# WANDEL

## Water resources as important factor in the energy transition at local and global scale

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WATER AS A GLOBAL RESOURCE

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# WANDEL Consortium

WANDEL
Wasserressourcen als bedeutsame Faktoren der Energiewende auf lokaler und globaler Ebene

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- Project Partners:
  - WAWI (Prof. Theobald)
  - IGB-FVB (Dr. Pusch)
  - USF (Prof. Pahl-Wostl)
  - UNU-EHS (Dr. Sebesvari)
  - WI (Dr. Viebahn)
  - KIMA (Dipl.-Ing. Boyer)
  - WAGU (Dipl. Biol. Schmidt)
  - mundialis (Dr. Neteler)

Wasserbau Kassel

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# Background: the SDGs on Water and Energy

***Transforming our world: the 2030 Agenda for Sustainable Development*** (UN, 2015)

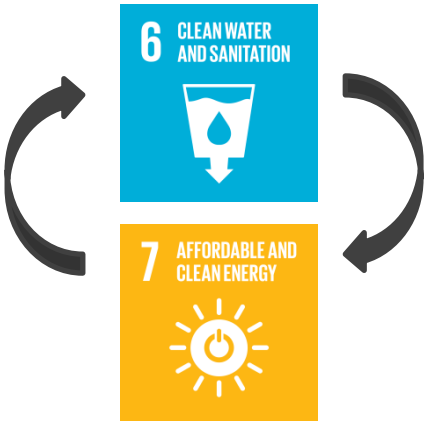
- 17 Sustainable Development Goals (SDGs), and their 169 targets, to be achieved by 2030

**Goal 6. Ensure availability and sustainable management of water and sanitation for all**

By 2030 …

6.1 … drinking water for all

6.3 … improve water quality by … halving the proportion of untreated wastewater and increasing recycling …




**Goal 7. Ensure access to affordable, reliable, sustainable and modern *energy for all***

7.1 By 2030, ensure universal access to affordable, reliable and modern energy services

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# WANDEL addresses two Key Research questions

**Realising Interactions among SDGs are crucial**

*"Actions taken to achieve one SDG may unintentionally hinder progress towards another"*

1. **Will restrictions on water availability limit the use of conventional energy systems, thereby accelerating the energy transition?**

2. **Can restrictions on water availability delay or even hinder the implementation of a global energy transition?**

- **WANDEL aims to identify trade-offs and synergies**
- **Develop strategies and practical solutions to support achievement**

