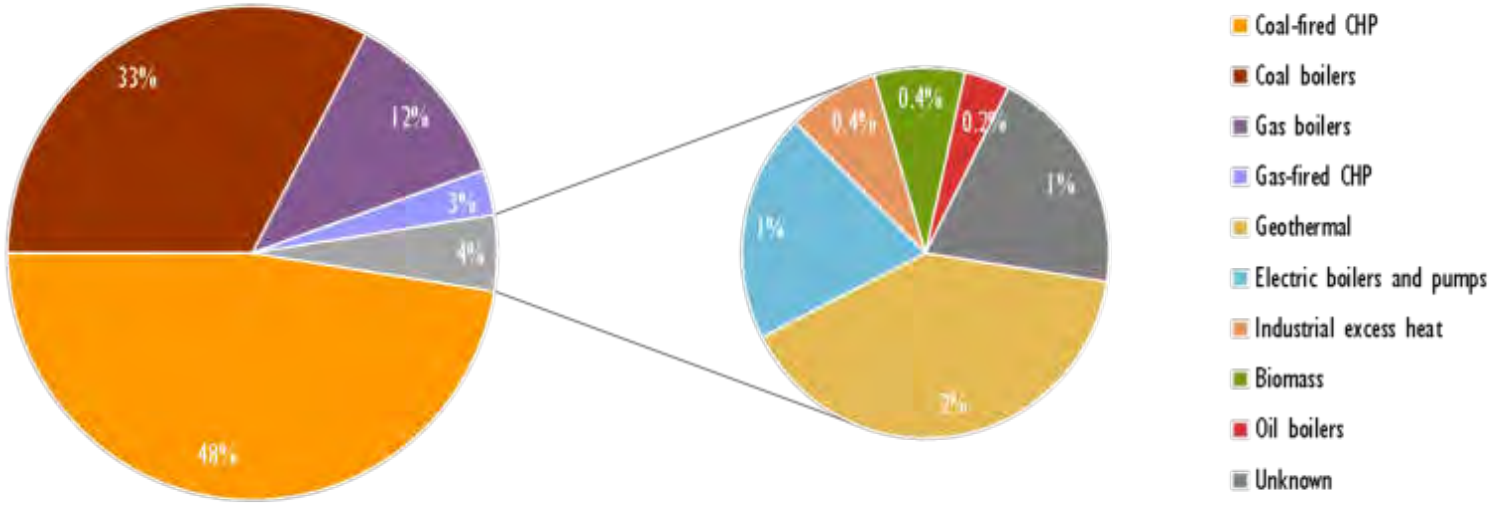
RURAL AREAS IN THE PRC

DISTRICT ENERGY – HEAT DEMAND OVERVIEW IN THE PRC



- Severe cold 150-200days
- Cold 90-150days
- Hot summer, cold winter Individual heating
- Hot summer No district heating
- Temperate No district heating

District Energy in the PRC Relies Heavily on Fossil Fuels!

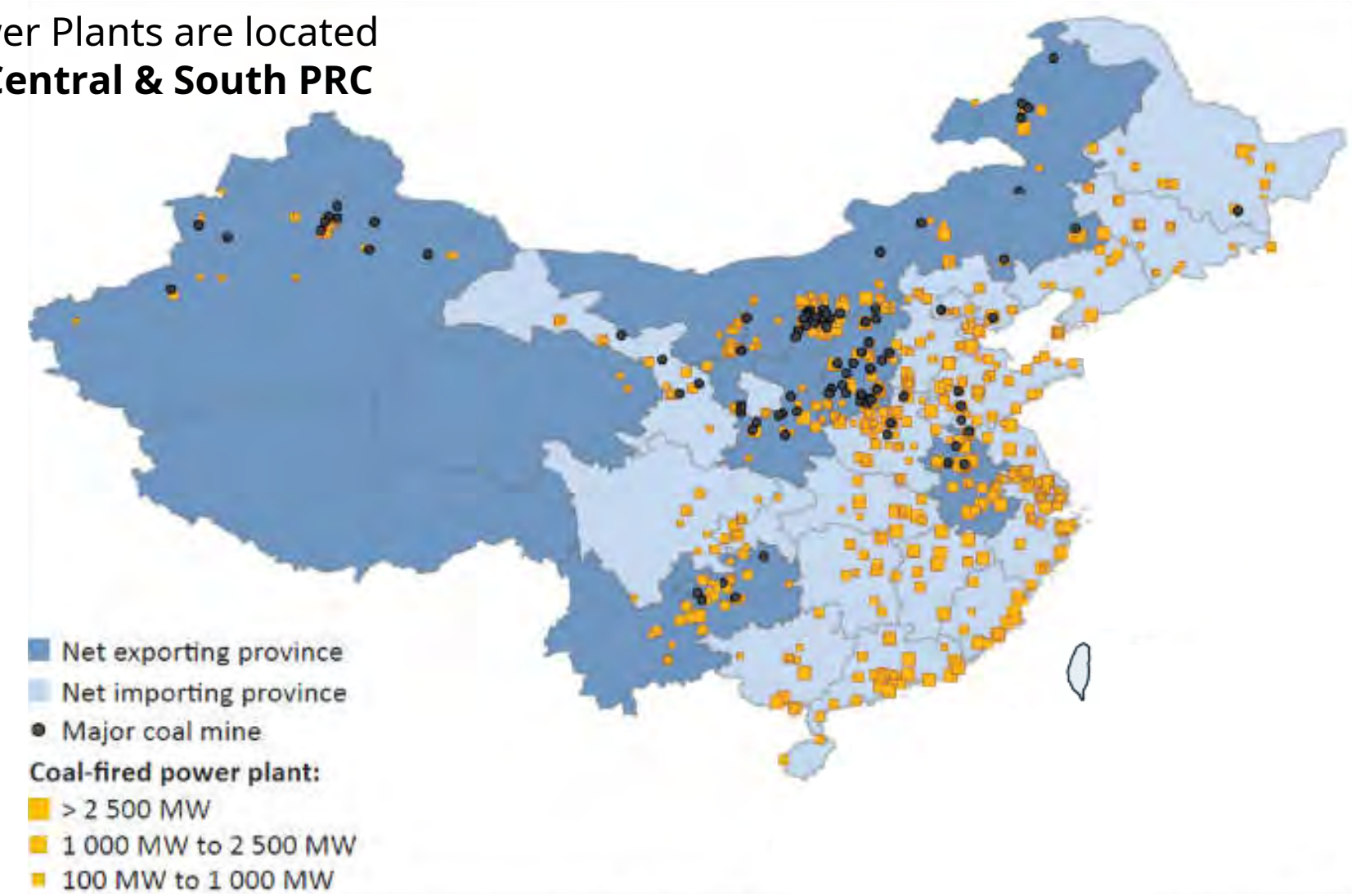


*BERC - Report on the clean heating source in northern PRC (2019)


