TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept

nanoSeminar at the Chair of Materials Science and Nanotechnology

Innovation Application Architecture

Dr.-Ing. Xiaoping Xie
Institute of Building and Design
Faculty of Architecture

18 November 2021

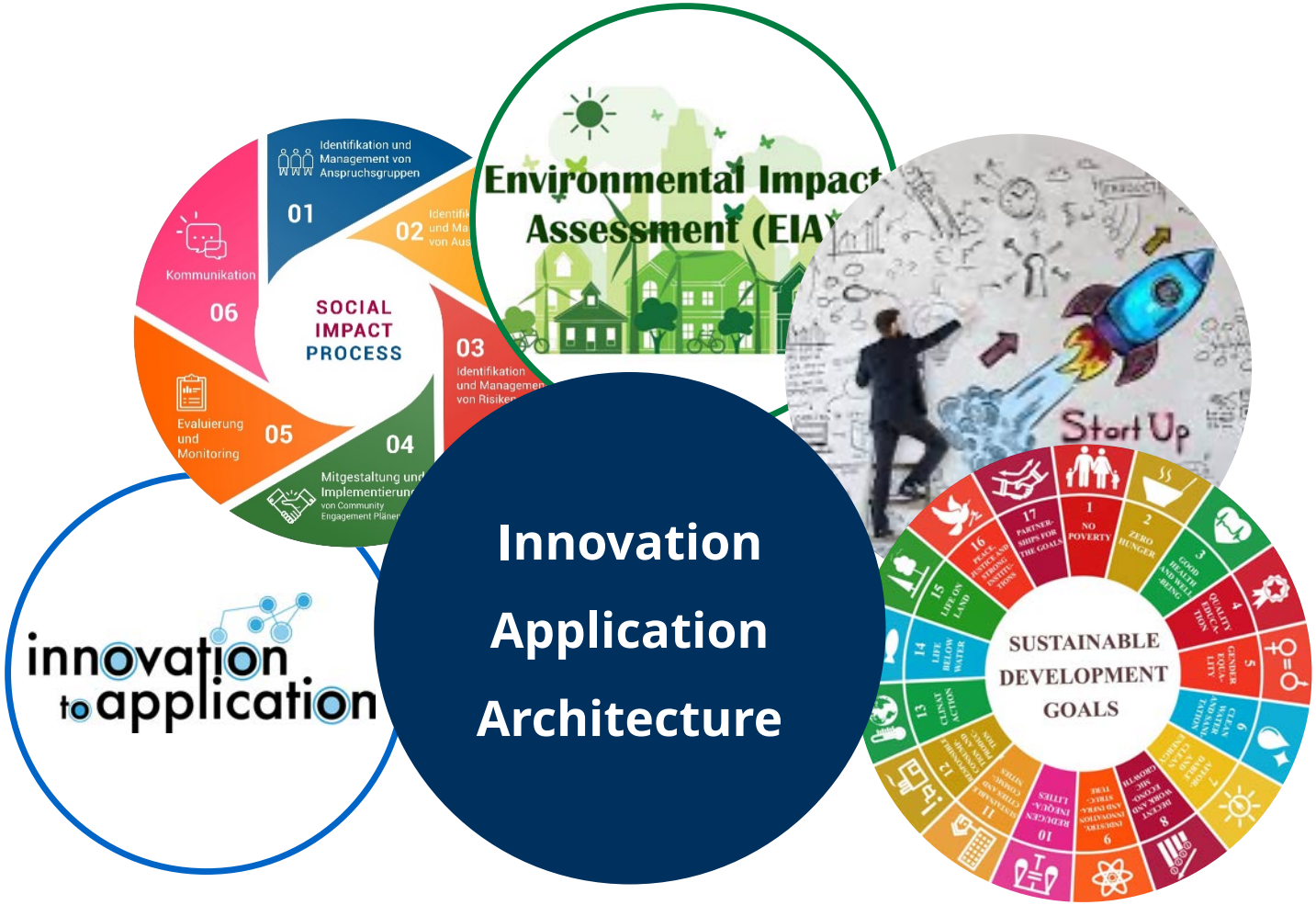
ABOUT ME

EDUCATION BACKGROUND

- Bachelor: Civil Engineering
- Master: Architecture
- PhD: Urban Planning

RESEARCH INTERESTS

- Social impact assessment of technological innovations
- Working environment in the digital-urban-era
- Urbanisation and metropolitanisation
- Urban and regional shrinkage
- Comparative study on development patterns of the Global North and the Global South


Identifikation und Management von Anspruchsgruppen
01
02
03
04
05
06
Kommunikation
Evaluierung und Monitoring
SOCIAL IMPACT PROCESS
Environmental Impact Assessment (EIA)
Start Up
innovation to application
Innovation
Application
Architecture
SUSTAINABLE DEVELOPMENT GOALS

THE AECHITECT'S TASKS

Vorplanung und Abnahme der Entwürfe vom Bauherrn

Genehmigungsplanung und Absprache mit Behörden

Ausführungsplanung und Absprache mit Gewerken

Bauüberwachung und finale Bauabnahme

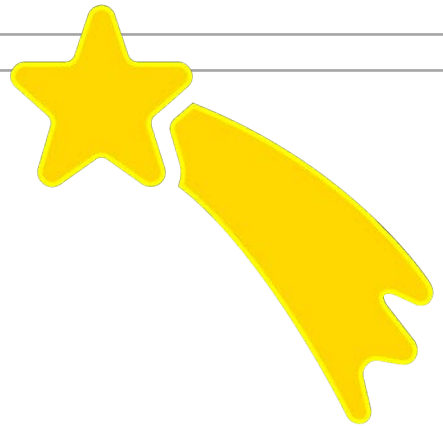
Gespräche mit dem Bauherrn und Grundlagenermittlung

Source:https://www.sanier.de

BLOOMS TAXONOMY

SUSTAINABLE DEVELOPMENT GOALS

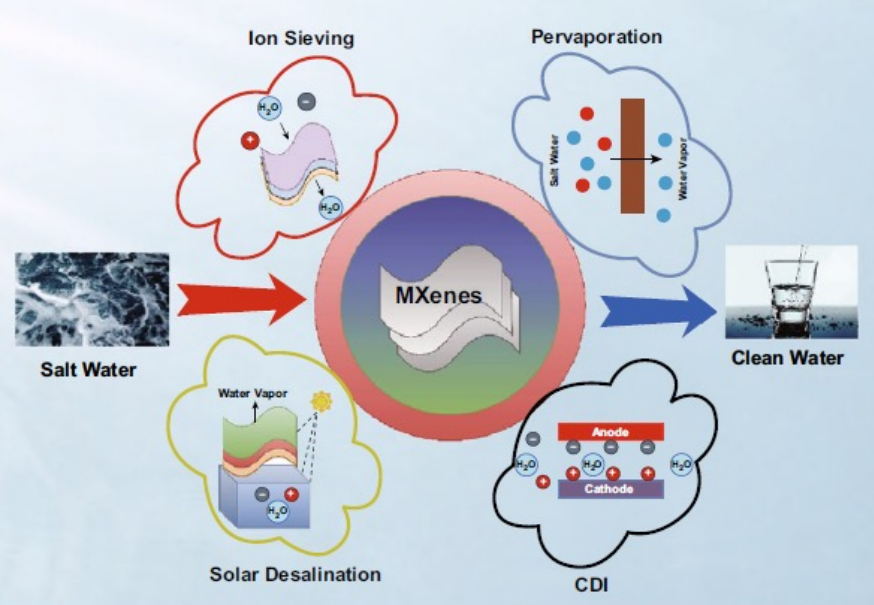
EXAMPLE CASE I

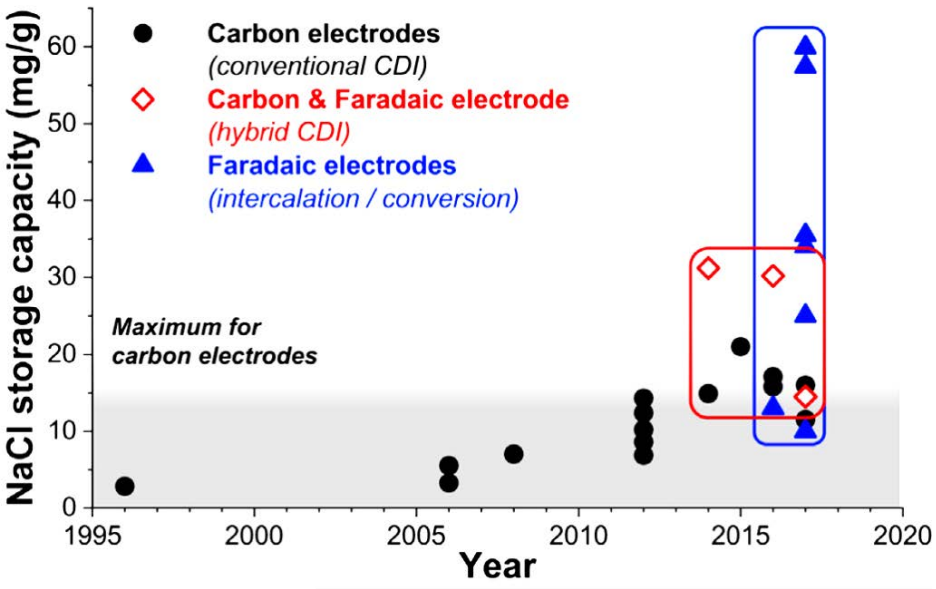


Application Architecture for Water Purification Technologies using Mxene-based Nanomaterials