# WANDEL framework

Global Level

## Energy sector

**Meta-analysis** energy, **scenarios**

X

**Direct and indirect water requirements** of different **energy technologies**

## Water sector

**Water supply scenarios based on** land-use & climate

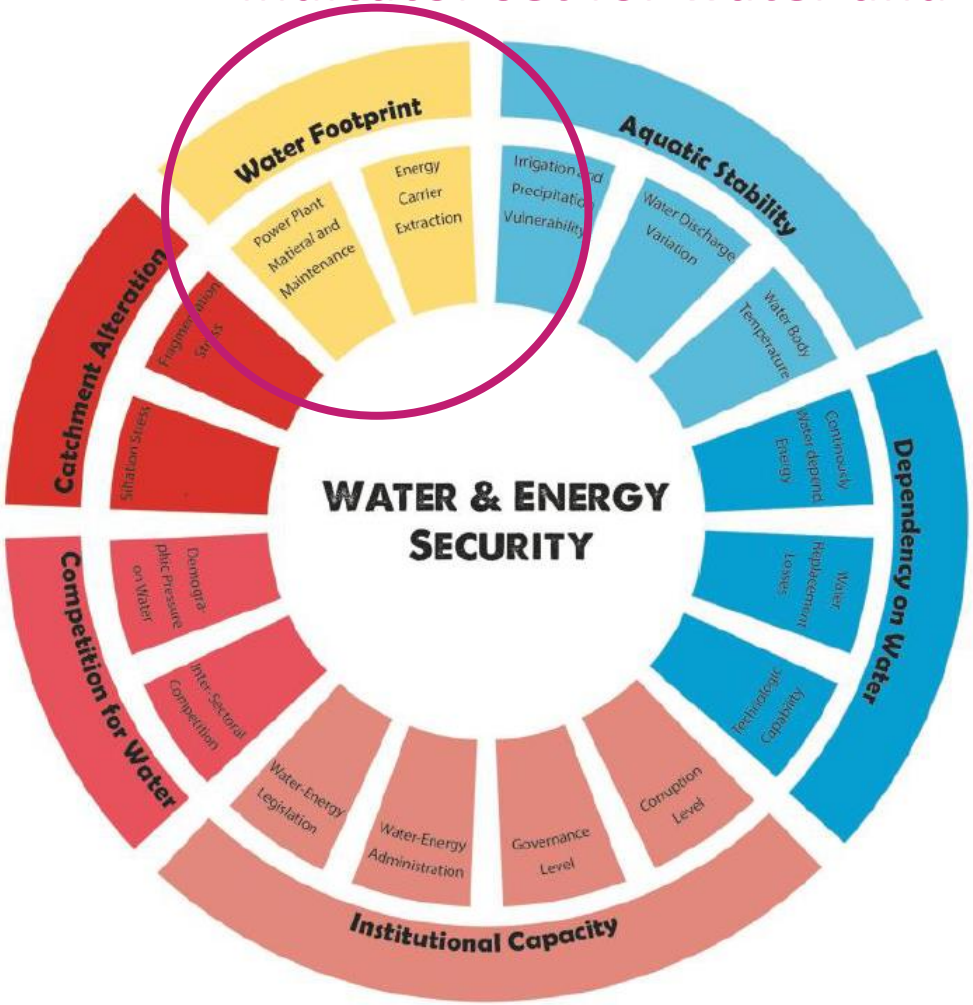
**Energy-Water-Hotspots**

Regional Level

## Regional case studies

| | |
|---|---|
| Concentrating Solar power (CSP) | Biomass |
| Large-Scale Hydro Power | Coal |

# How to address the key questions
# Indicator set for water and energy security




- Demonstrate trade-offs and synergies in the linkages between energy and water security
- Support institutes, NGOs, companies & administrations who have to deal with water and energy security
- Identification of prerequisites to rise regulation capability on local/regional and global level for achieving the combined aims

# How to address the key questions?
# The Water Footprint Concept

To identify trade-offs and synergies among SDGs

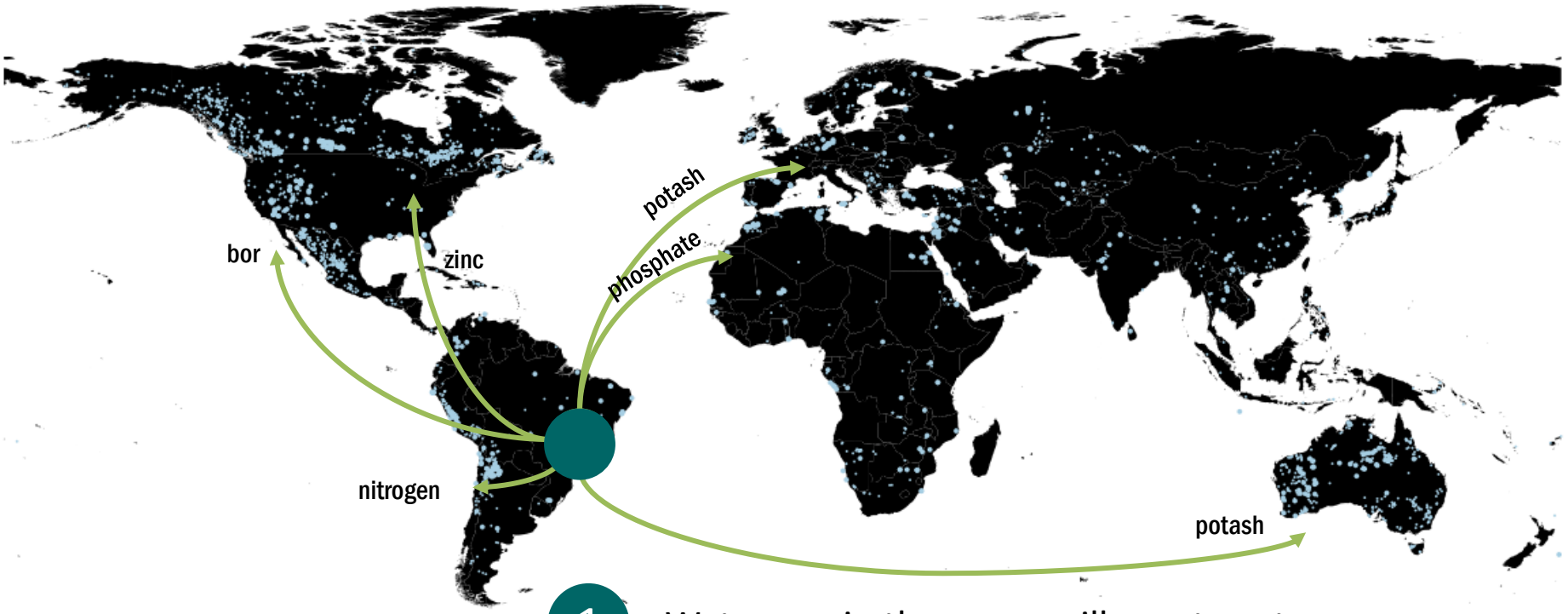
The WANDEL Water Footprint is developed to assess **direct** (on-site) and **indirect impacts** of electricity production on water resources along the energy supply chain in a spatially explicit way

