

**CITIES &
KeepWarm &
University of Zagreb (FSB)**

Workshop on:

Data intelligent operation of district heating and district cooling systems

Organizing committee:

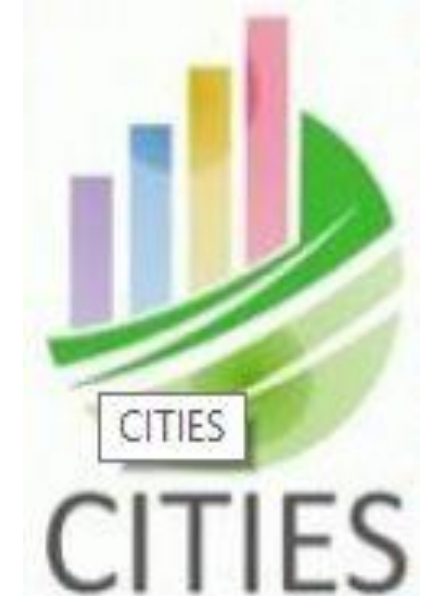
Henrik Madsen, DTU

Goran Krajačić, UNIZG

Nikola Matak, UNIZG

Tihomir Capan, UNIZG

Dominik Franjo Dominković, DTU (workshop chair)



Workshop participants

- Registered participants: 76
- 36 different companies/universities/institutes
- Sweden, Germany, Denmark, Austria, Slovenia, Croatia
- 20 oral presentations (1 online), and one panel
- Presenters and panelists: 15 from abroad and 9 from Croatia

Agenda overview (I)

- Wednesday

	Title	Presenter and the organization
14:30 – 15:00	Registration	
15:00 – 15:20	Opening address	
15:20 – 15:40	CITIES project: status, solutions and the future	Henrik Madsen, Technical University of Denmark
15:40 – 16:00	KeepWarm - Perspectives for the integration of the DH systems in Eastern Europe	Goran Krajačić, University of Zagreb
16:00 – 16:20	District Heating – The Road Ahead: A city's view on challenges and opportunities in deep decarbonization	Ivan Ivanković, City of Zagreb, City Office For Economy, Energy and Environment Protection
16:20 – 16:50	COFFEE BREAK	
16:50 – 17:10	Biomass district heating in Croatia	Velimir Šegon, Regional Energy Agency of North-west Croatia
17:10 – 17:30	Potential of geothermal energy in DHS in Slovenia	Jure Čižman, Josef Stefan Institute
17:30 – 17:50	Geothermal CHP concepts	Fabian Dawo, Technical University of Munich
17:50 – 18:10	Velika Ciglana: geothermal field, power plant, and district heating potential	Dragutin Domitrović, MB Geothermal d.o.o.

Agenda overview (II)



	Title	Presenter and the organization
08:30 – 09:00	Registration	
09:00 – 09:20	3Smart- smart buildings, smart grid, smart city – project results	Vinko Lešić, University of Zagreb
09:20 – 09:40	Model Predictive Control in connection with district heating networks	Frederik Banis, Technical University of Denmark
09:40 – 10:00	Market optimization of district heating and cooling plants	Anders Andersen, EMD International
10:00 – 10:20	Decision-making to optimize the bidding strategy and operation of district heating plants	Ignacio Blanco, Technical University of Denmark
10:20 – 10:50	COFFEE BREAK	
10:50 – 11:10	Stakeholder cooperation as the key step for unlocking the potential of DHS - PentaHelix project	Ana Lovrak, University of Zagreb
11:10 – 11:30	Solar Heat – A future major source for district heating	Hrvoje Milošević, SOLID GmbH
11:30 – 11:50	Direct Hydro-Geothermal Energy Use in District Heating & Cooling Systems - The potential of Croatian Pannonian Basins	Slobodan Kolbah, Geothermal energy d.o.o.
11:50 – 12:10	Potential for interconnecting district heating grids in the greater Zagreb region	Dominik Dominković, Technical University of Denmark
12:10 – 13:10	LUNCH	
13:10 – 13:30	Digitalised District Heating - from buzz to business case	Bjarne Sig Halkjær, Kamstrup Denmark
13:30 – 13:50	OT / IoT platform Tango as a new tools for smart infrastructure management - example on district heating	Julijo Josip Franz, Petrol Slovenia
13:50 – 14:10	Securing a lower grid temperature through increased digitalization: Using heat load forecasting and feedback from the grid	David Edsbäcker & Markus Falkvall, Kraftringen Sweden
14:10 – 14:30	Methods for data-intelligent operations of low temperature DH systems	Hjörleifur Bergsteinsson, Technical University of Denmark
14:30 – 14:50	PreHEAT - A collaborative heating controller for energy efficient buildings	Pierre Vogler-Finck, Neogrid Denmark
14:50 – 15:20	COFFEE BREAK	
15:20 – 16:20	Panel: "Towards low temperature district heating within the smart energy systems framework"	
	<ul style="list-style-type: none"> Henrik Madsen, Atli Benonysson, Markus Falkvall, Igor Balen, Tomislav Novosel Panel chair: Goran Krajačić	
16:20 – 16:30	A final wrap-up of the workshop	