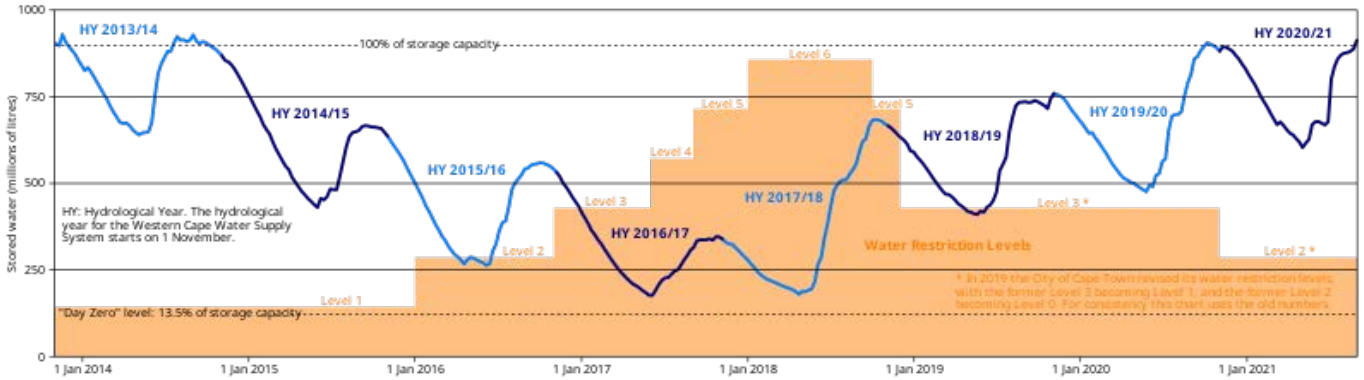
THE MISSION

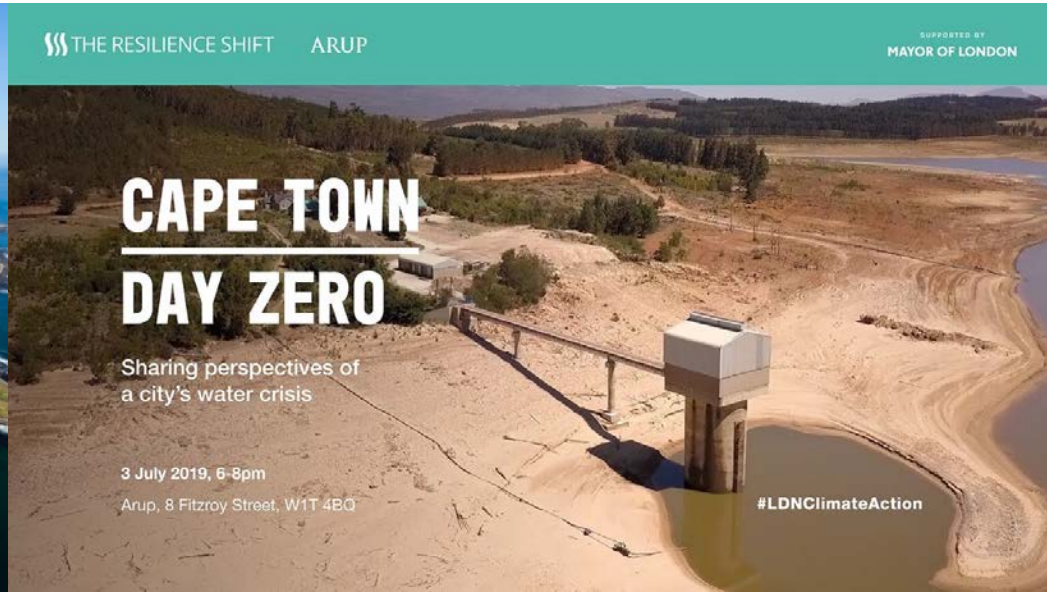
"If we could produce fresh water from salt water at a low cost, that would indeed be a great service to humanity, and would dwarf any other scientific accomplishment." - John F. Kennedy, 1962





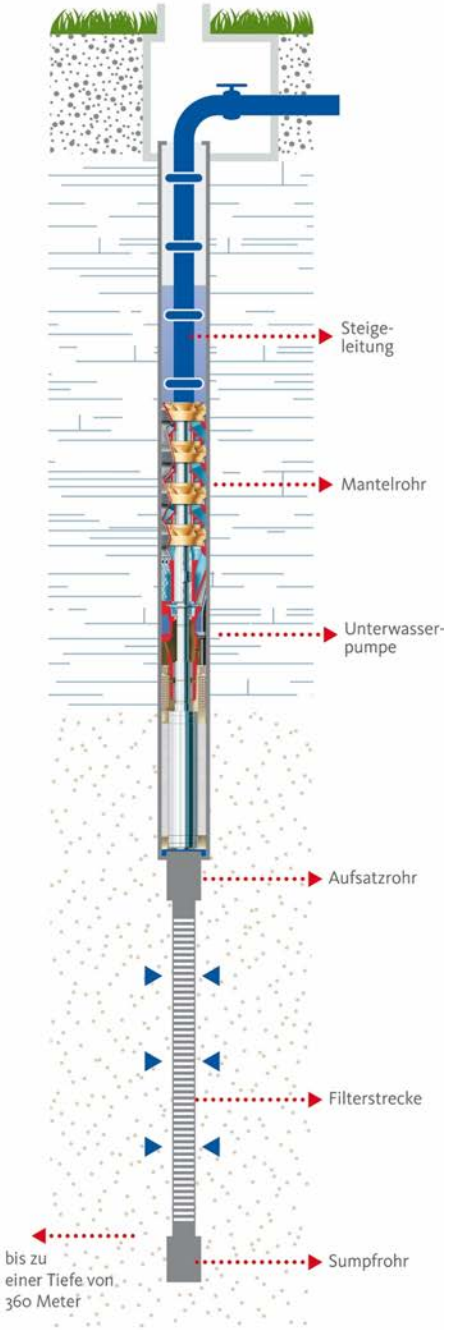
Capacitive Deionization (CDI) is a green, economical, and highly promising water desalination technique mainly because of its low operating costs and energy consumption, absence of secondary pollution, easy regeneration and maintenance. This technology has its roots in supercapacitor technology. Traditional porous carbon-based CDI systems have salt adsorption capacities (SAC) around 0.1-10 mg/g; whereas, $Ti_3C_2T_x$ MXenes, the outstanding Faradic 2D materials largely-used in supercapacitors, have shown superior salt adsorption capacities (68 mg/g of NaCl 585 mg/L) with very low energy consumption of 0.24 kWh/kg.





Cape Twon declared a national emergency in 2018 due to water crisis. It faced becoming the first major city in the world to run out of drinkable water as it dealt with serious water scarcity.

Between 2015 and 2018, a decline in rainfall resulted in Cape Town's worst droughts on record. These droughts saw the city on the brink of Day Zero, the point at which the municipal water supply would be shut off.



Hamburg's drinking water is obtained exclusively from groundwater. After at least 50 days of flow, the water has reached the groundwater layer. It is now free of pathogenic microorganisms as well as dirt and pollutants, has enriched itself with numerous minerals and collects above impermeable layers of clay. From there it is pumped through one of the 446 (461 with Haseldorfer Marsch) wells in Hamburg.