家超市
家超市
平电二期、三期、四期
平电一期#1门

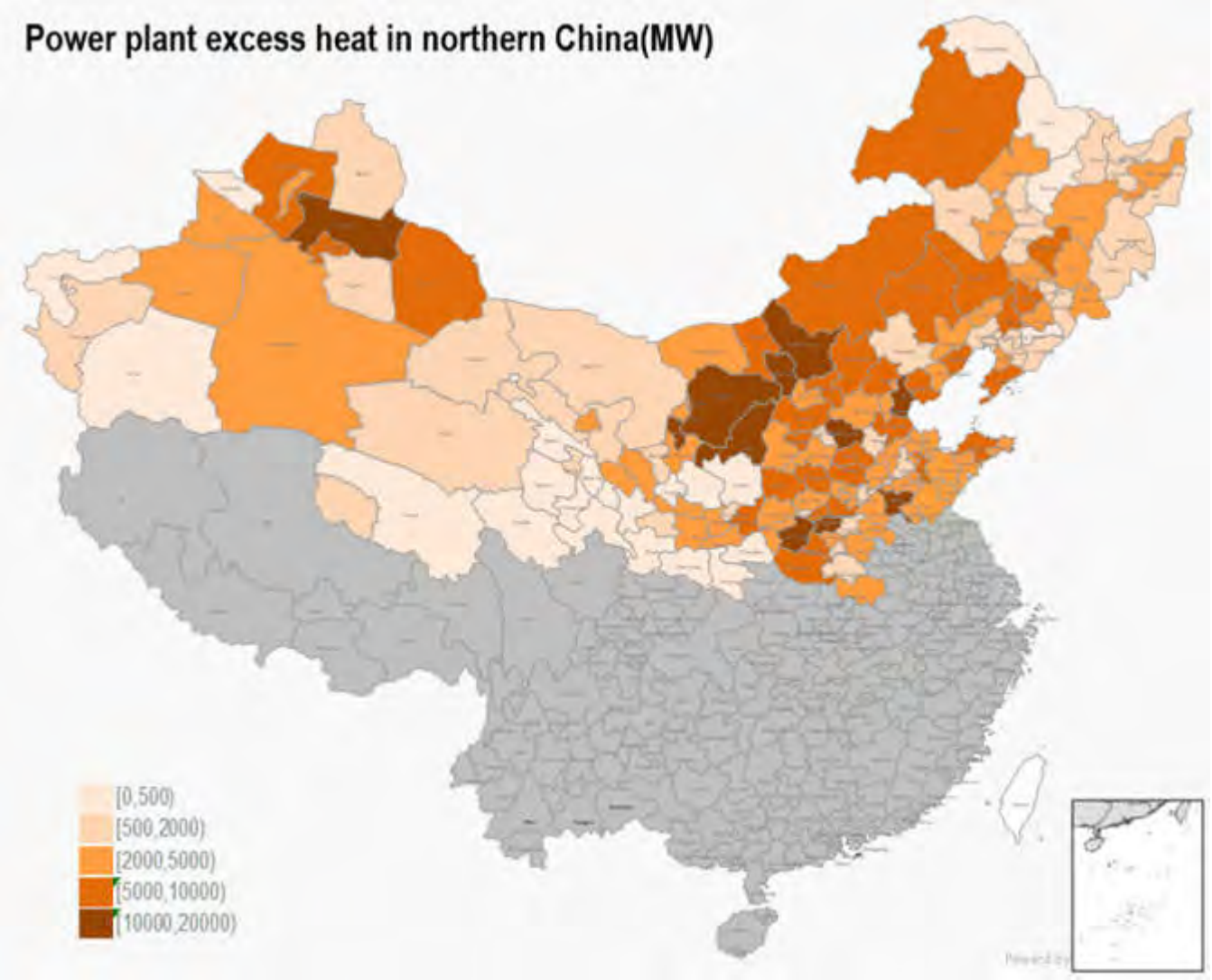
COAL FIRED POWER PLANTS IN THE PRC

Most Coal Power Plants are located around **East, Central & South PRC**



Sources: IEA analysis and Wood Mackenzie Databases

SURPLUS HEAT POTENTIAL IN THE PRC?

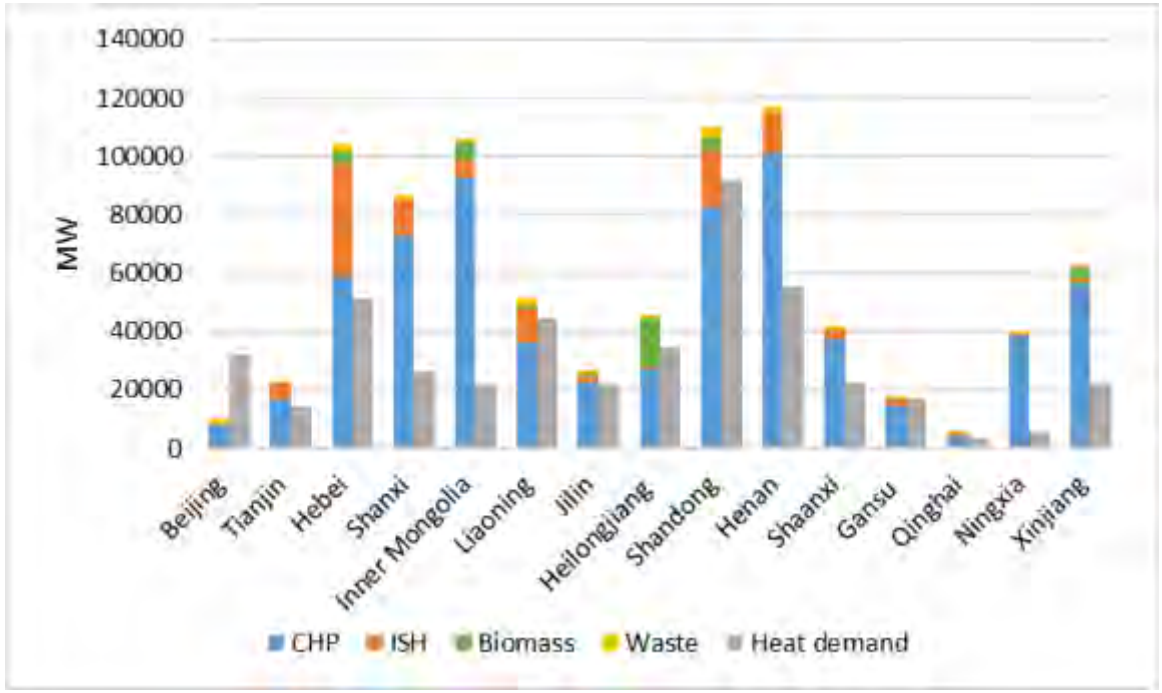


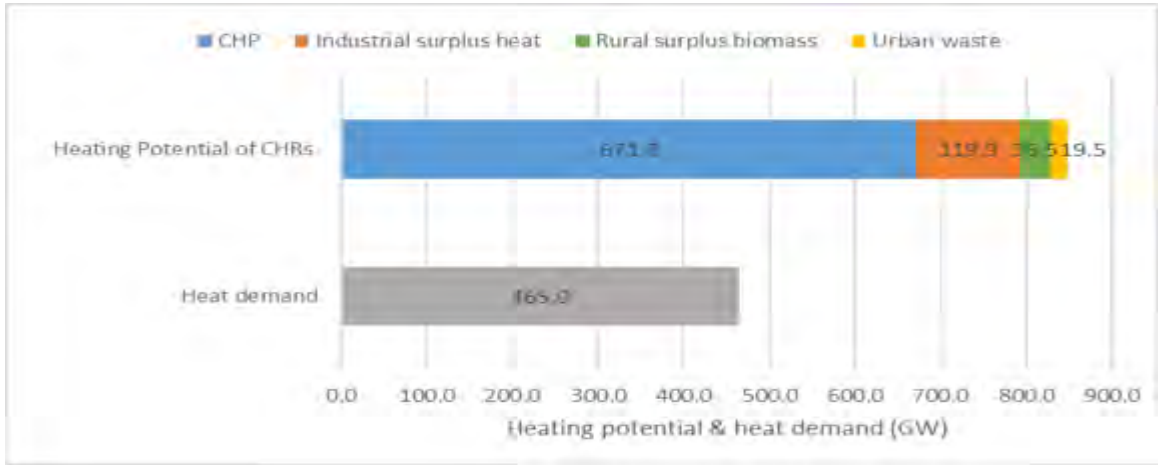
Power plant excess heat (MW)	The number of prefecture-level cities
0~500	24
500~2000	37
2000~5000	55
5000~10000	31
> 10000	11

