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WATER FORUM 2021 Conference and Exhibition

Water Infrastructure for the Future: Climate Change Challenges

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CONTENT

- ▶ CLIMATE CHANGE IMPACT
- ▶ INFRASTRUCTURE IMPACT
- ▶ SOCIO_TECHNICAL SYSTEM
- ▶ A ROOM FOR ACTION



CLIMATE CHANGE

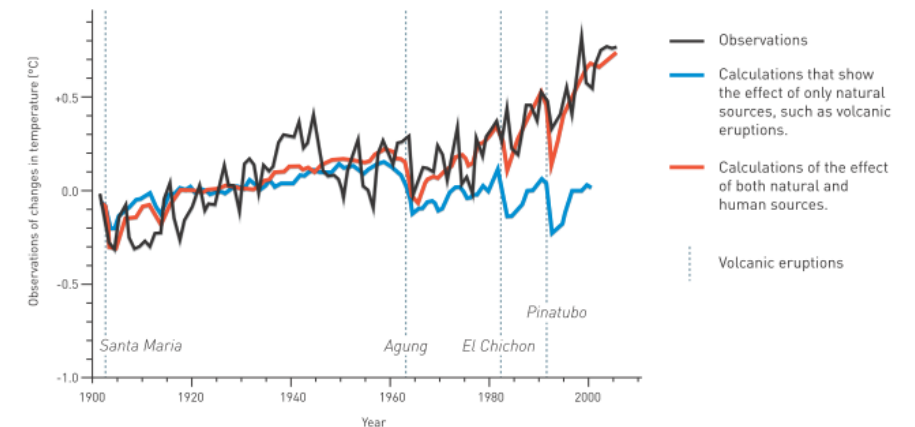
- ▶ Science or Pseudoscience ?
 - ▶ IPCC (from 90-ties): sum of evidence suggests visible human impact on the global climate
- ▶ Public debate - myth or truth
 - ▶ The Earth's climate is always changing and this is nothing to do with humans... (most often)
- ▶ The Nobel Prize in Physics 2021 (one half) Manabe - Hasselmann
 - ▶ for ground-breaking contributions to our understanding of complex systems for the physical modelling of Earth's climate, quantifying variability and reliably predicting global warming



https://www.thestar.com/news/gta/g20/2010/06/29/kettling_police_tactic_controversial_everywhere_it_was_used.html

Identifying fingerprints in the climate

Klaus Hasselmann developed methods for distinguishing between natural and human causes (fingerprints) of atmospheric heating. Comparison between changes in the mean temperature in relation to the average for 1901-1950 [°C].

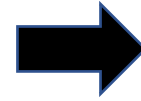
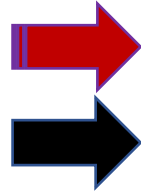


Source: Hegerl and Zwiers (2011) Use of models in detection & attribution of climate change, WIREs Climate Change.