Scope of the workshop – general

- Fostering industry – institutes – universities – governmental organizations collaboration
- Fostering implementation of research results
- Overcoming a spasm between real-life industry problems vs. theoretical scientific ones
- Gathering experts from many interacting field at one place
- Knowledge transfer between different countries (special emphasis on Nordic countries to south-east and central European countries)
- Acknowledging the place of district heating and cooling in future energy systems
- Showing where industry is heading in the near and middle term future

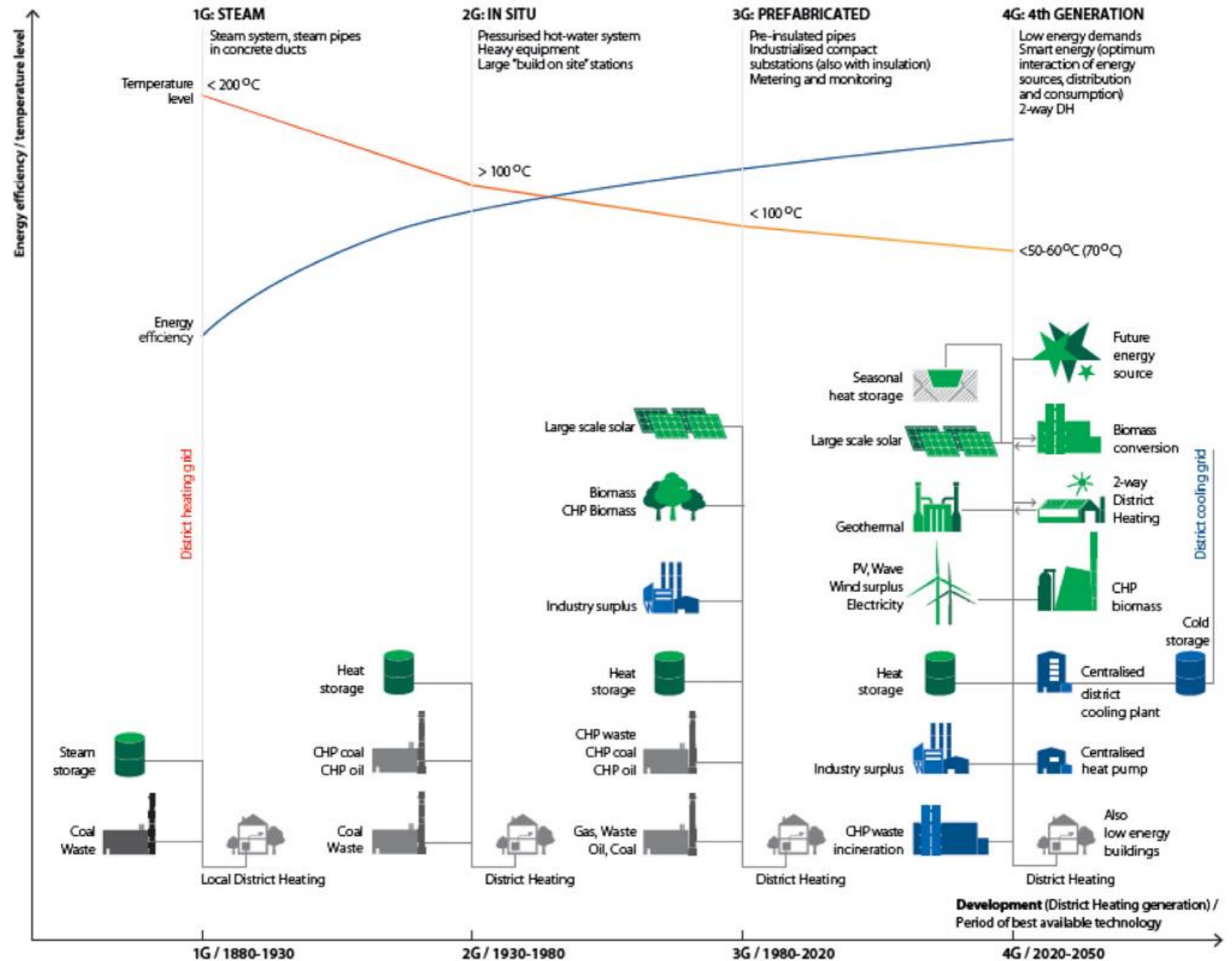
Scope of the workshop - specific

- Impact of cheaper sensors and large amounts of data on operation of DH