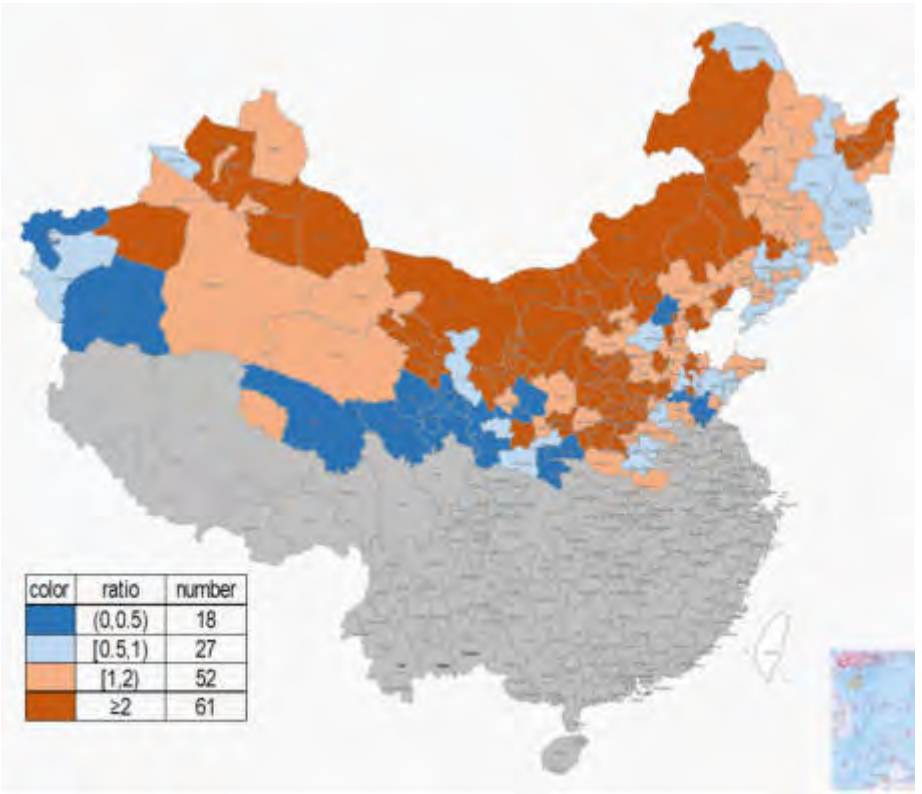
*BERC - Report on the clean heating source in northern China (2019)

CLEAN HEATING POTENTIAL IN NORTH PRC?

*ISH = Industrial Surplus Heating
*CHR = Clean Heating Resource







There is enough surplus heat in North PRC to cover all heat demand!

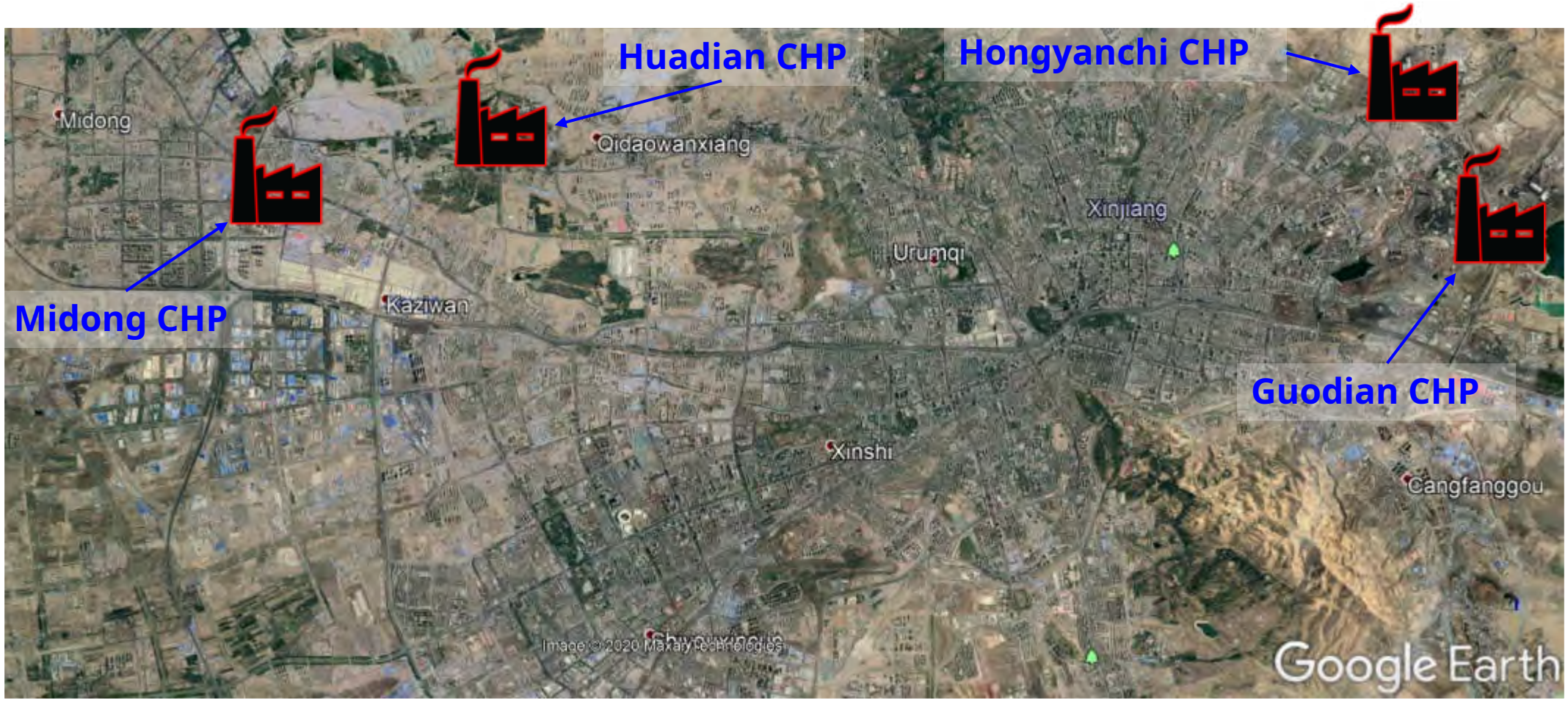
In fact 182.3 % available heat (847.7 GW), meaning 82.3 % capacity to cover future demands!

(But transporting (transmission) heat for long distances is expensive and inefficient)

*BERC - Report on the clean heating source in northern China (2019)