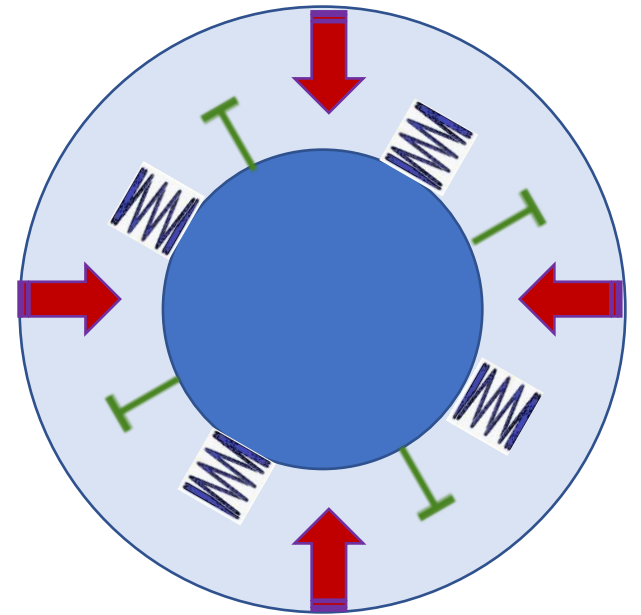
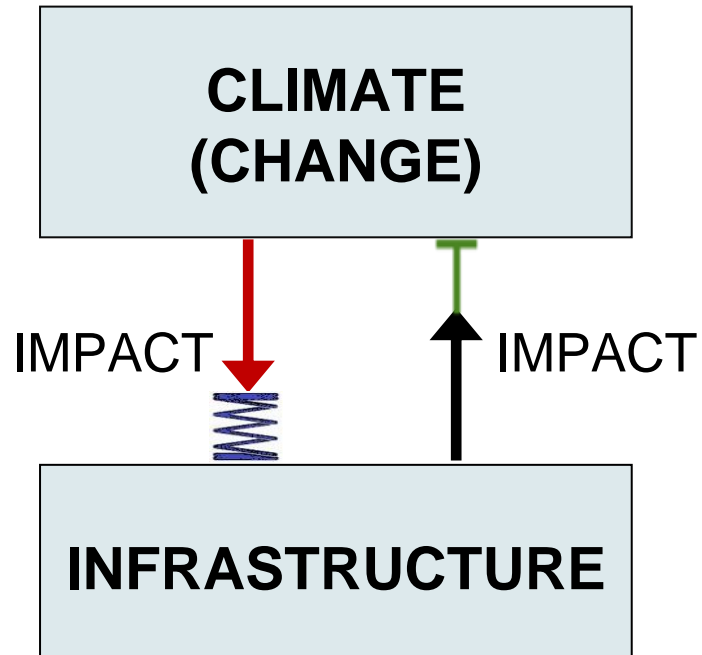
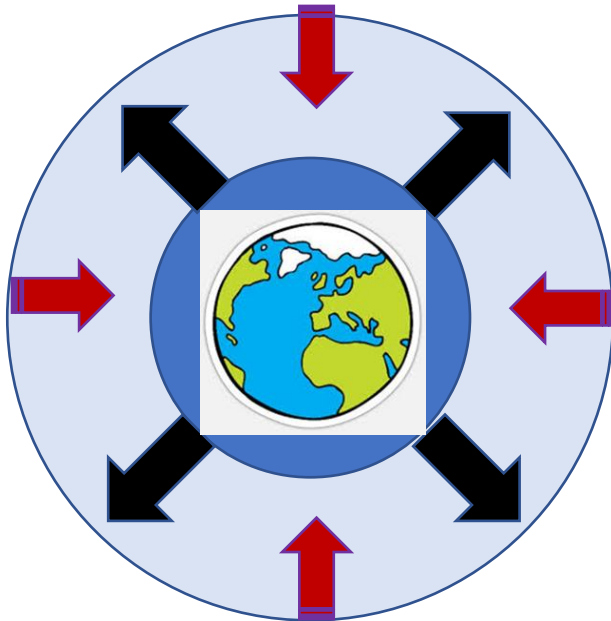
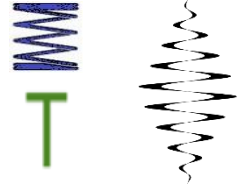
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CLIMATE CHANGE vs HUMAN ACTIVITIES