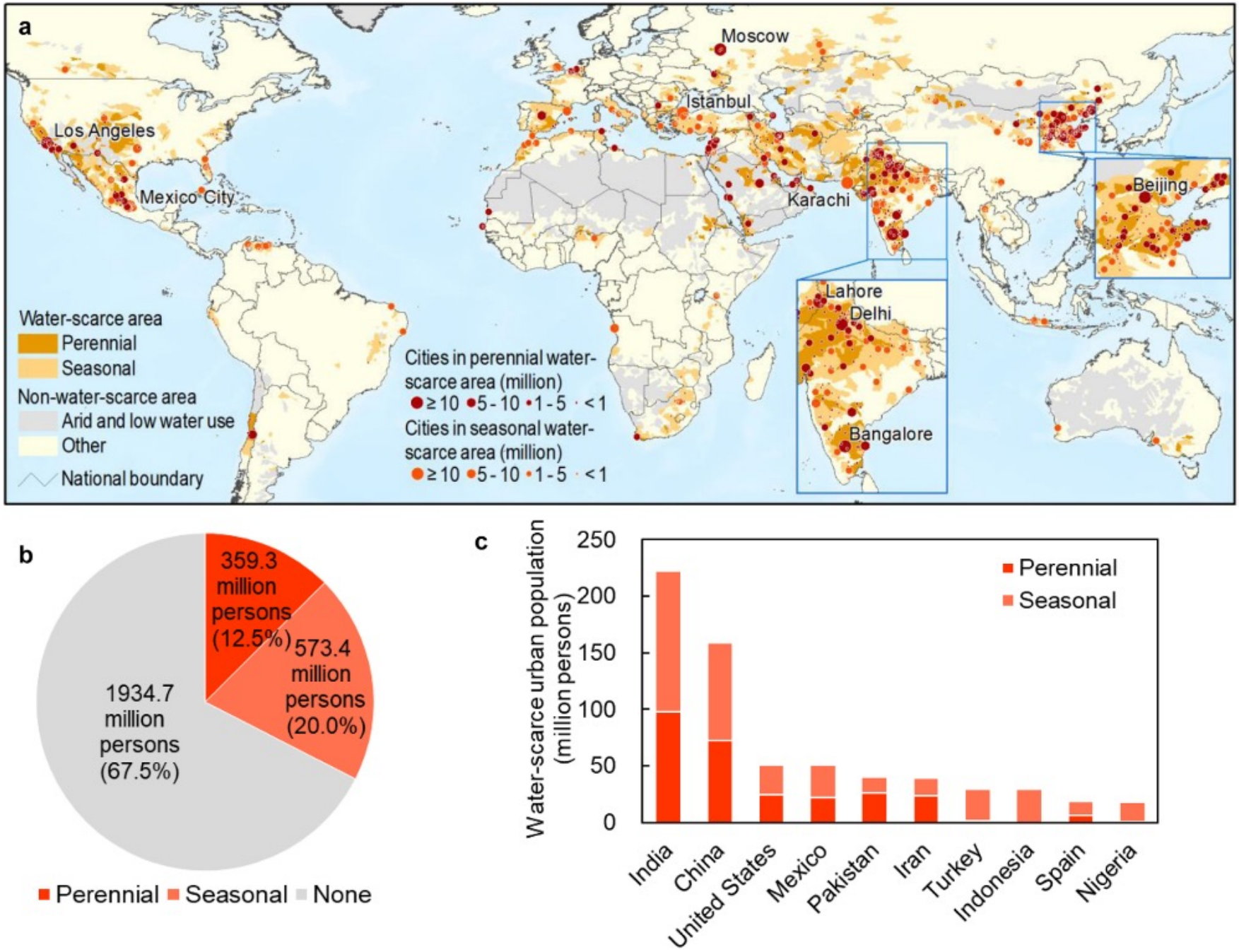
Source: https://www.hamburgwasser.de

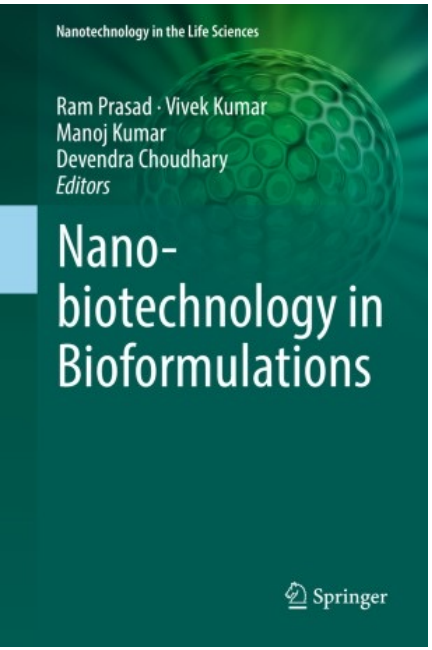
KLIMAWANDEL UND TROCKENHEIT

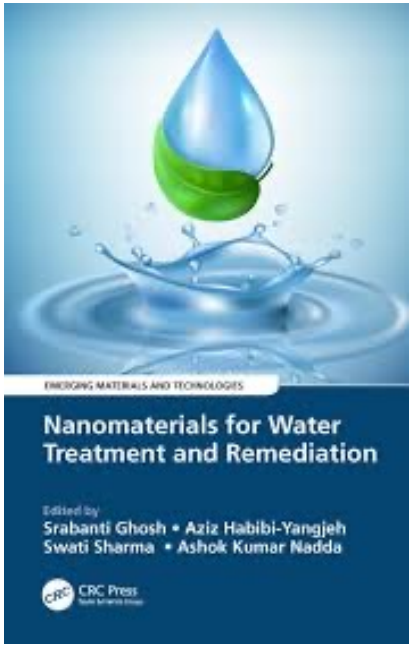
Hamburg appelliert an seine Bürger: Spart Wasser

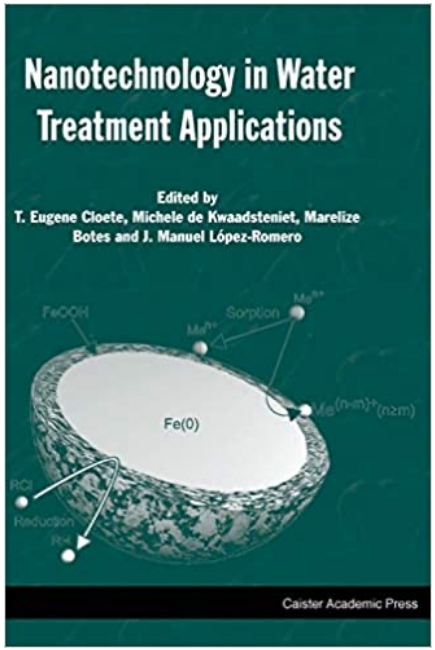
von **Markus Lorenz** 06. Mai 2021, 17:10 Uhr

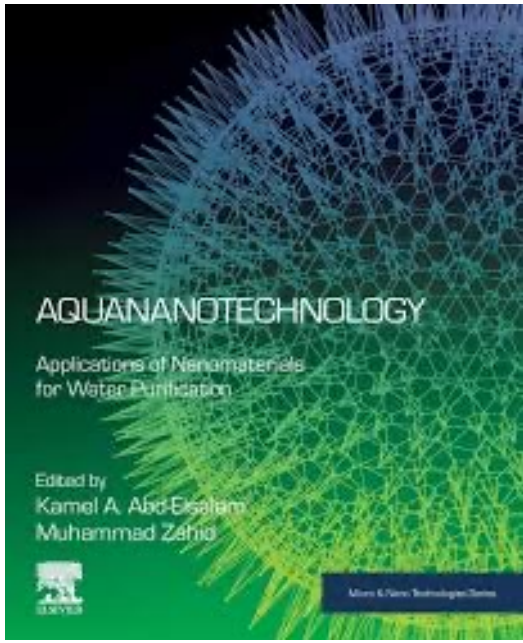
Belüftungspilz im Wasserwerk Hamburg-Walddörfer.


a
Moscow
Istanbul
Los Angeles
Mexico City
Karachi
Beijing
Lahore
Delhi
Bangalore
Water-scarce area
Perennial
Seasonal
Non-water-scarce area
Arid and low water use
Other
National boundary
Cities in perennial water-scarce area (million)
≥10 5-10 1-5 <1
Cities in seasonal water-scarce area (million)
≥10 5-10 1-5 <1
b
359.3 million persons (12.5%)
573.4 million persons (20.0%)
1934.7 million persons (67.5%)
Perennial
Seasonal
None
c
Water-scarce urban population (million persons)
250
200
150
100
50
0
Perennial
Seasonal
India
China
United States
Mexico
Pakistan
Iran
Turkey
Indonesia
Spain
Nigeria


Nanotechnology in the Life Sciences
Ram Prasad · Vivek Kumar
Manoj Kumar
Devendra Choudhary
Editors
Nano-biotechnology in Bioformulations
Springer