PROJECT EXAMPLE FROM URUMQI, XINJIANG

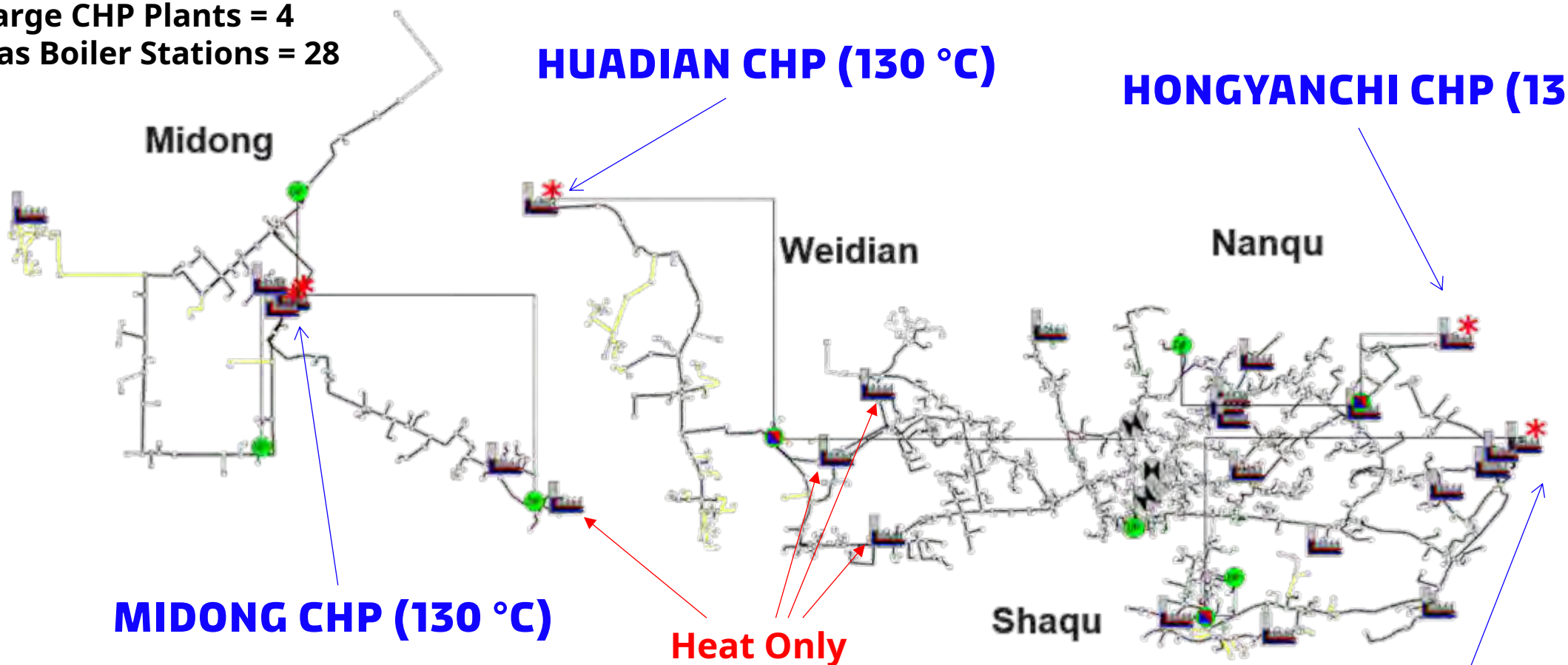
URUMQI – XINJIANG



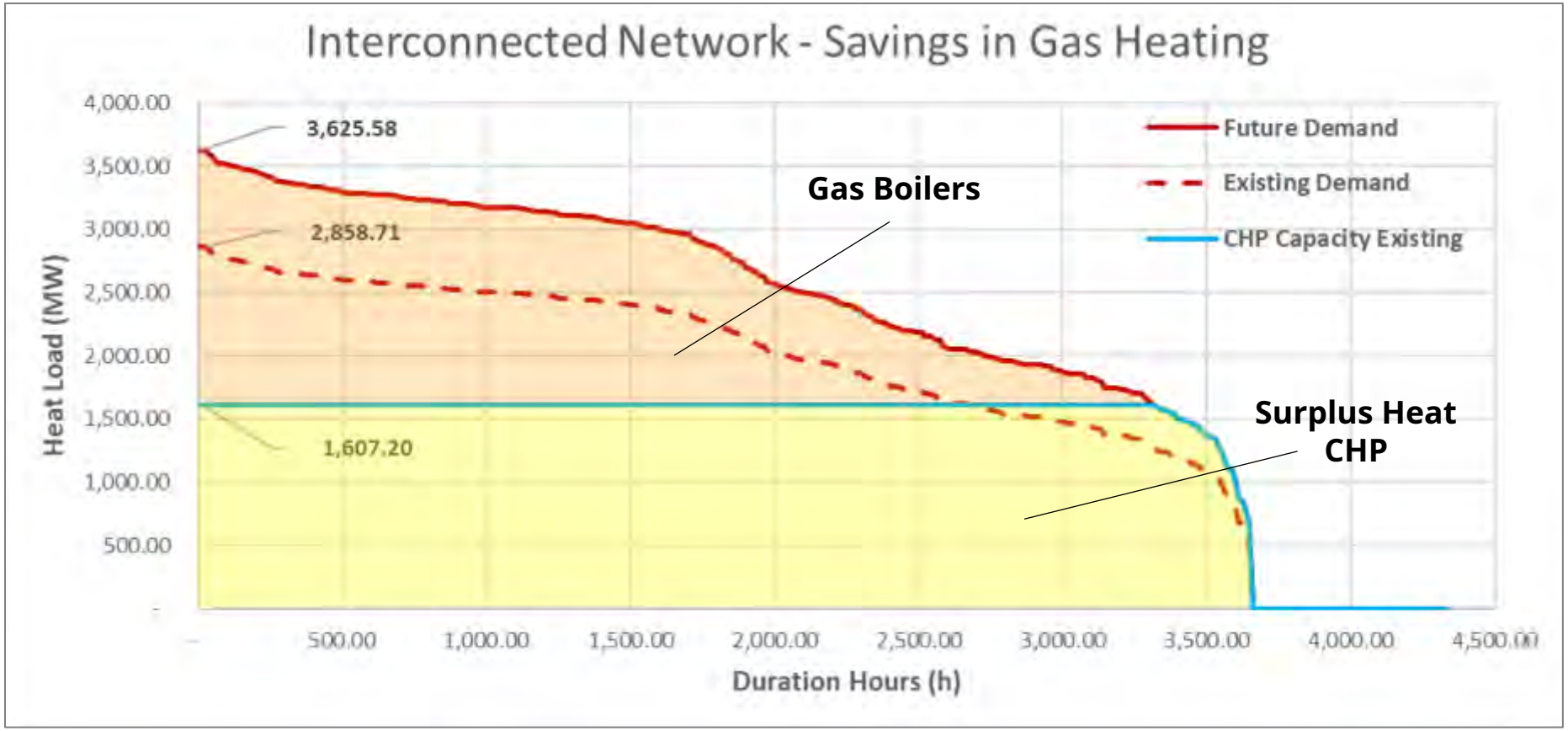
Population: 3,575,000 inhabitants

DISTRICT HEATING SYSTEM IN URUMQI – XINJIANG

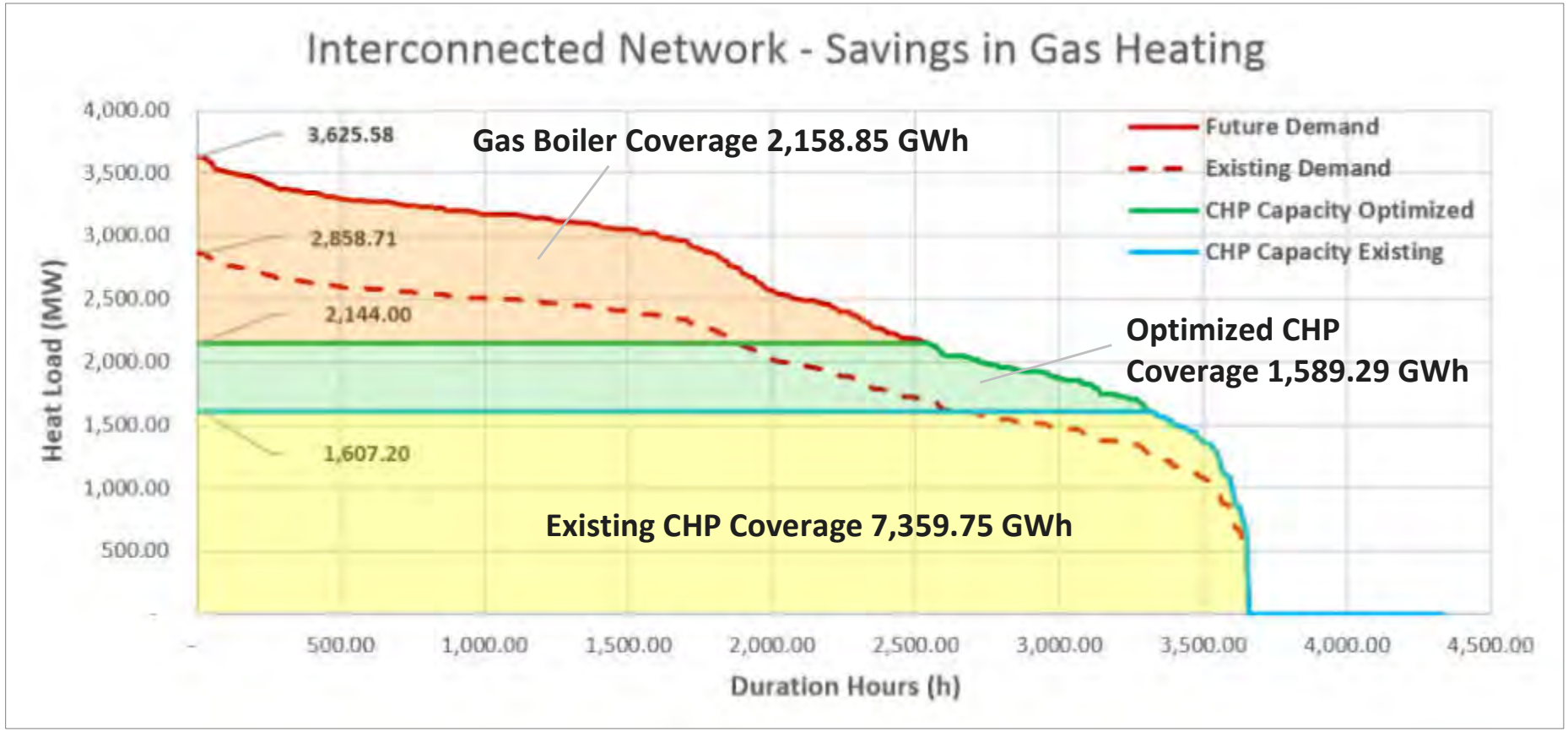
Large CHP Plants = 4
Gas Boiler Stations = 28