- Smart metering in DH systems
- Cogeneration units, storage, heat pumps and variable renewable sources – handling uncertainty
- Future heat generation sources – difference between sources for 3rd and 4th generation district heating
- Energy flexibility on the demand side: the role of DH

General directions of energy systems (and DH)

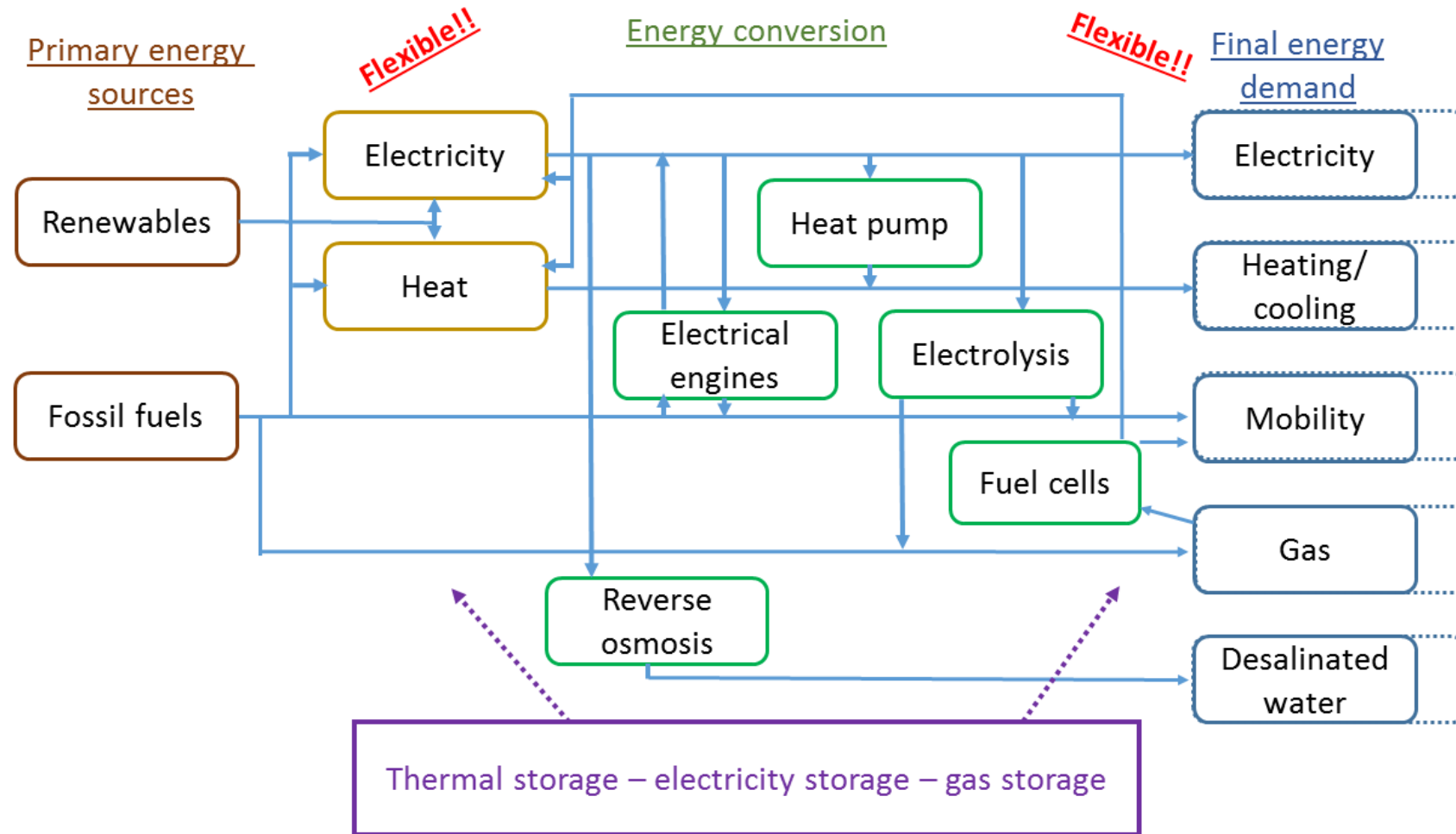
- Integrated energy approach (decarbonizing the whole energy system)
- Air pollution consideration
- Sustainability of biomass
- Unlocking flexibility in different energy sectors
- More specific to district heating
- Lowering forward and return temperatures (4th generation DH)
- Introducing decentralized (and distributed) energy generation sources