- ▶ Climate change (impact)
- ▶ Anthropogenic impact



- ▶ Adaptation
- ▶ Mitigation

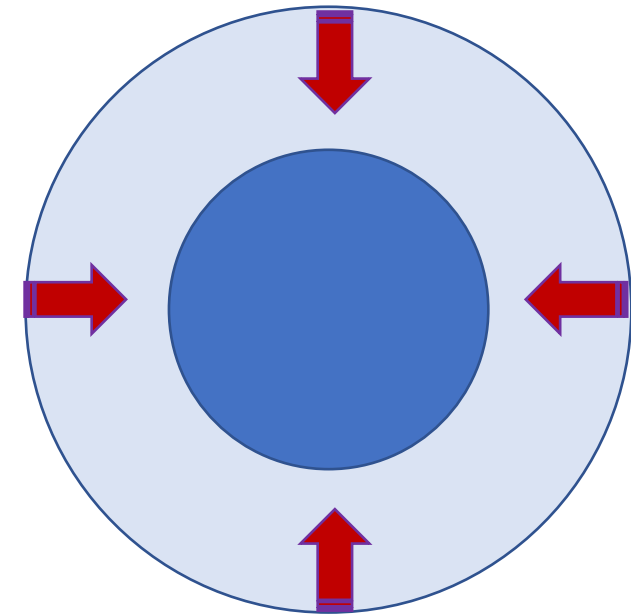


CLIMATE CHANGE IMPACT

- ▶ DIRECT: Temperature increase, ...
- ▶ INDIRECT: Population movements,

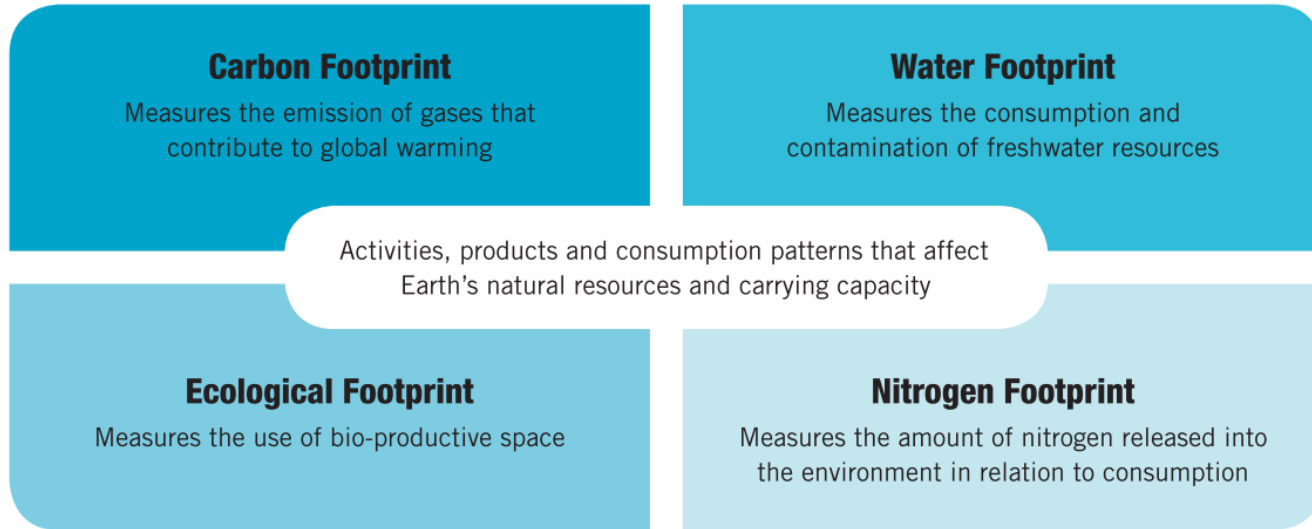
- ▶ Main IMPACT Groups :
 - ▶ Temperature rise / Heatwaves
 - ▶ Drought / Low flows
 - ▶ Flood / Prolonged rainfalls
 - ▶ Storm surge / Intense storm events

- ▶ 3 kinds of hazards:
 - ▶ Higher or Lower **AVERAGE**
 - ▶ More **EXTREMES**
 - ▶ A wider range of **VARIABILITY**

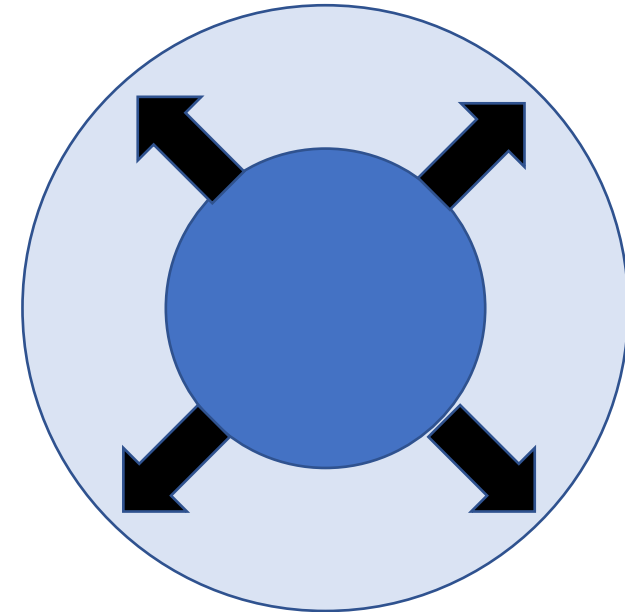


- ▶ Impact Consequences Groups on Infrastructure:
 - ▶ Supply-Demand Balance
 - ▶ Service Performance Affected
 - ▶ Asset Damage/Failure
 - ▶ Stuff H&S Issue