DURATION CURVE DURING THE EXISTING SUPPLY SETUP



SAVING ACHIEVED FROM USING SURPLUS HEAT



URUMQI CAN USE MORE SURPLUS HEAT FROM CHP!

Total Economical Savings:

- Reduced Heat from Gas Boilers = 536.8 MW
- Total Energy Saved from Gas Boilers = 1,589,287.6 MWh/Year

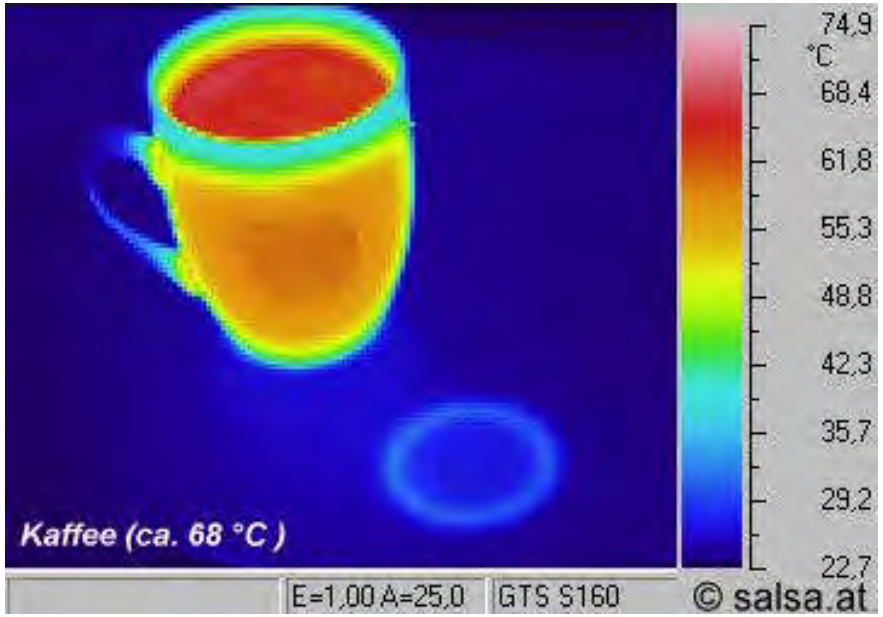
- Energy Price CHP = 41.4 RMB/MWh
- Energy Price Gas = 201.6 RMB/MWh
- Energy Price Saving = 160.2 RMB/MWh

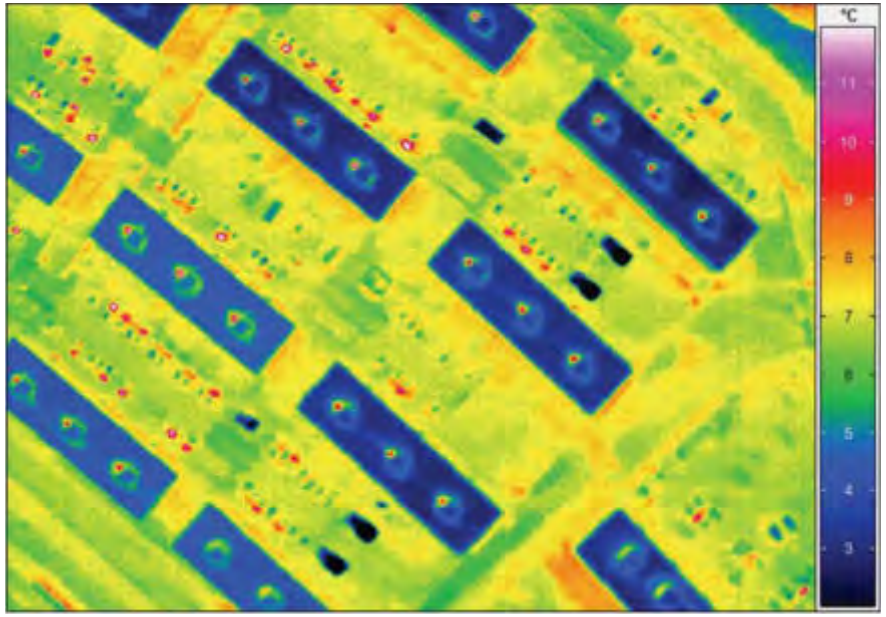
Total Savings Achieved = 254,603,873 RMB/Year **≈(255 million RMB/Year)**

NEW TECHNOLOGIES

HOW DO WE RENOVATE OUR SYSTEMS?

- Well… There are of course many ways on how to do this.
- One of the best options is Thermographic Surveying!