DH (r)evolution



- Source: Lund et al. (2014). 4th Generation District Heating (4GDH). Energy, 68, 1-11. <https://doi.org/10.1016/j.energy.2014.02.089>

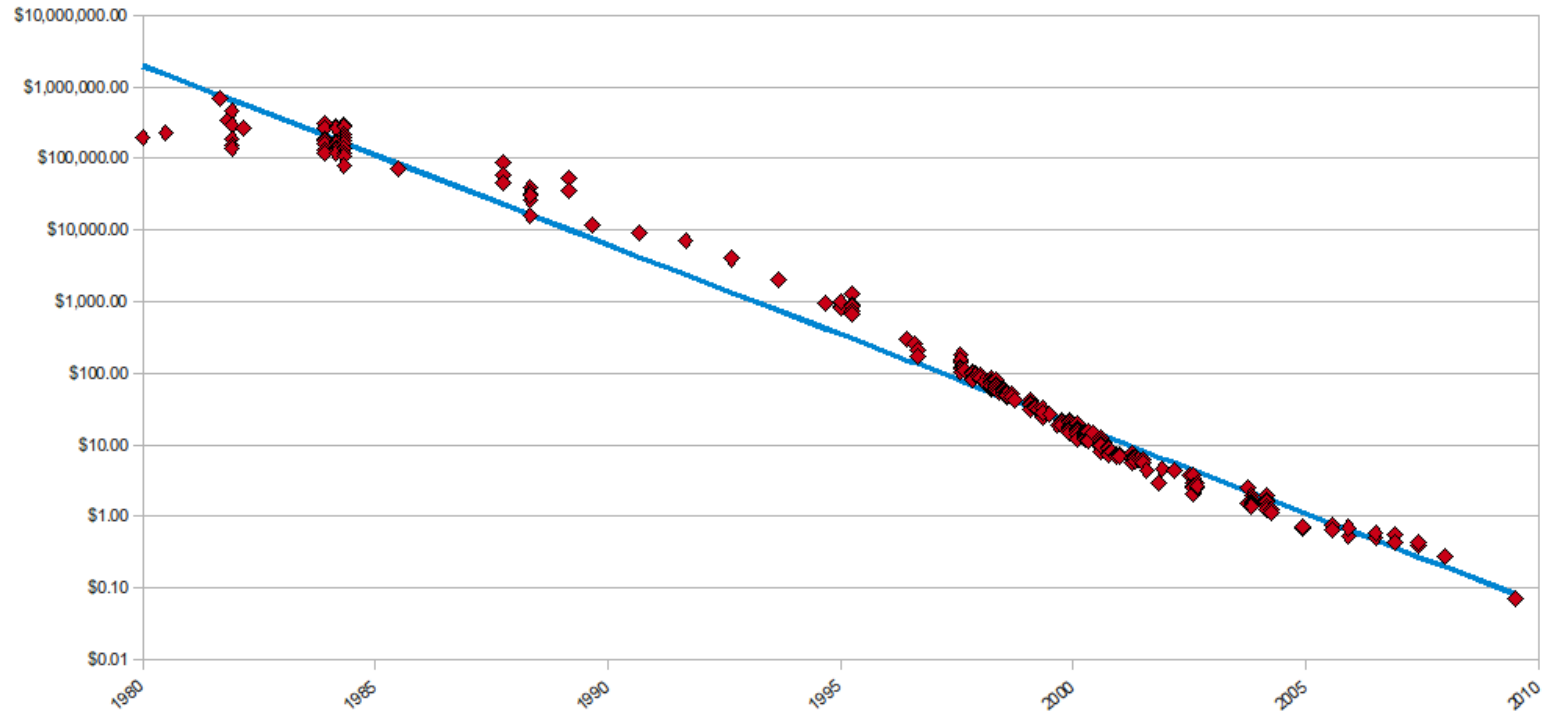
Energy system (r)evolution – from sector focused to holistic modelling