INFRASTRUCTURE IMPACT

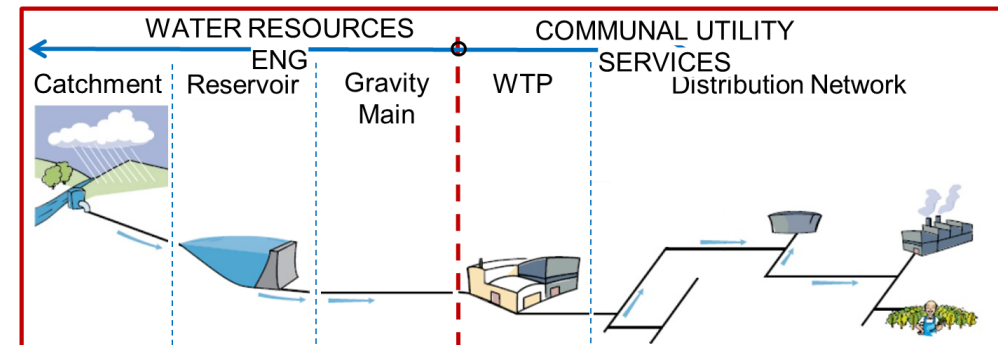


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CARBON FOOTPRINT

- ▶ GHG (GreenHouse Gases) Emission
- ▶ Main CO2 SOURCES
 - ▶ Electricity use (originated by fossil fuels)
 - ▶ Petrol and diesel consumption (by vehicles)



INFRASTRUCTURE - CLIMATE Interaction



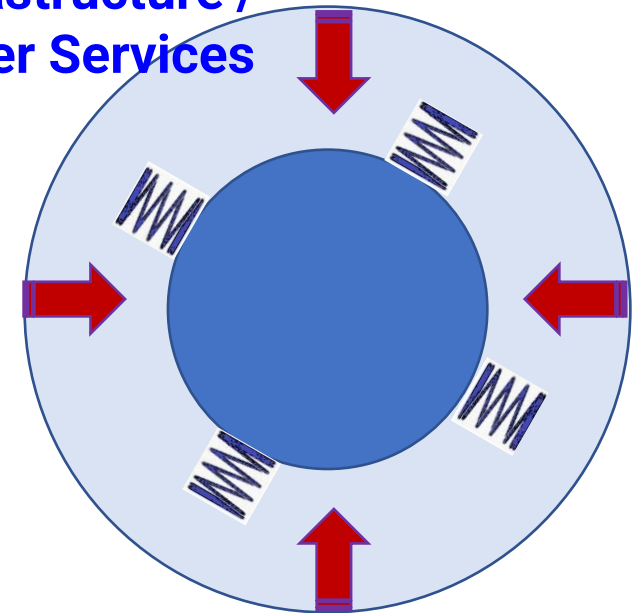
ADAPTATION Response Options Groups:

- ▶ **CAPABILITY**
 - ▶ Building models to understand changes
- ▶ **PLANS**
 - ▶ Using models to analyse options
- ▶ **ACTION**
 - ▶ Implementing plans / controls:
 - ▶ Hard – engineering
 - ▶ Soft – procedures, communication, ...

ADAPTATION to Climate Change

RESILIENT

Infrastructure / Water Services



GOAL: RESILIENT Infrastructure / Water Services in line with requirements

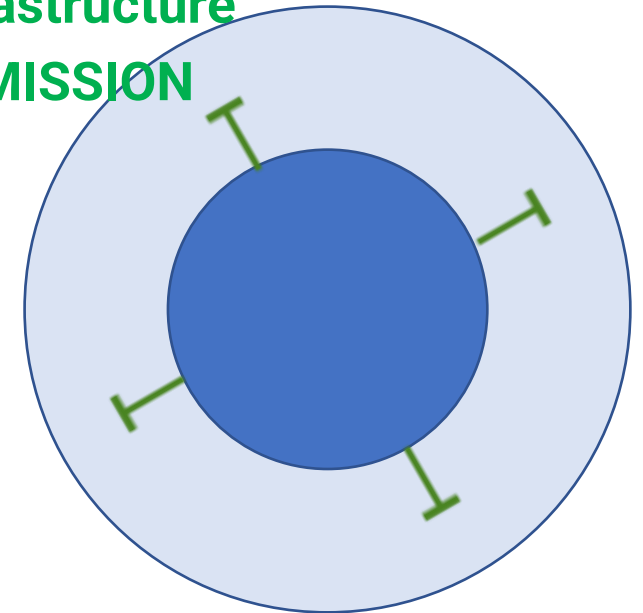
INFRASTRUCTURE - CLIMATE Interaction

T MITIGATION Response Options Groups:

- ▶ WATER SUPPLY Options
 - ▶ All supply side measures result in increase in carbon emissions (need to calculate)
- ▶ DEMAND MANAGEMENT Options
 - ▶ Water network optimisation, water saving devices, rainwater harvesting, water mains leakage reduction, etc.
- ▶ etc.