THERMOGRAPHIC SURVEY – DISTRICT HEATING

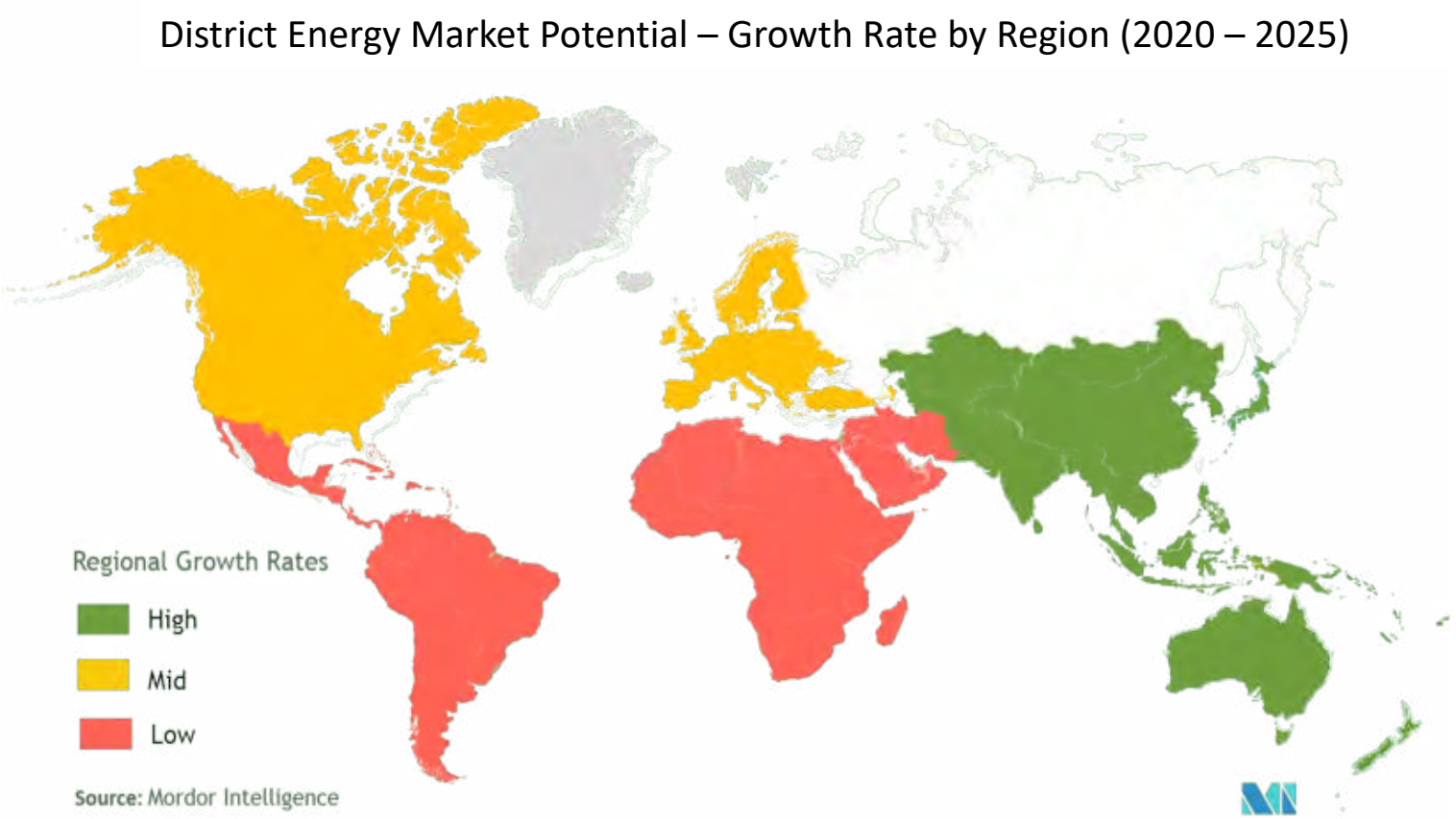
- Here are some examples:

THERMOGRAPHIC SURVEY – DISTRICT HEATING

ASIAN DISTRICT ENERGY GROWTH

ASIA HAS A HIGH GROWTH RATE

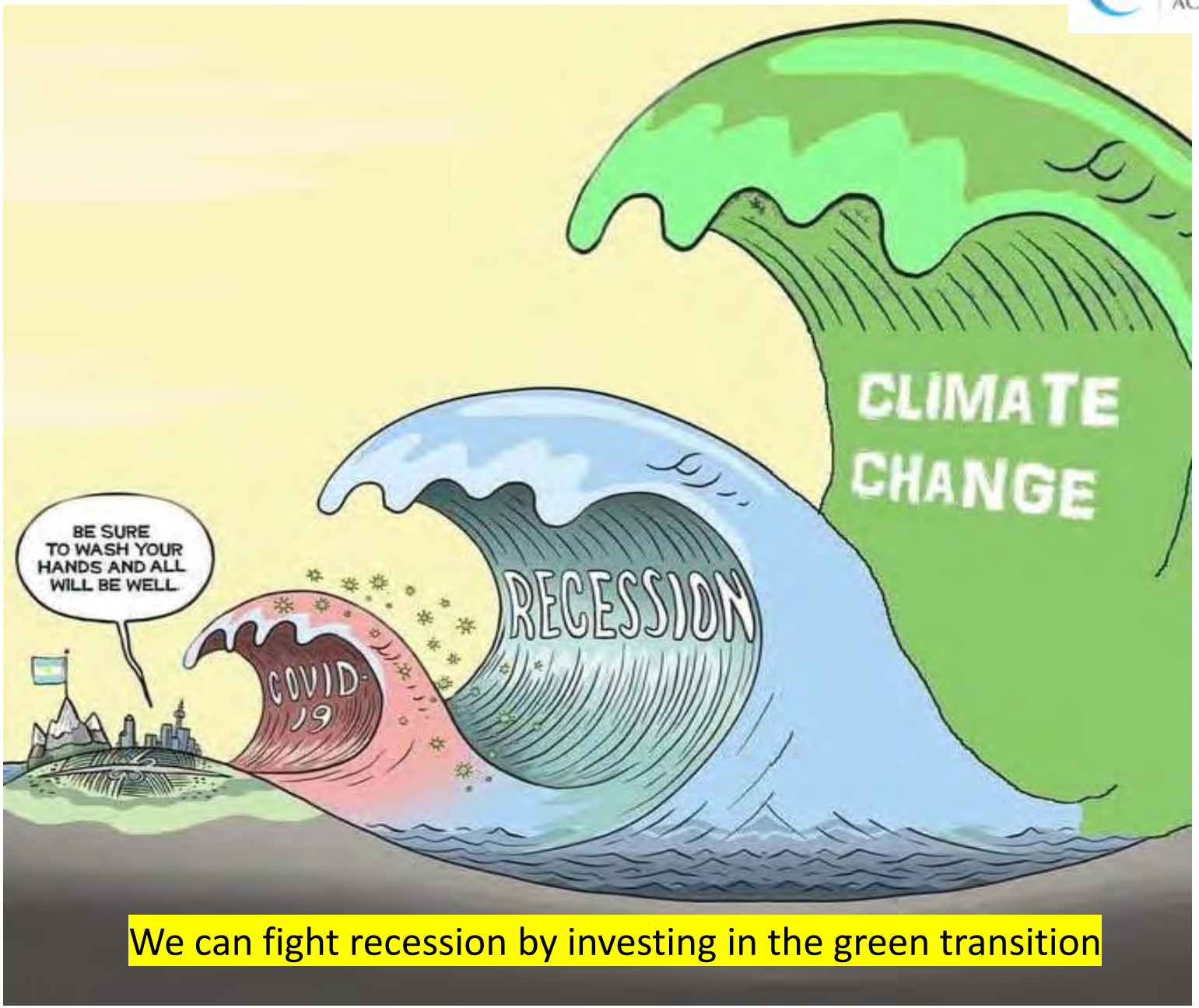
District Energy Market Potential – Growth Rate by Region (2020 – 2025)



*District Energy = District Heating & Cooling

THANK YOU!

ANY QUESTIONS?



We can fight recession by investing in the green transition

The global status

Globally we have observed increased attention to energy and climate matters.

Most countries, regions and metropolitan areas are, regardless of level of economic development, seeking to strike a balance between economy, environmental and geopolitical matters.

This tendency has an impact on both newly established as well as established energy- and climate organizations.