EMERGING MATERIALS AND TECHNOLOGIES
Nanomaterials for Water Treatment and Remediation
Edited by
Srabanti Ghosh • Aziz Habibi-Yangjeh
Swati Sharma • Ashok Kumar Nadda
CRC Press


Nanotechnology in Water Treatment Applications
Edited by
T. Eugene Cloete, Michele de Kwaadsteniet, Marelize Botes and J. Manuel López-Romero
FeOOH
Sorption
Fe(0)
Caister Academic Press


AQUANANOTECHNOLOGY
Applications of Nanomaterials for Water Purification
Edited by
Kamel A. Abd-Elsalam
Muhammad Zahid

Deutschlandfunk

Montag, 13.09.2021

Die Nachrichten Politik Wirtschaft Wissen Kultur Europa Gesellschaft Sport LIVE

Startseite › Umwelt und Verbraucher › Angst vor Nanomaterialien › 29.02.2008

Angst vor Nanomaterialien

Diskussion über neue Grenzwerte für giftige Stoffe

Während die einen glänzende Augen bekommen, wenn es um den Einsatz von Nanomaterialien geht, tritt anderen der Angstschweiß auf die Stirn. Denn diese Teilchen, die unter anderem in Sonnencremes, in Lacken, Farben und in Reinigungsprodukten vorkommen, können unter Umständen auch Schäden in Körperzellen anrichten.

Von Arndt Reuning

Auch einige Sonnencremes enthalten Nanoteilchen. (AP)

Drinking Water

DIN EN 806-2

Specification for installations inside buildings conveying water for human consumption - Part 2: Design

Swimming Water

DIN 19643-2

Treatment of Water of swimming pools and baths

Irrigation Water

DIN 19650

Hygiene parameters for irrigation water

Source: German Institute for Standardization


U. S. VERMA
D54
अधिशासी अभियन्ता दिल्ली जल बोर्ड दिल्ली सरकार निःशुल्क जल सेवा
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Table 8.16 Guideline values for chemicals used in water treatment or materials in contact with drinking-water that are of health significance in drinking-water

Chemical	Guideline value[a] µg/l	mg/l	Remarks
Disinfectants			
Chlorine	5 000 (C)	5 (C)	For effective disinfection, there should be a residual concentration of free chlorine of ≥ 0.5 mg/l after at least 30 min contact time at pH < 8.0. A chlorine residual should be maintained throughout the distribution system. At the point of delivery, the minimum residual concentration of free chlorine should be 0.2 mg/l.
Monochloramine	3 000	3	
Sodium dichloroisocyanurate	50 000	50	As sodium dichloroisocyanurate
	40 000	40	As cyanuric acid
Disinfection by-products			
Bromate	10[a] (A, T)	0.01[a] (A, T)	
Bromodichloromethane	60[a]	0.06[a]	
Bromoform	100	0.1	
Chlorate	700 (D)	0.7 (D)	
Chlorite	700 (D)	0.7 (D)	
Chloroform	300	0.3	
Dibromoacetonitrile	70	0.07	
Dibromochloromethane	100	0.1	
Dichloroacetate	50[a] (D)	0.05[a] (D)	
Dichloroacetonitrile	20 (P)	0.02 (P)	
N-Nitrosodimethylamine	0.1	0.0001	
Trichloroacetate	200	0.2	
2,4,6-Trichlorophenol	200[a] (C)	0.2[a] (C)	
Trihalomethanes			The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1
Contaminants from treatment chemicals			
Acrylamide	0.5[a]	0.0005[a]	
Epichlorohydrin	0.4 (P)	0.0004 (P)	
Contaminants from pipes and fittings			
Antimony	20	0.02	
Benzo[*a*]pyrene	0.7[a]	0.0007[a]	
Copper	2000	2	Staining of laundry and sanitary ware may occur below guideline value
Lead	10 (A, T)	0.01 (A, T)	
Nickel	70	0.07	
Vinyl chloride	0.3[a]	0.0003[a]	

INDIAN STANDARD SPECIFICATIONS FOR DRINKING WATER IS. 10500

S.NO.	Parameter	Requirement desirable Limit	Remarks
1.	Colour	5	May be extended up to 50 if toxic substances are suspected
2.	Turbidity	10	May be relaxed up to 25 in the absence of alternate
3.	pH	6.5 to 8.5	May be relaxed up to 9.2 in the absence
4.	Total Hardness	300	May be extended up to 600
5.	Calcium as Ca	75	May be extended up to 200
6.	Magnesium as Mg	30	May be extended up to 100
7.	Copper as Cu	0.05	May be relaxed up to 1.5
8.	Iron	0.3	May be extended up to 1
9.	Manganese	0.1	May be extended up to 0.5
10.	Chlorides	250	May be extended up to 1000
11.	Sulphates	150	May be extended up to 400
12.	Nitrates	45	No relaxation
13.	Fluoride	0.6 to 1.2	If the limit is below 0.6 water should be rejected, Max. Limit is extended to 1.5
14.	Phenols	0.001	May be relaxed up to 0.002
15.	Mercury	0.001	No relaxation
16.	Cadmium	0.01	No relaxation
17.	Selenium	0.01	No relaxation
18.	Arsenic	0.05	No relaxation
19.	Cyanide	0.05	No relaxation
20.	Lead	0.1	No relaxation
21.	Zinc	5.0	May be extended up to 10.0
22.	Anionic detergents (MBAS)	0.2	May be relaxed up to 1
23.	Chromium as Cr^{+6}	0.05	No relaxation
24.	Poly nuclear aromatic Hydrocarbons	--	--
25.	Mineral Oil	0.01	May be relaxed up to 0.03
26.	Residual free Chlorine	0.2	Applicable only when water is chlorinated
27.	Pesticides	Absent	--
28.	Radio active	--	--

WHO guideline values

Indian standard

6 CLEAN WATER AND SANITATION

ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

BEFORE COVID-19

DESPITE PROGRESS,

BILLIONS STILL LACK

WATER AND SANITATION SERVICES

2.2 BILLION PEOPLE
LACK SAFELY MANAGED DRINKING WATER
(2017)

4.2 BILLION PEOPLE
LACK SAFELY MANAGED SANITATION
(2017)

TWO IN FIVE
HEALTH CARE FACILITIES WORLDWIDE HAVE
NO
SOAP AND WATER OR ALCOHOL-BASED HAND RUB
(2016)