MITIGATION to Climate

**Mitigate
Infrastructure
EMISSION**



GOAL: Net ZERO Emission (EU/USA/AUS 2050; RF/China 2060; India 2070)

WATER INFRASTRUCTURE – CLIMATE CHANGE CHALLENGES

- ▶ Water supply systems
- ▶ Sewer systems
- ▶ Flood defense
- ▶ Urban drainage
- ▶ Drainage of agricultural land
- ▶ Irrigation systems
- ▶ Inland waterways, ports, locks
- ▶ Hydropower
- ▶ etc.

Room for **mitigation measures** is low
(mainly related to energy/resource use
rationalization/optimization)

but

Defining and implementation of
Adaptation measures is the must!

**Essential part of any
mitigation strategy!**

WATER INFRASTRUCTURE – CLIMATE CHANGE CHALLENGES

▶ CCC: **OPPORTUNITY** OR **THREAT?**

The answer is not straightforward, nor simple.

It **depends** on:

- Location
- Time frame considered
- Type of infrastructure
- Interactions with other technical/social/eco systems
- Other factors



WATER INFRASTRUCTURE – CLIMATE CHANGE CHALLENGES

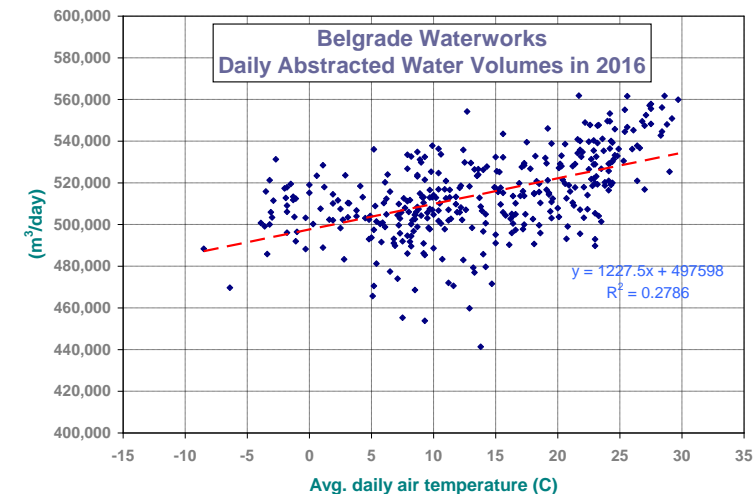
Climate impact may have **opposite impacts** on different infrastructure.

- e.g. river transport may benefit from increased precipitation, but flood defenses and drainage systems will be at the same time under increased risks

Climate impacts may be **difficult to quantify** precisely.

- e.g. air temperature impacts on drinking water demand exist, but statistically is weak and with great variability

Climate impacts investigated so far are predominantly focused on **water quantity dynamics**, while CC **impacts on water quality remains mainly unknown**



WATER INFRASTRUCTURE – CLIMATE CHANGE CHALLENGES

City of Belgrade - Climate Change Adaptation Action Plan and Vulnerability Assessment (City of Belgrade, GIZ, 2015)