From centralized to decentralized (distributed)

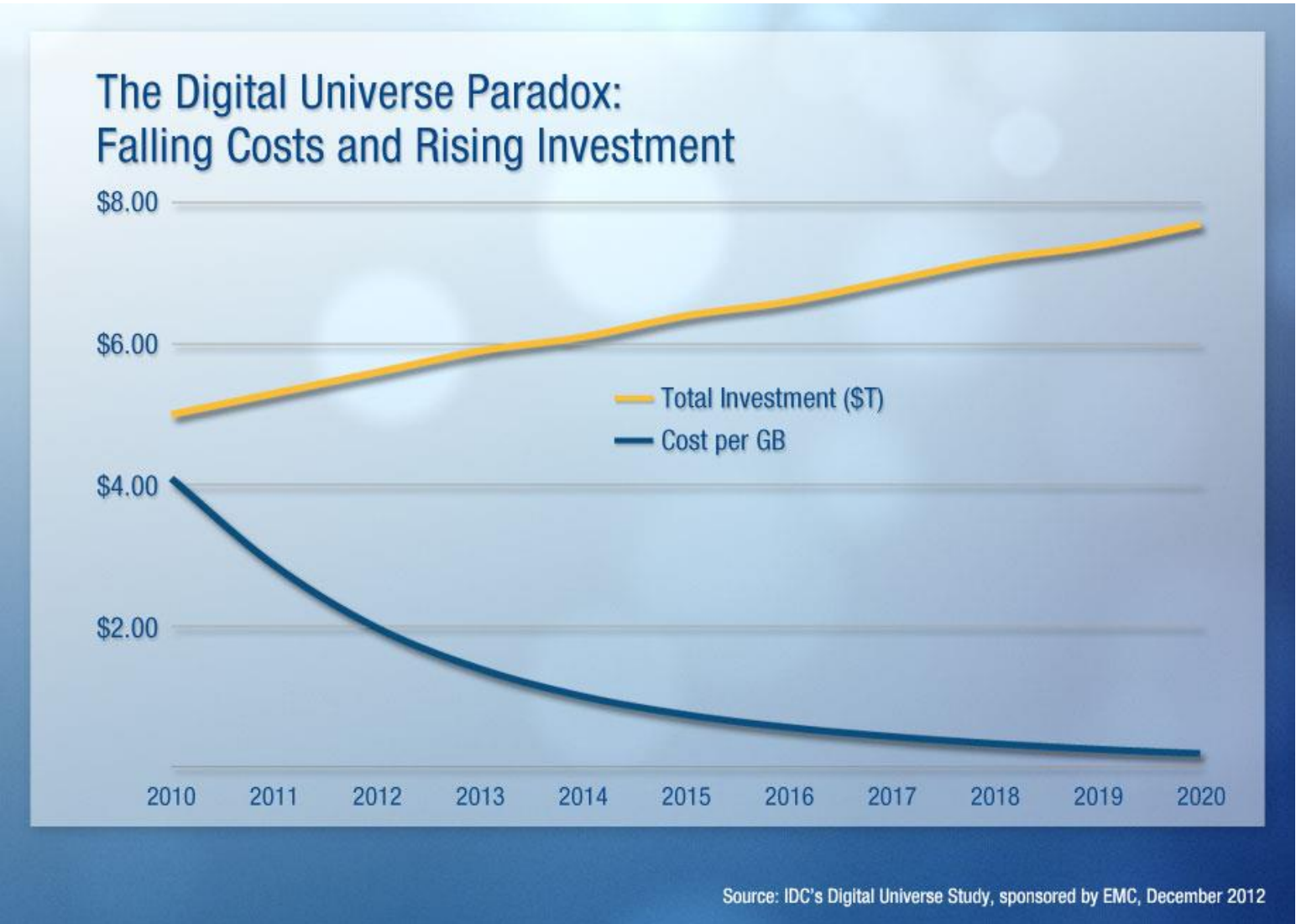
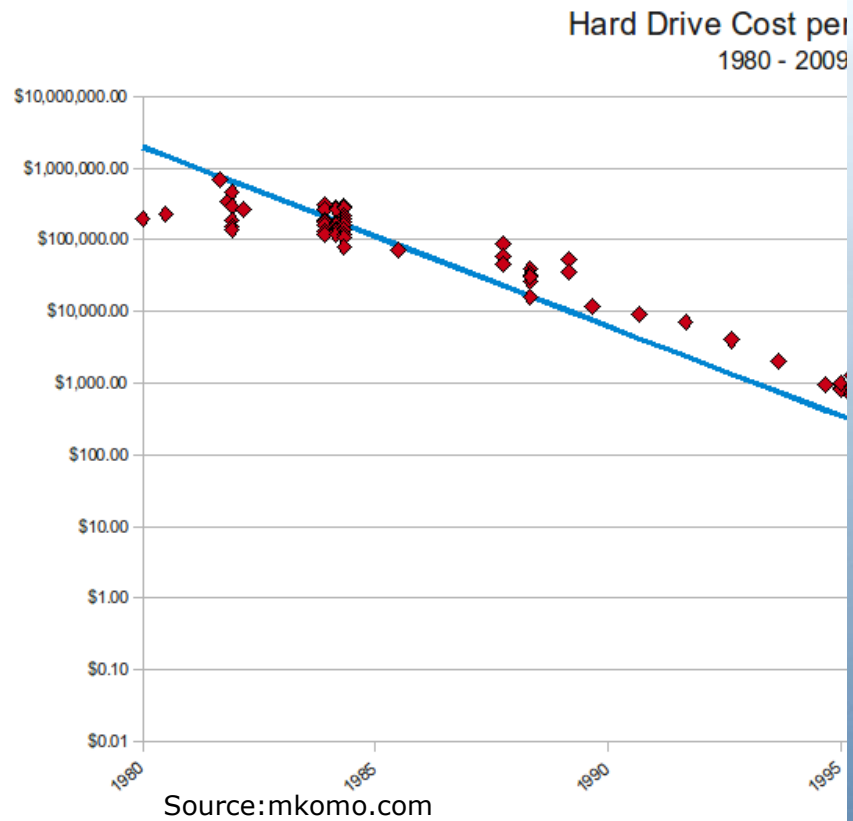
ICT (r)evolution – the cost of storage

Hard Drive Cost per Gigabyte
1980 - 2009



Source:mkomo.com

ICT (r)evolution – the cost of storage



ICT (r)evolution – the cost of sensors - IoT