COVID-19 IMPLICATIONS

3 BILLION
PEOPLE WORLDWIDE
LACK BASIC HANDWASHING FACILITIES AT HOME

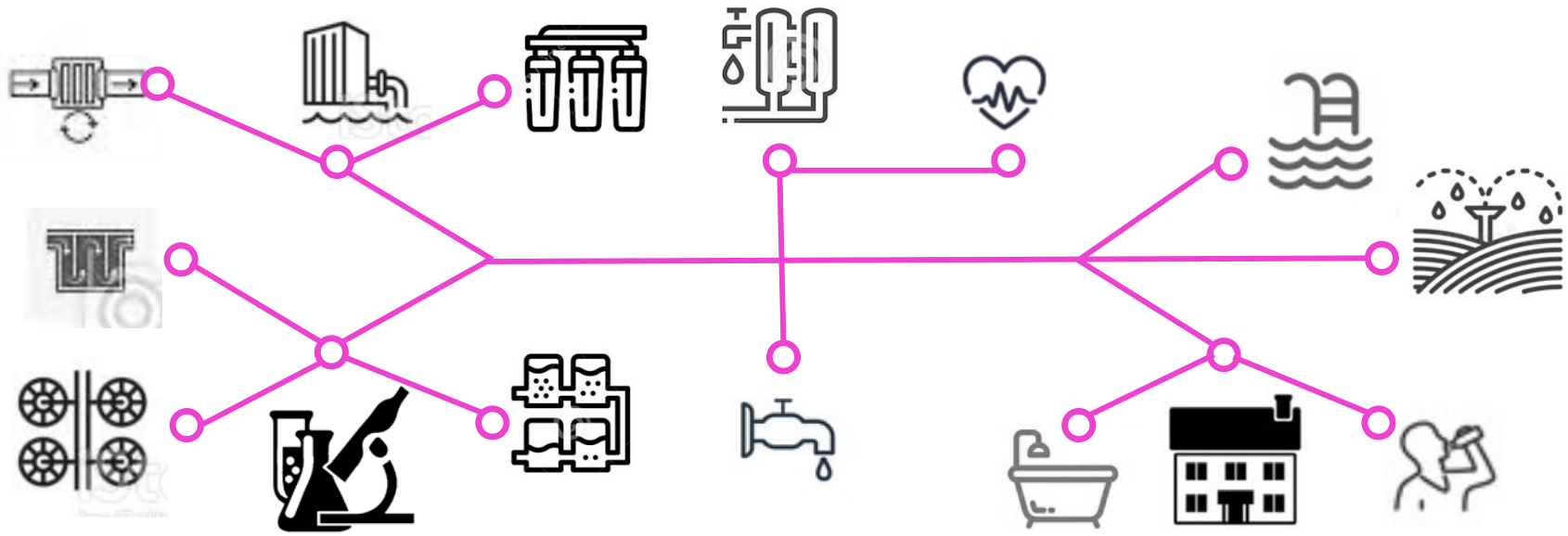
THE MOST EFFECTIVE METHOD FOR **COVID-19 PREVENTION**

WATER SCARCITY
COULD DISPLACE
700 MILLION PEOPLE
BY 2030

SOME COUNTRIES EXPERIENCE
A FUNDING GAP OF 61% FOR ACHIEVING
WATER AND SANITATION TARGETS

SUSTAINABLE DEVELOPMENT GOALS

ACCESS MORE DATA AND INFORMATION ON THE INDICATORS AT HTTPS://UNSTATS.UN.ORG/SDGS/REPORT/2020/



ISO 24512:2007(en) Activities relating to drinking water and wastewater services — Guidelines for the management of drinking water utilities a

Available in: EN FR ES

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

accuracy

closeness of agreement between a measure and the accepted reference value

Note 1 to entry: The term "accuracy", when applied to a set of measures, involves a combination of random components and a common systematic error or bias component.

Note 2 to entry: Adapted from ISO 5725-1:1994.

2.2

affordability

ability to be economically bearable for the **users** (2.50)

Note 1 to entry: The affordability can be estimated through the degree to which charges for **services** (2.44) can be paid by targeted social groups of users without significant adverse economic or social impact, taking into account allowances for subsidies and payment assistance programmes for low-income users.

2.3

assessment

process (2.31), or result of this process, comparing a specified subject matter to relevant references

2.4

asset

capital-forming goods used for the provision of the **service** (2.44)

Note 1 to entry: Assets can be tangible or intangible. Examples of tangible assets are: land, buildings, pipes, wells, tanks, treatment plants, equipment, hardware. Examples of intangible assets are: software, databases.

Note 2 to entry: Contrary to consumables, assets can be depreciated in accounting systems.

2.5

asset management

processes (2.31) that enable a **water utility** (2.53) to direct, control and optimize the provision, **maintenance** (2.19) and disposal of **infrastructure** (2.17), **assets** (2.4), including the necessary costs for specified **performances** (2.24), over their life-cycle

2.6

availability

extent to which the **infrastructure** (2.17), **assets** (2.4), resources and employees of a **water utility** (2.53) enable effective provision of **services** (2.44) to **users** (2.50) according to specified **performances** (2.24)

2.7

community

one or more natural or legal persons and, in accordance with national legislation or practice, their associations, organizations or groups, having interests in the area where the **service** (2.44) is provided

2.8

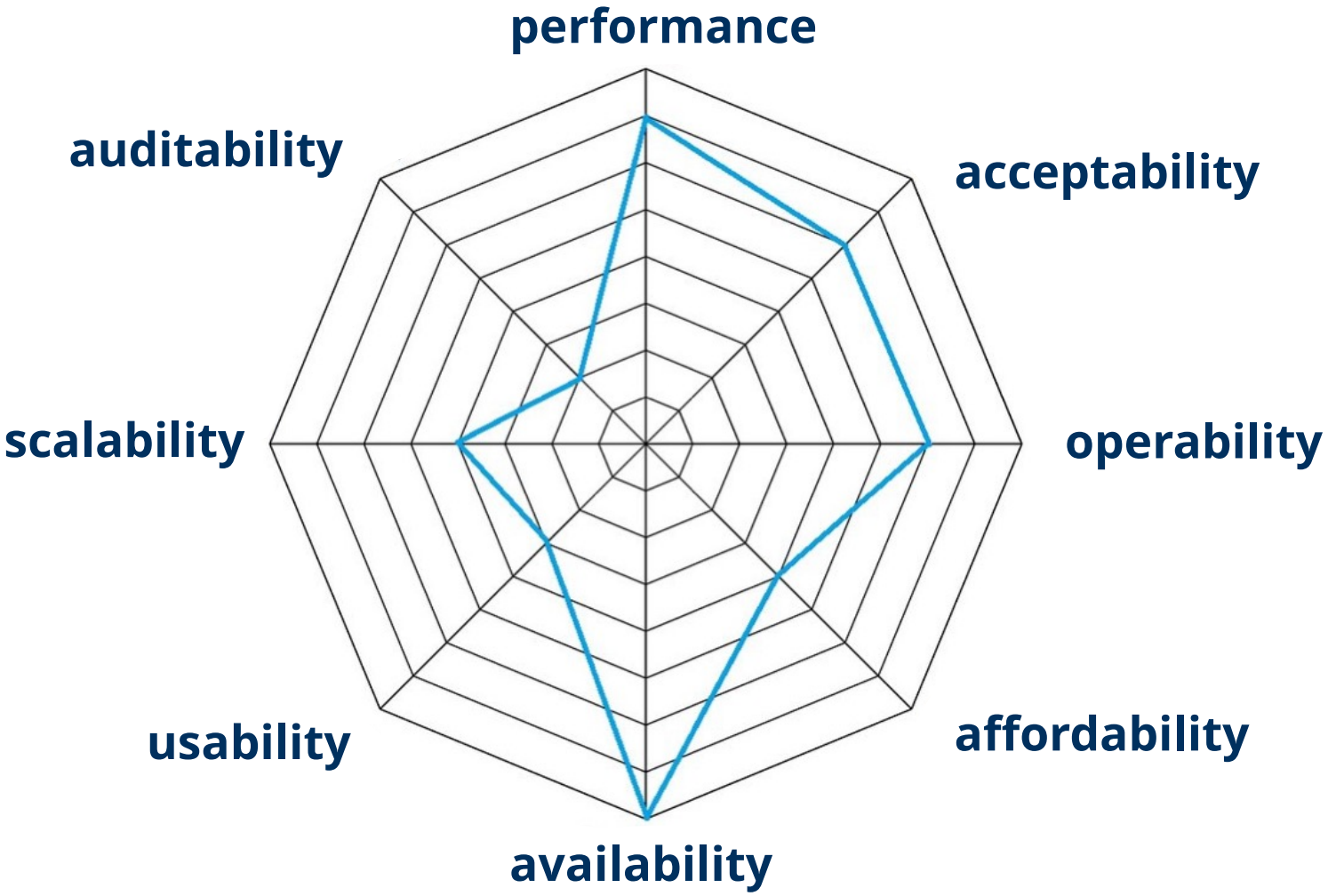
confidence grade

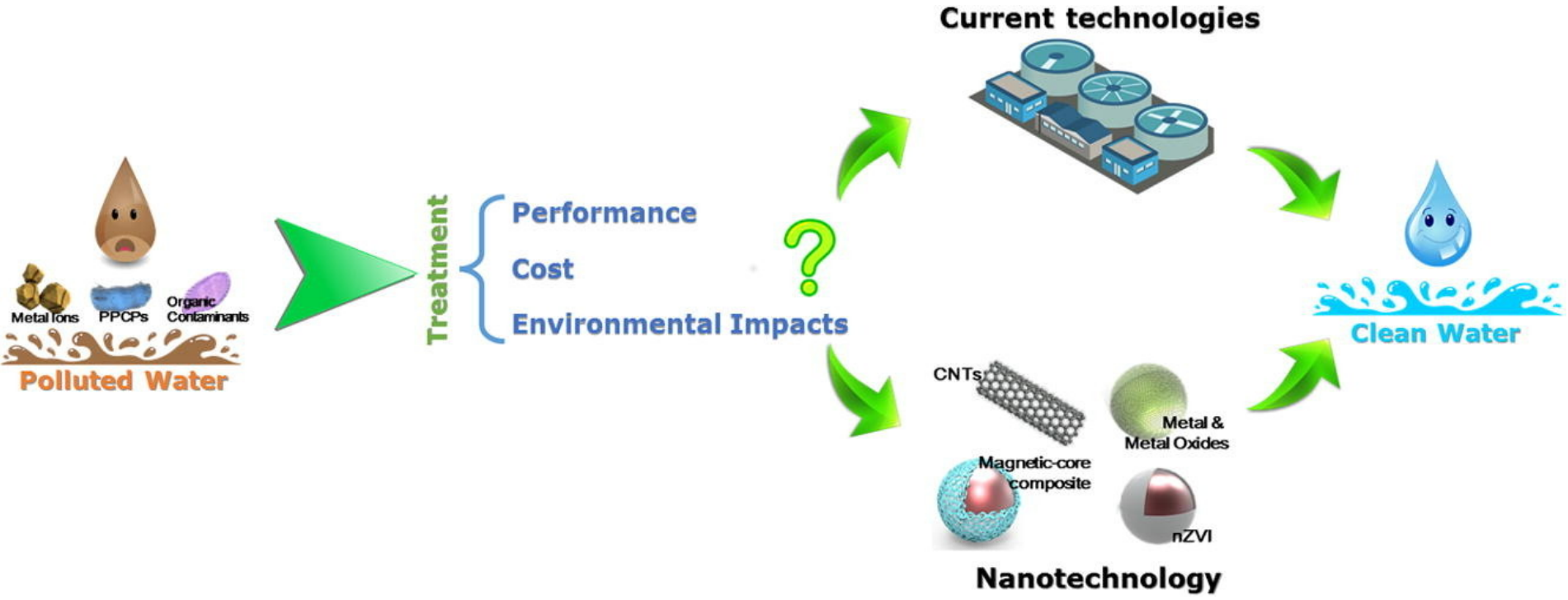
assessment (2.3) of the **quality** (2.32) in terms of **accuracy** (2.1) and **reliability** (2.37)