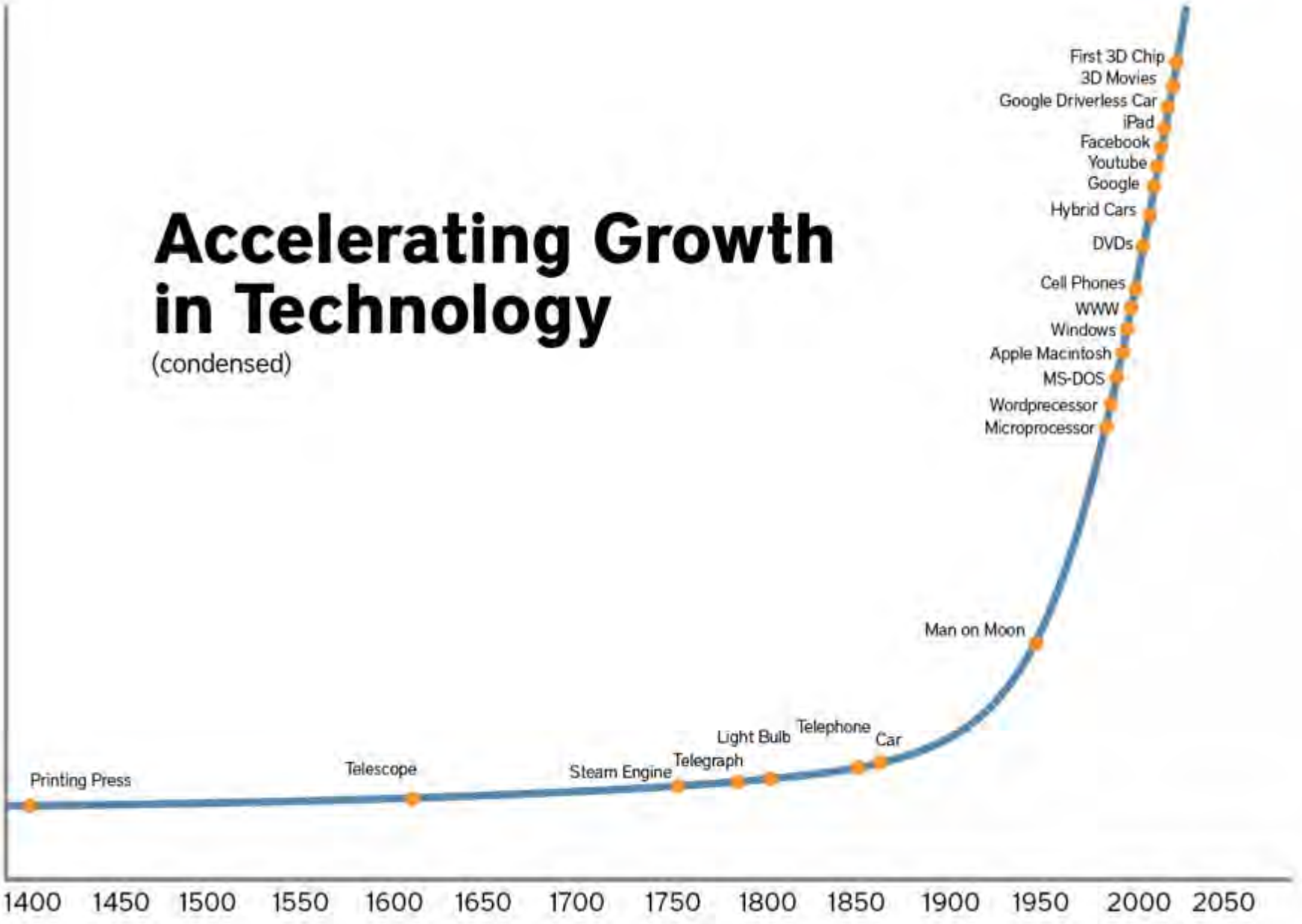
In addition to this the companies have to pay attention to efficient use of energy, green energy, sustainability, and resource optimization, in order to secure survival.

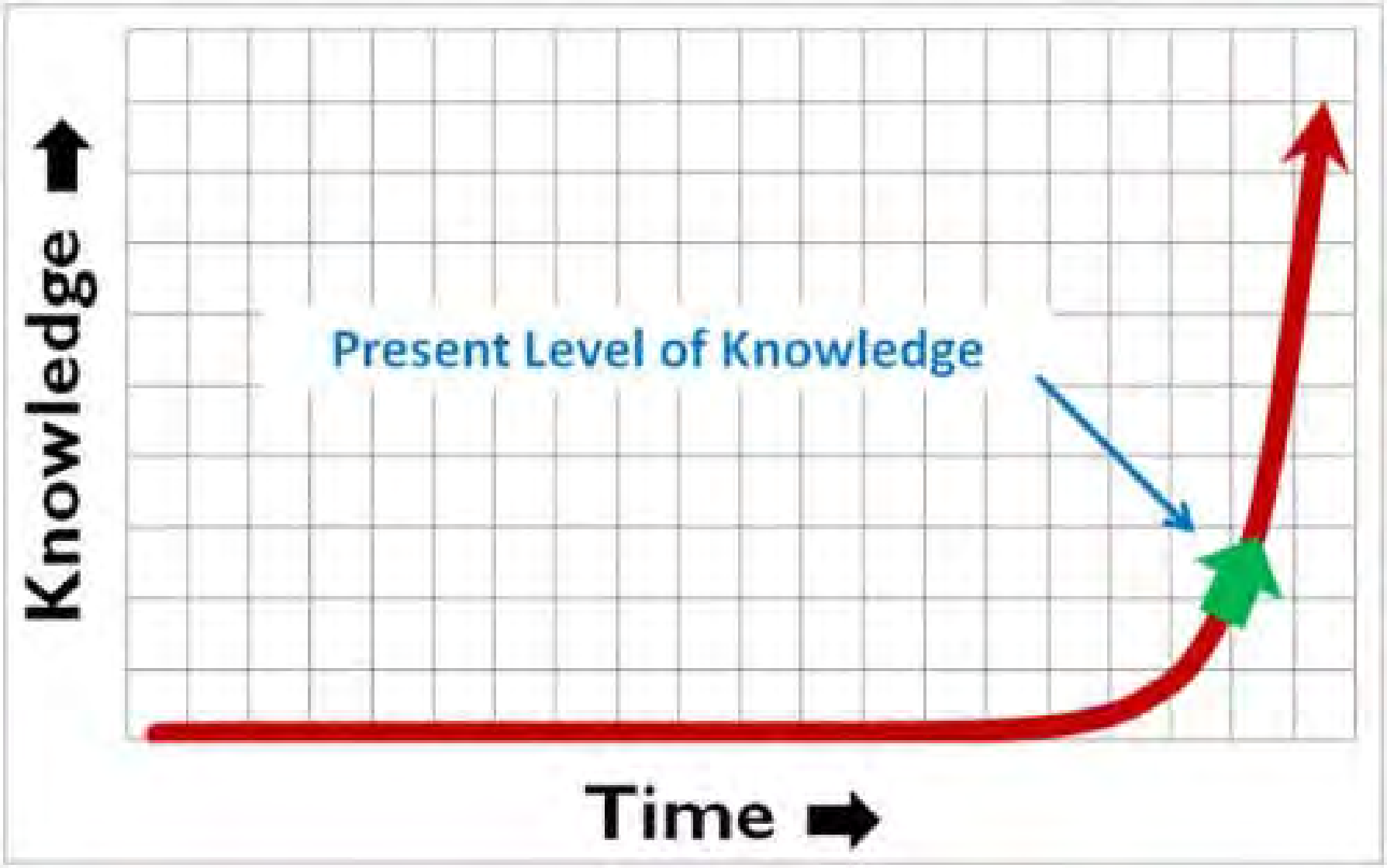
New technology and new knowledge are essential in the struggle for a greener world

ENERGY AND CLIMATE ACADEMY

Accelerating Growth in Technology

(condensed)




Knowledge
Present Level of Knowledge
Time

The rapid growth in technology and knowledge means new challenges

Years ago, a good education would last for many years. Society and technology developed slowly and the need for new knowledge was not evident.

Today we see an increasing speed in development and this requires constant continuous acquisition of knowledge and experience of all staff members.

This can take place in many forms:

- On-the-job training
- Mentoring / Peer to Peer
- Self study
- Professional courses, where lecturers pass on their knowledge and experience

Capacity Building / Education / Training

Many words for the same activity. Different forms and at different periods in your life.

All over the word there are well educated engineers, managers, administrators a.o. that have graduated from a university, academy or other schools.

The development in green technology has been explosive the last years and new systems, technology and processes has changed the world.

The aim for Energy and Climate Academy is to offer professional postgraduate education in form of short (2- 10 days) courses for employees and managers that already have a degree.

This kind of knowledge transfer is effective, inexpensive and can be used immediately after the course.

As an extra benefit the participants will build professional network to the other participants and to the lecturers.