Infrastructure

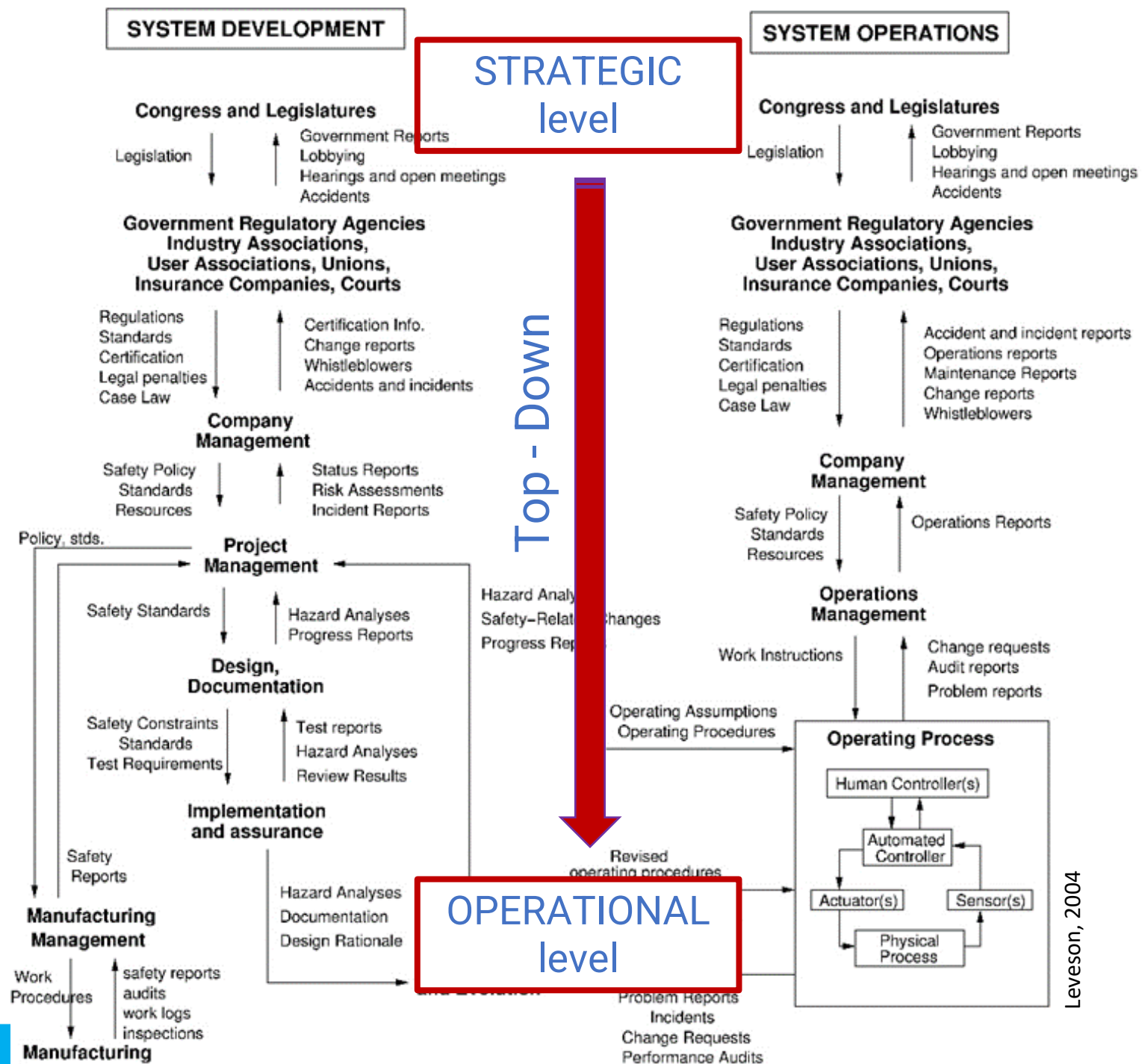
	VULNERABILITY				
	Heat wave	Extreme cold	Drought	Heavy precipitation / Floods	Storms
Transport	Medium	High	Low	High	Medium
Electricity and heating services	Medium	High	Medium	High	High
Water supply and sewage	High	Medium	High	High	High
Social infrastructure	Medium	Medium	High	Low	Low

Example:

Urban water supply and sewerage identified as the most vulnerable infrastructure regarding CC impacts