2.9

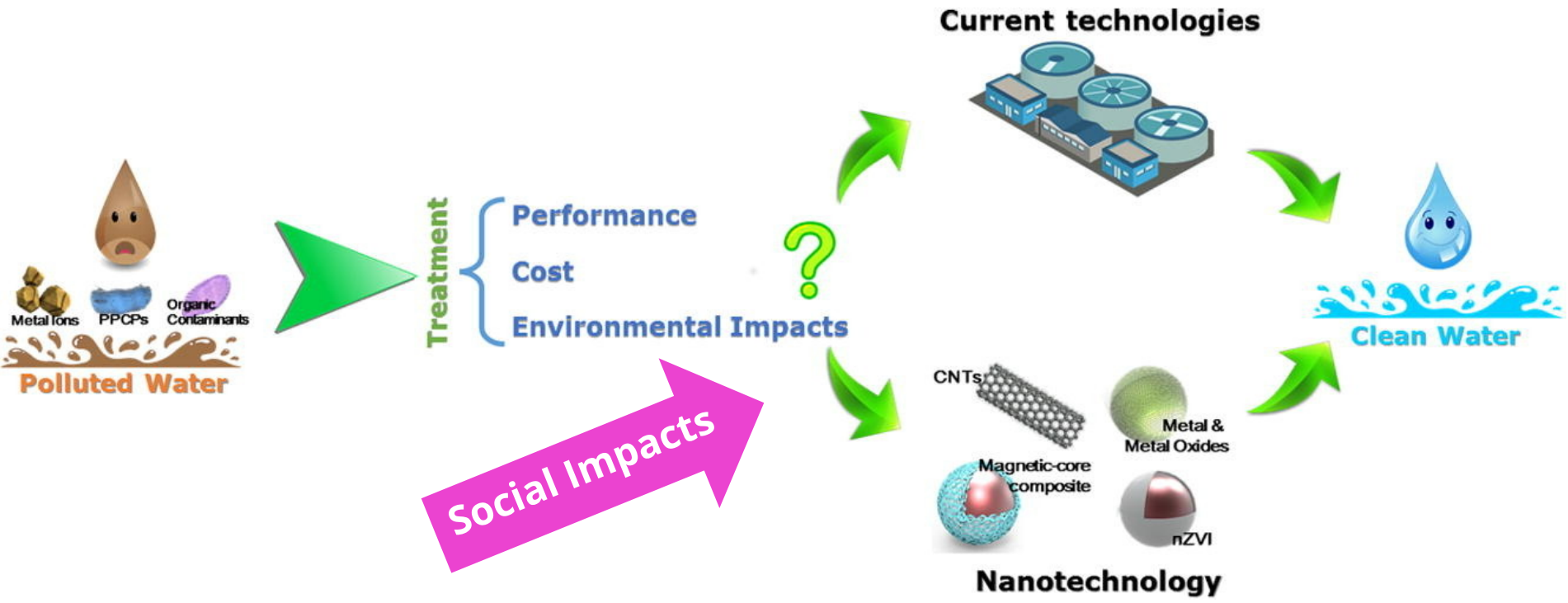
connection

set of physical components ensuring the link between a **point-of-delivery** (2.26) and the local water main or the **point-of-collection** (2.25) and the sewer

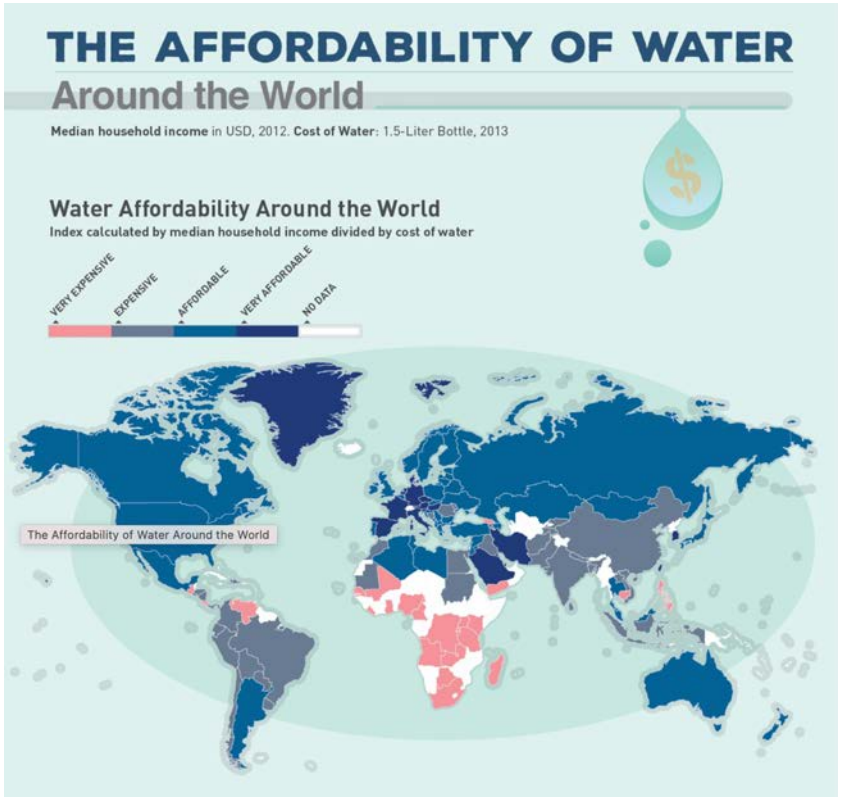

performance
acceptability
operability
affordability
availability
usability
scalability
auditability