All over the world billions of CNY, EUR and USD are invested in the green transition

For me it is evident, that by adding new knowledge and experience to individuals and organisations working in this area, there will be many benefits:

Projects will have:

- Better quality
- Higher efficiency
- Better economy

The winners:

- The individual, as his/her competencies will grow
- The organization, as their employees and managers will be more efficient
- The climate, as the transition will move faster

Denmark and Danish companies

The increasing focus on the green transition means, that the need for relevant post-graduate education must equally be expected to grow. This is where Denmark and Danish corporations can contribute in a positive way.

Since the 1970s you will find Danish organizations, which have gained an international positive reputation within the areas of energy efficiency, green energy, environmental matters, development of new technologies, resource optimization, planning and organizing.

A huge amount of experience and knowledge have been gained, covering organizational, technological and societal matters.

Danish Companies have a large and global export of technological and planning solutions, while our experience and knowledge not yet have been applied nor perceived as an asset within the area of competence development i.e. of training, development, and education.

ENERGY AND CLIMATE ACADEMY

A global leader in post-graduate education within energy, climate and environmental matters

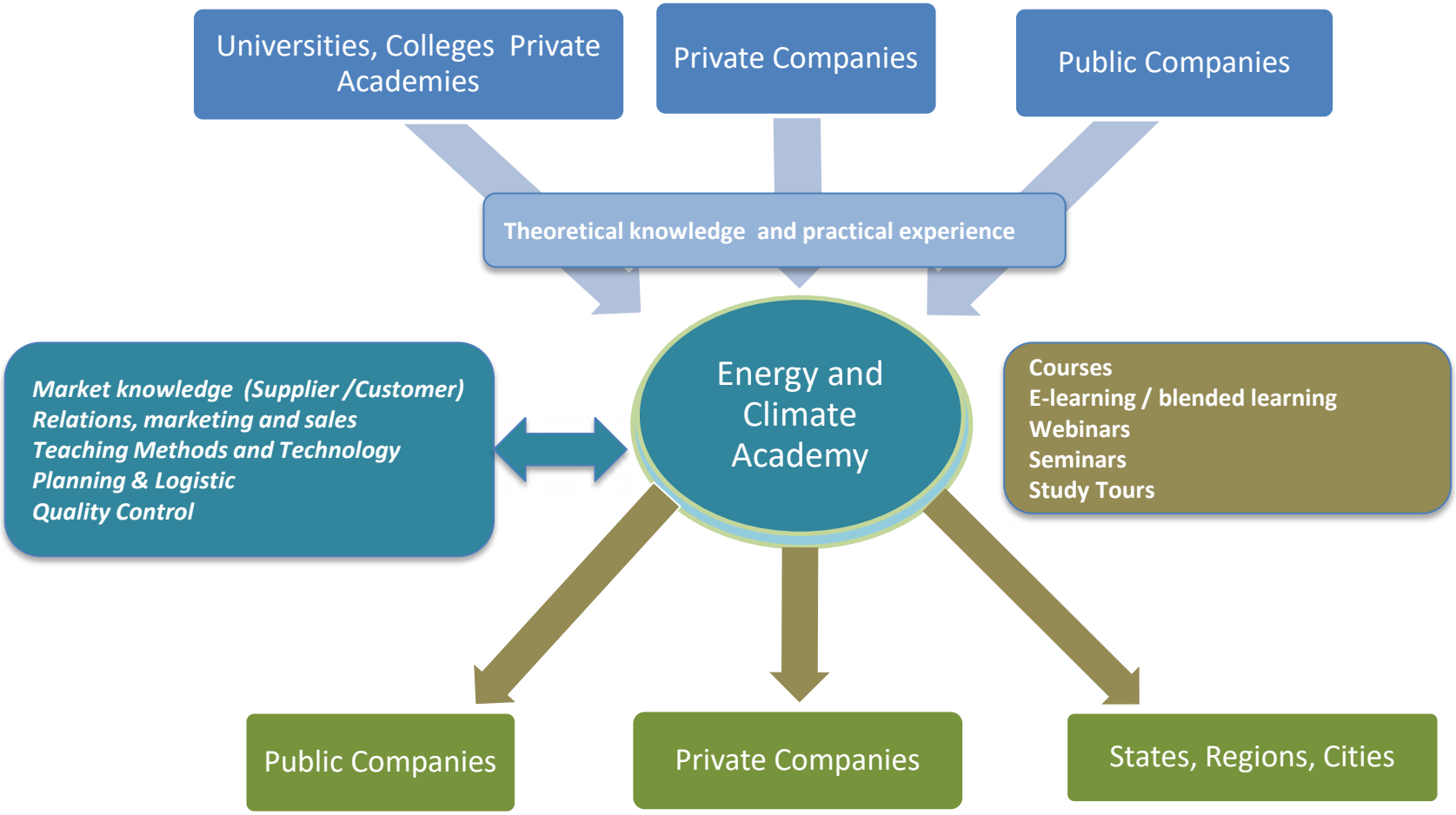
We offer open product-neutral, post graduate courses in various areas as well as customized courses in:

- District Energy
- Onshore and offshore wind energy
- Water Management
- Wave and Ocean Energy
- Energy and Climate Executive Programme
- Integrated Energy Systems

More than 2.000 have participated in our wind energy courses, started in 2004 as Danish University Wind Energy Training, which were adapted by Energy and Climate Academy in 2013.

We always ensure that our courses are designed to meet local requirements and we always work together with local institutions and individuals.

World Class lecturers and practical experience



Examples of Knowledge Partners

Universities:

- Aalborg University
- Massachusetts Institute of Technology – MIT Sloan
- Technical University of Denmark
- Delaware University
- The University of Southern Denmark

Companies and public organisations:

Danfoss, COWI, EMD, K2Management, MHI Vestas, Danish Energy Agency, Energinet, Logstor, Danish Board of District Heating, Kamstrup, State of Green, Orsted a.o.

Selected Customers

ENERGY AND CLIMATE ACADEMY

VEKS

TEKFEN

TEKFEN ENGINEERING

HOFOR

GRUNDFOS

VERDO
energi til fremtiden

Danfoss

Erasmus University Rotterdam

Wind Solutions

OFFSHORE ENERGY.DK

ලංකා විදුලිබල මණ්ඩලය
இலங்கை மின்சார சபை
CEYLON ELECTRICITY BOARD

Danish Ministry of Climate, Energy and Utilities

Klimarådet.

MHI VESTAS OFFSHORE WIND

LM WIND POWER

EDF renewables

NIRAS

Brunel
access to excellence

SWECO

ENERGINET

DNV·GL

Infratek

Best Green

DWEA Danish Wind Export Association

SOLSTAD OFFSHORE

Schneider Electric

Danish Energy Agency

OLYMPIC
OLYMPIC SHIPPING AS

DEPARTMENT OF ENERGY & ENVIRONMENT

BIC electric

BOEM
Bureau of Ocean Energy Management

Norfund

Quality

After each session at our courses the participants evaluate the session:

- The content of the presentation
- The lecturers knowledge
- The lecturers pedagogic skills

The evaluation are at a 1-5 scale, where 5 is best. In average the overall evaluations for our courses are between 4,1 and 4,5

Course example – District Energy

Course Example – District Energy

3-DAY COURSE
- your acces to world class knowledge and experience

DISTRICT HEATING: ENERGY EFFICIENCY FOR URBAN AREAS - IN-DEPTH INTRODUCTION

The future

Right now we are developing a District Energy course in collaboration with the Danish Embassy in Beijing. The course is aimed at managers and employees already working with District Heating or planning to go into the DH Business.

We have been offering this kind of courses in Copenhagen for the last 3 years with participants from all over Europe

Contact information:
Torben Kirkegaard
tki@energyandclimatecademy.com
0045 3023 7636
Resilience House, Lysholt Alle 6,
DK – 7100 Vejle