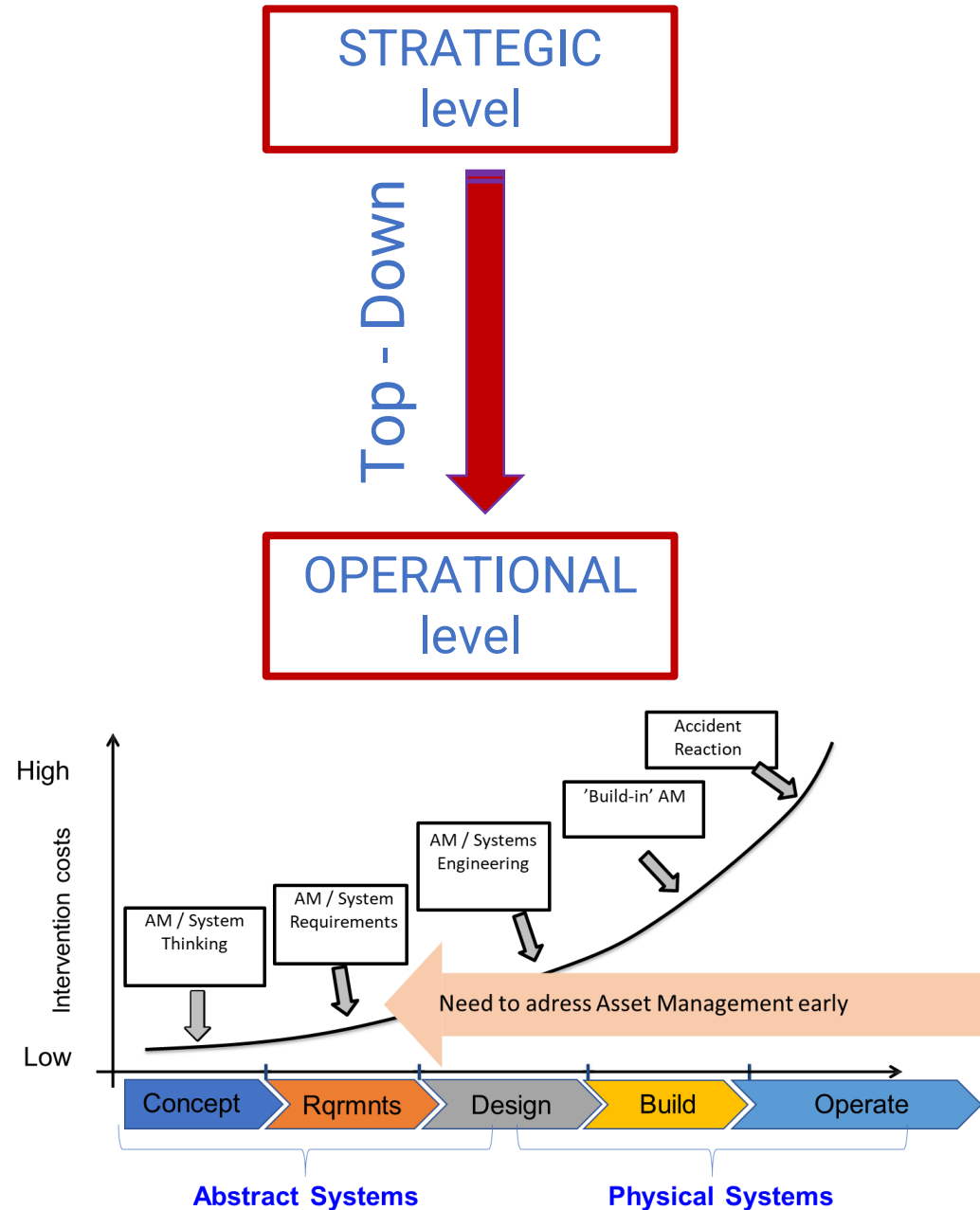
OUR INFRASTRUCTURE IS NOT TECHNICAL BUT SOCIO-TECHNICAL HIERARCHICAL SYSTEM

- ▶ Decision-making
- ▶ coupled with
- ▶ Technical systems
- ▶ Different hierarchical levels
- ▶ require
- ▶ Different language of communication
- ▶ Water companies (Operators) need clear well communicated rules/GLs set by upper levels (govt, reg, assoc)



SOCIO-TECHNICAL SYSTEM vs INFRASTRUCTURE

- ▶ A need to cross
- ▶ VERTICAL & HORIZONTAL axis
- ▶ Decision makers Hierarchical levels &
- ▶ Asset Life Cycle Phases



SOCIO-TECHNICAL SYSTEM

- ▶ Parliament & Legislatures
- ▶ Government Regulatory Agencies, , Universities, Consultants, Industry Associations, User Assoc, Insurance Companies, Courts
- ▶ Local Gvt Units (as Owners)
- ▶ Water Company Management
- ▶ Project/Mfg/Maint/Ops Management
- ▶ Strategies, Legislations
- ▶ Regulations, Gudelines, Instructions, Studies, Analysis
- ▶ ... [Incorporation CC requirements in ToRs for Infrastructure]
- ▶ Reports & Plans
- ▶ Implementation [Incorporation CC attributes in assets data models]