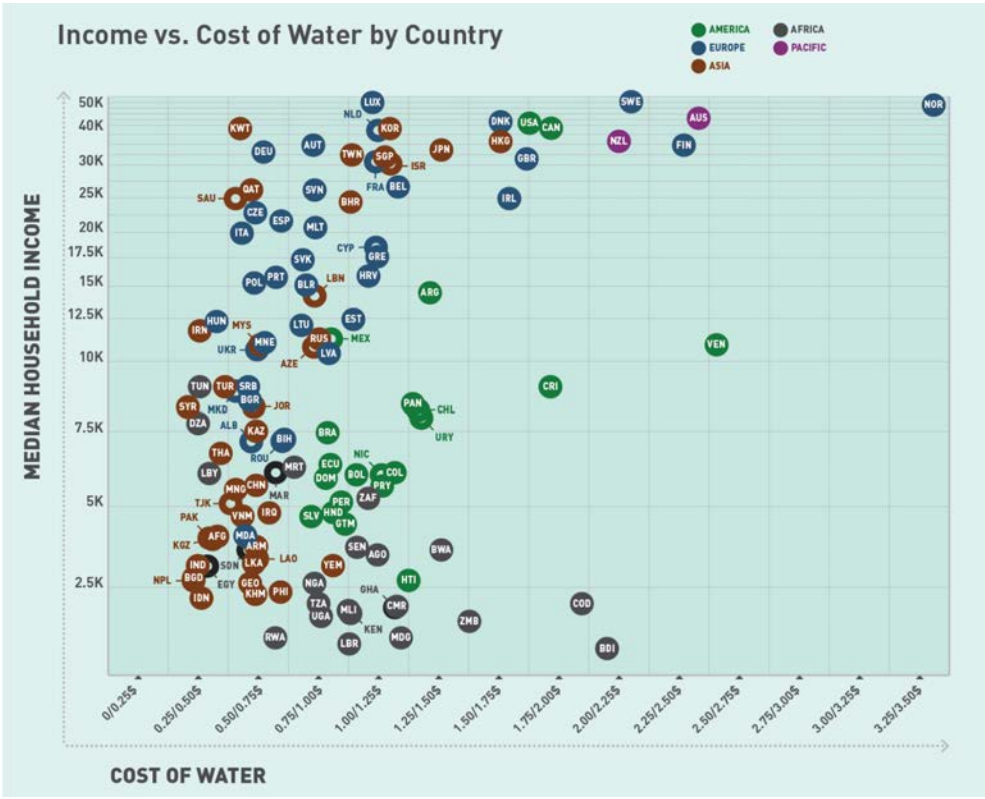


Source: Adeyemi S. Adeleye, Jon R. Conway, Kendra Garner, Yuxiong Huang, Yiming Su, Arturo A. Keller, **Engineered nanomaterials for water treatment and remediation: Costs, benefits, and applicability**, Chemical Engineering Journal, Volume 286, 2016, Pages 640-662, ISSN 1385-8947, https://doi.org/10.1016/j.cej.2015.10.105.



Source: Adeyemi S. Adeleye, Jon R. Conway, Kendra Garner, Yuxiong Huang, Yiming Su, Arturo A. Keller, Engineered nanomaterials for water treatment and remediation: Costs, benefits, and applicability, Chemical Engineering Journal, Volume 286, 2016, Pages 640-662, ISSN 1385-8947, https://doi.org/10.1016/j.cej.2015.10.105.



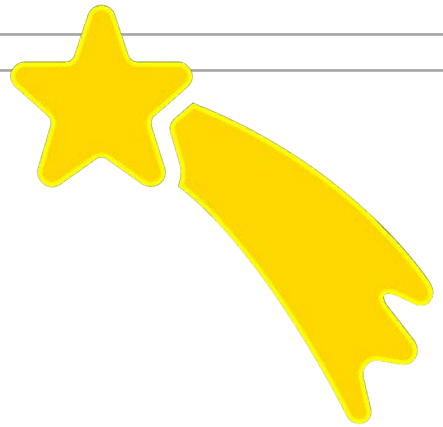


Sources:
http://news.gallup.com/poll/166211/worldwide-median-household-income-000.aspx
http://www.nationmaster.com/country-info/stats/Cost-of-living/Prices-at-markets/Water/1.5-litre-bottle
https://www.numbeo.com/cost-of-living/rankings_by_country.jsp

Table 8.7 Naturally occurring chemicals for which guideline values have not been established

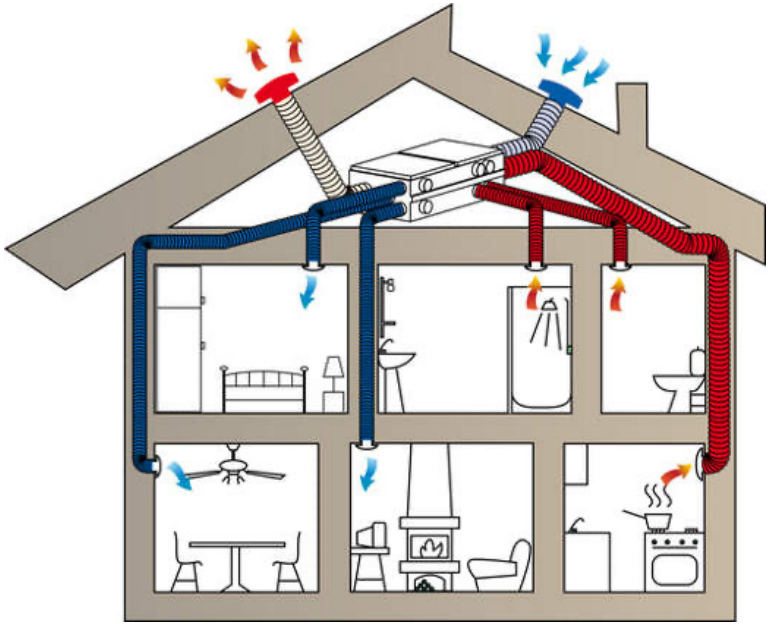
Chemical	Reason for not establishing a guideline value	Remarks
Bromide	Occurs in drinking-water at concentrations well below those of health concern	
Chloride	Not of health concern at levels found in drinking-water	May affect acceptability of drinking-water (see chapter 10)
Hardness	Not of health concern at levels found in drinking-water	May affect acceptability of drinking-water (see chapter 10)
Hydrogen sulfide	Not of health concern at levels found in drinking-water	May affect acceptability of drinking-water (see chapter 10)
Iron	Not of health concern at levels causing acceptability problems in drinking-water	May affect acceptability of drinking-water (see chapter 10)
Manganese	Not of health concern at levels normally causing acceptability problems in drinking-water. However, there are circumstances where manganese may remain in solution at higher concentrations in some acidic or anaerobic waters, particularly groundwater	May affect acceptability of drinking-water (see chapter 10)
Molybdenum	Occurs in drinking-water at concentrations well below those of health concern	
pH	Not of health concern at levels found in drinking-water	An important operational water quality parameter
Potassium	Occurs in drinking-water at concentrations well below those of health concern	
Sodium	Not of health concern at levels found in drinking-water	May affect acceptability of drinking-water (see chapter 10)
Sulfate	Not of health concern at levels found in drinking-water	May affect acceptability of drinking-water (see chapter 10)
Total dissolved solids	Not of health concern at levels found in drinking-water	May affect acceptability of drinking-water (see chapter 10)

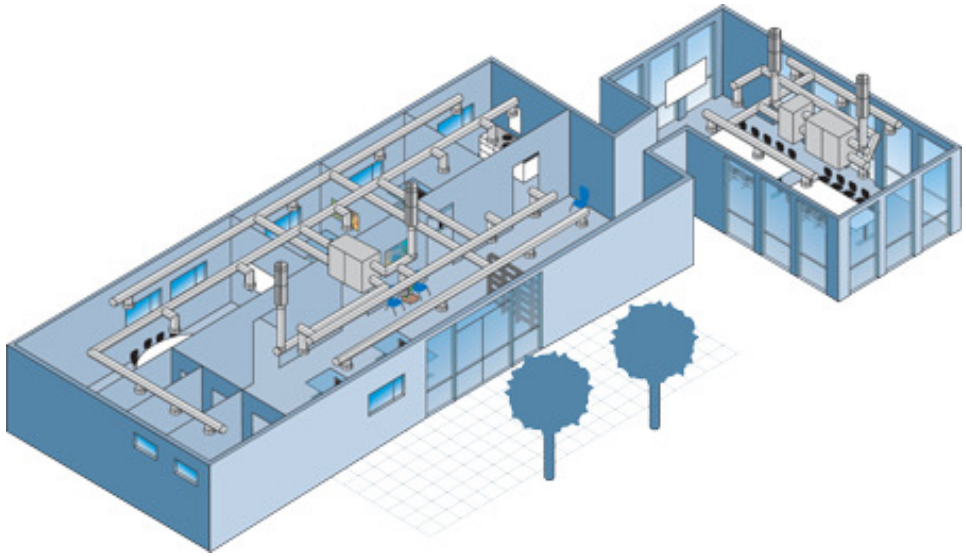
Source: WHO Guidelines for Drinking-water Quality



EXAMPLE CASE II

Application Architecture for ventilation systems with self-cleaning graphene-based air filters





Guidance on improving ventilation and indoor air quality in buildings amid the COVID-19 situation

For air-conditioned spaces with mechanical ventilation provision (e.g. office buildings, shopping malls)

- Ensure ventilation systems are in good working order
- Maximise fresh air intake
- Purge indoor air daily before occupancy
- Reduce indoor air recirculation
- Keep toilet exhaust fan running

For enclosed air-conditioned spaces without mechanical ventilation provision (e.g. retail shops with split-unit air-conditioners)

- Open doors/windows frequently
- Consider window-mounted fan systems
- Keep toilet exhaust fan running
- Ensure intact water seal in sanitary system

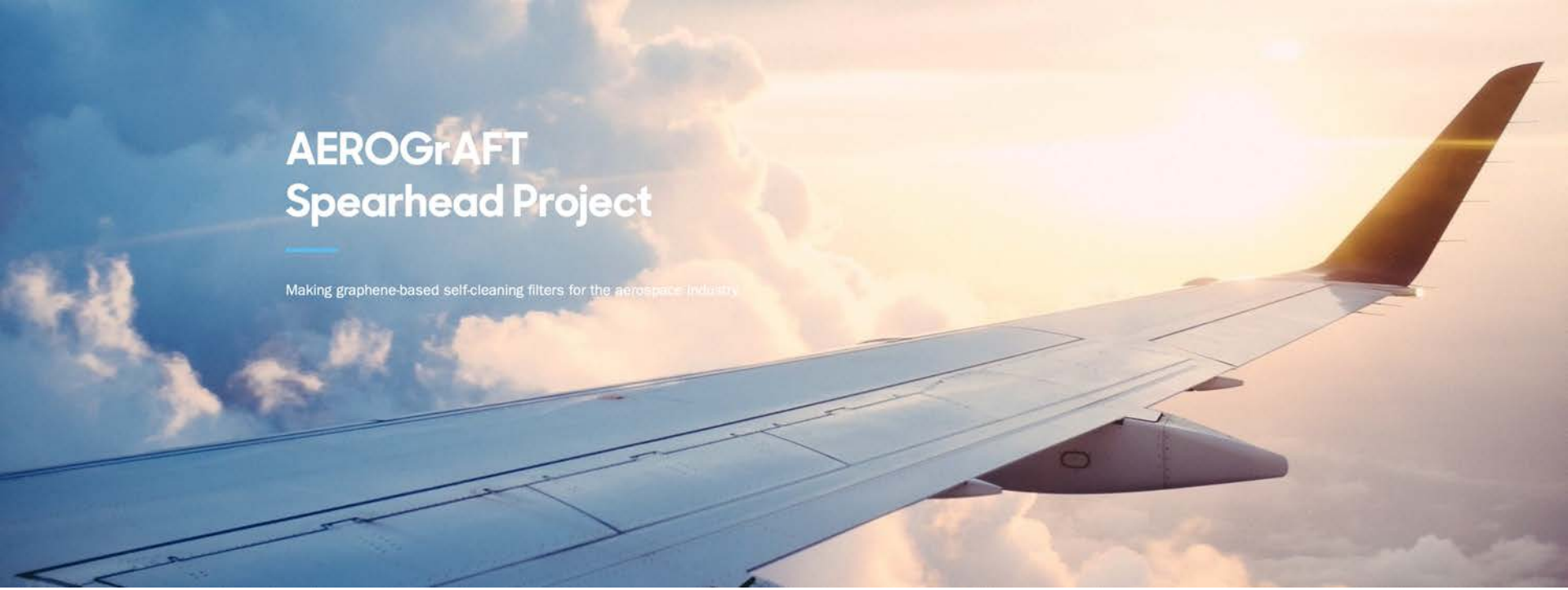
For naturally ventilated premises (e.g. coffee shops, markets, dormitories)

- Keep windows and/or doors open
- Install outward-facing fans at windows to increase ventilation
- Keep toilet exhaust fans running; consider window-mounted fans
- Ensure intact water seal in sanitary system

Building and Construction Authority

National Environment Agency

MINISTRY OF HEALTH SINGAPORE



The *AEROGrAFT* Spearhead Project, announced by the Graphene Flagship, is set to produce heatable aero-graphene foams, to reduce the cleaning time of aero-material filters in the aerospace industry, saving businesses huge sums of maintenance costs and downtime.

Developed in collaboration with Naturality Research & Development, Spain and Lufthansa Technik, Phi-Stone, and Sixonia Tech in Germany, the *AEROGrAFT* Spearhead Project is on a mission to develop prototype self-cleaning air filters that use aero-graphene foam.

Developed with graphene's homogenous heat distribution properties in mind, the graphene-enabled foam will ensure even heat throughout the air filter, to elicit a consistent cleaning across all air filter surfaces. What's more, the self-cleaning air filters can use the same graphene foam repeatedly, for recurrent cleaning cycles, without losing stability.

Lufthansa Technik

SIXONIA TECH

Phi-Stone AG

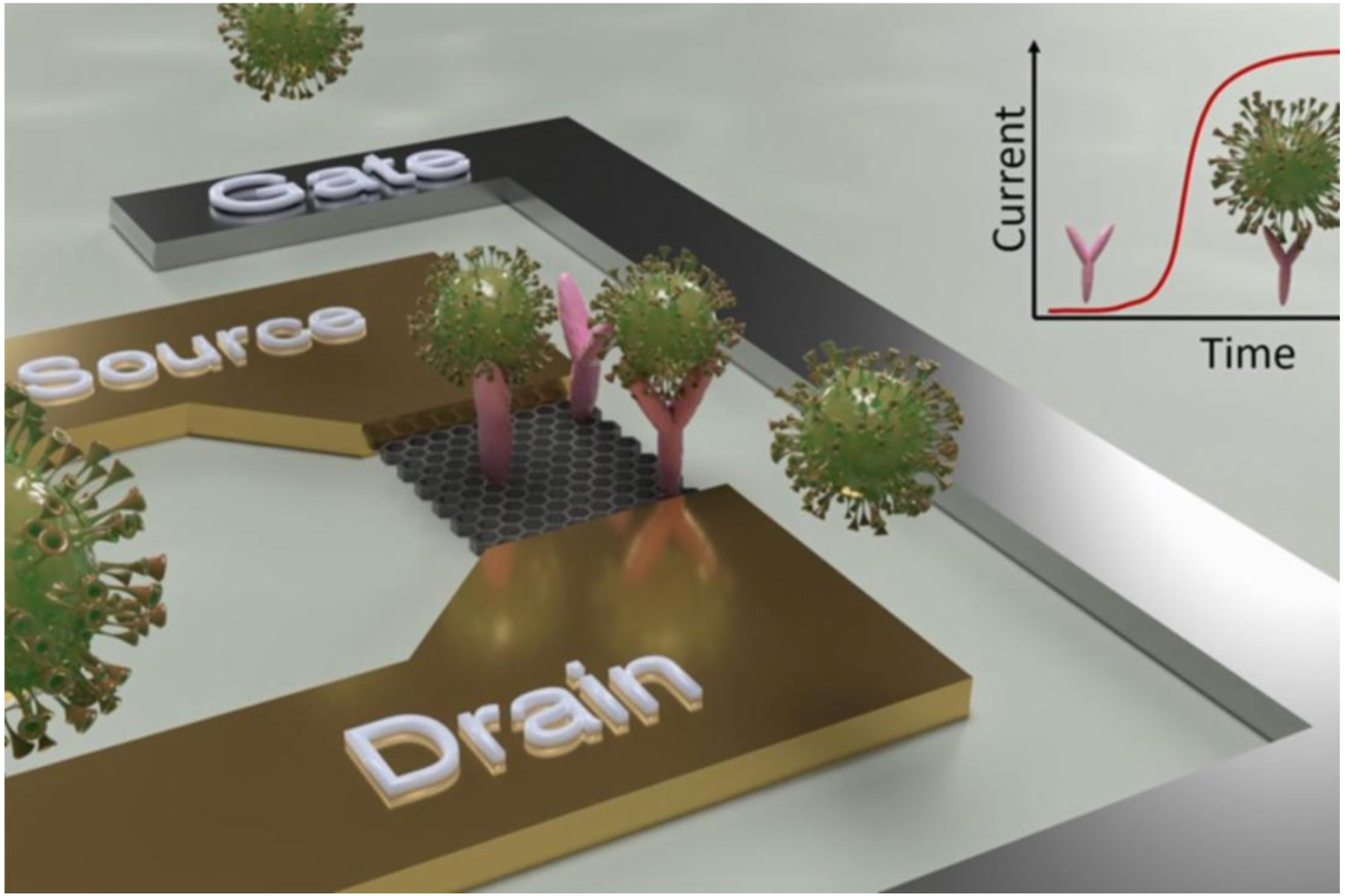
TECHNISCHE UNIVERSITÄT DRESDEN

C | A | U
Kiel University
Christian-Albrechts-Universität zu Kiel

NATURALITY ®
MICRO/NANO-EMULSION TECHNOLOGIES

Startschuss für neues Corona-Forschungsprojekt an der TU Dresden

03.08.2020, 12:47 Uhr — Erstveröffentlichung (aktuell)



Konstruktionsprinzips eines Sensors zum Direktnachweis von SARS-CoV-2-Viren Schematische Darstellung des Konstruktionsprinzips eines Sensors zum Direktnachweis von SARS-CoV-2-Viren

THANKS
for your attention!