There are no sense Water Companies produce climate (change) studies but to communicate and then to follow requirements set by upper levels

A ROOM FOR WATER COMPANIES

- ▶ From the engineering standpoint CCA/M means (as we percept) defining of:
 - ▶ **requirements** (in ToRs, specifications, regulations, guidelines, or so)
 - ▶ **models** of systems (environment, weather, engineering systems, etc.)
 - ▶ required A/M **controls** due to their implementation
 - ▶ appropriate **monitoring/observation** systems
- ▶ Water Companies could:
 - ▶ include CCA/M attributes in AM data models, for all life-cycle phases
 - ▶ calculate elements/balance of carbon footprint, particularly sources and sinks
 - ▶ present some data (e.g. water losses) concerning CCA/M attributes (e.g. per pressure zones, failure repairing time) due to prioritization of actions
 - ▶ present some other data (e.g. energy/fuel consumption) through the CF
 - ▶ improve water efficiency, implement water reuse where appropriate
 - ▶ present CCA/M data in proper manner in AM Plans and Reports

A ROOM FOR WATER ASSOCIATIONS

- ▶ The challenges should be:
 - ▶ CC awareness
 - ▶ overcoming the gap of recognition of methodologies, requirements and roles concerning CCA/M
 - ▶ approaching all of concerning sides (State & Municipal level, Utility level, Client/Public level)
 - ▶ proposing roles and responsibilities, tasks and feedbacks regarding CCA&M in IAM
- ▶ Water Associations should advocate:
 - ▶ sharing best practices & methodologies
 - ▶ use of renewable energy
 - ▶ incorporation of CCA/M elements in referent national reports (issued by State Audit Institution, etc.), water company's annual reports, and so
 - ▶ incorporation – integration of CCA/M elements in benchmarking system
 - ▶ changing water use behaviours

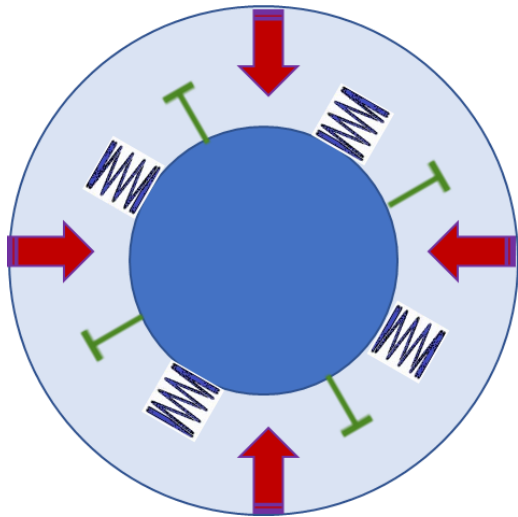
A ROOM FOR UNIVERSITIES

- ▶ Activities could be shaped for:
 - ▶ Scientific researches on CC phenomenon
 - ▶ R&D of appropriate methodologies concerning CC valuation
 - ▶ R&D of improved calculation methods for water-related infrastructure systems
 - ▶ R&D for integration of ICT tools
 - ▶ Recommendation on proper risk analysis and system safety methodologies
 - ▶ Participation in global and EU scientific network concerning CC

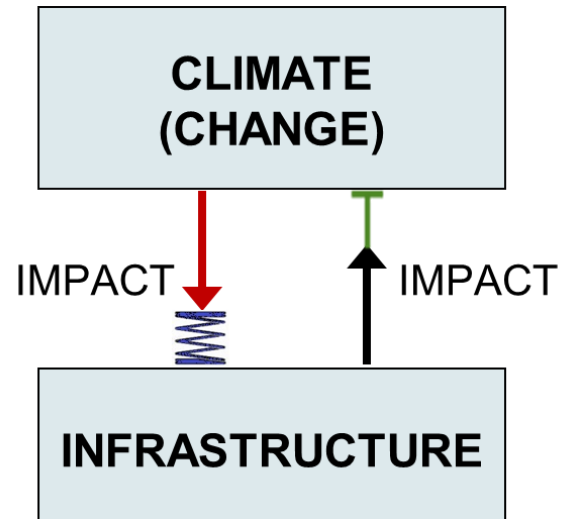
The need for transition from R&D phase into standard rules, guidance and practise

Resilience (enhancing capabilities) is a manner for facing unexpected

Thank you for your attention!



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