# Water Footprint: accounting for direct and indirect impacts

| Human water usage | Indicator | Impact category |
|---|---|---|
| extraction of surface water | volume of withdrawal | **direct impact on water availability (wa)** |
| extraction of groundwater | | |
| retention of natural water flows by means of damming | volume of retention | **direct impact on wa** for downstream users |
| | volume of evaporation | |
| emission of energy to water (heating) | virtual dilution volume | direct reduction of quality for downstream users (**direct & indirect impact on wa**) |
| emission of material to water (pollution) | | |
| usage of rainwater through change of land cover | Δ ET (natural coverage vs. human induced coverage) | **Indirect impact on wa** in consequence of land use change |

# Case study Brazil

## Water Footprint Concept: accounting for direct and indirect impacts




1. Water use in the sugar mill; wastewater
2. Water use for sugar cane irrigation; water quality
3. Water use for fertilizer demand (bor, nitrogen phosphate, potash, zinc); water use & water pollution

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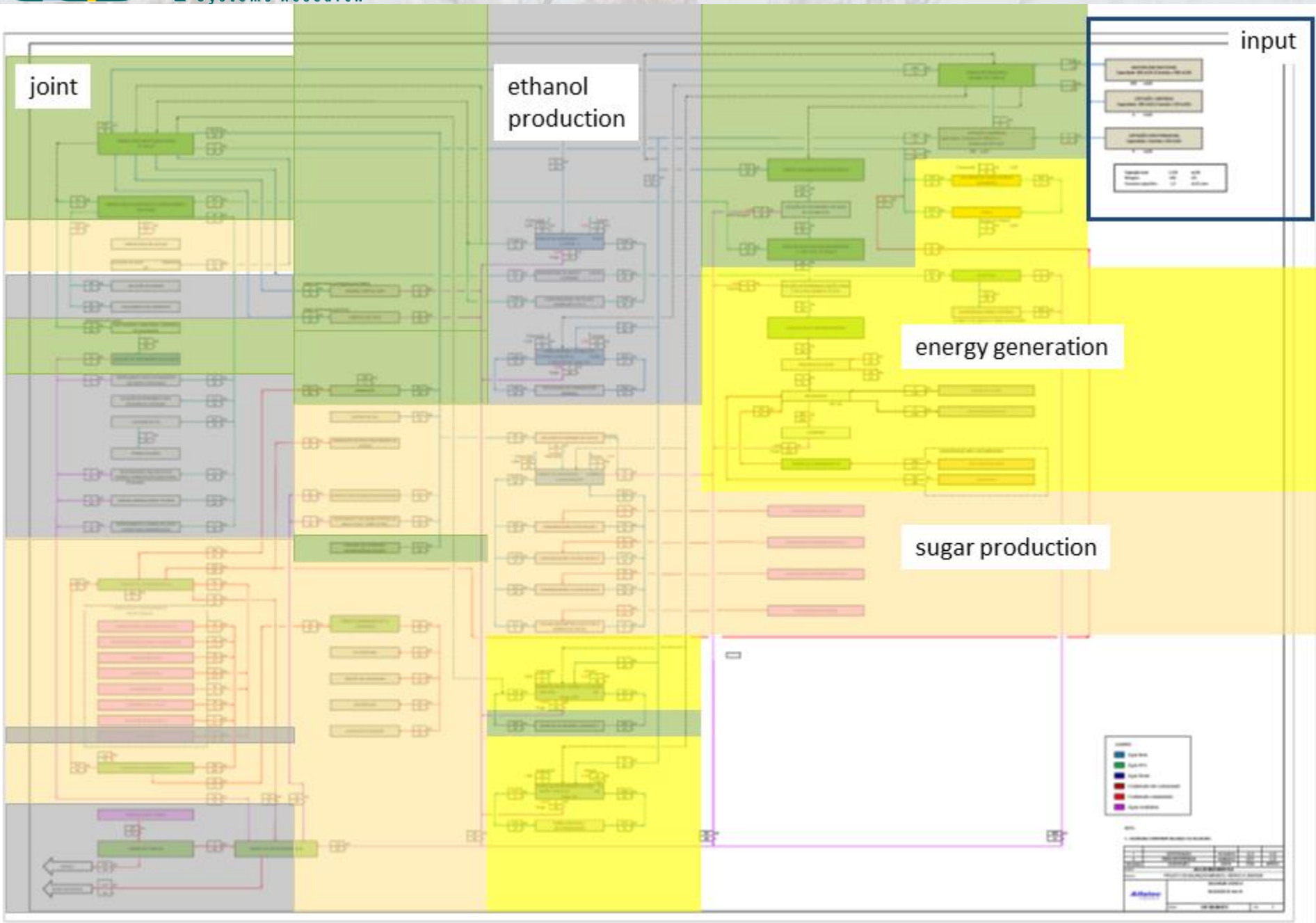
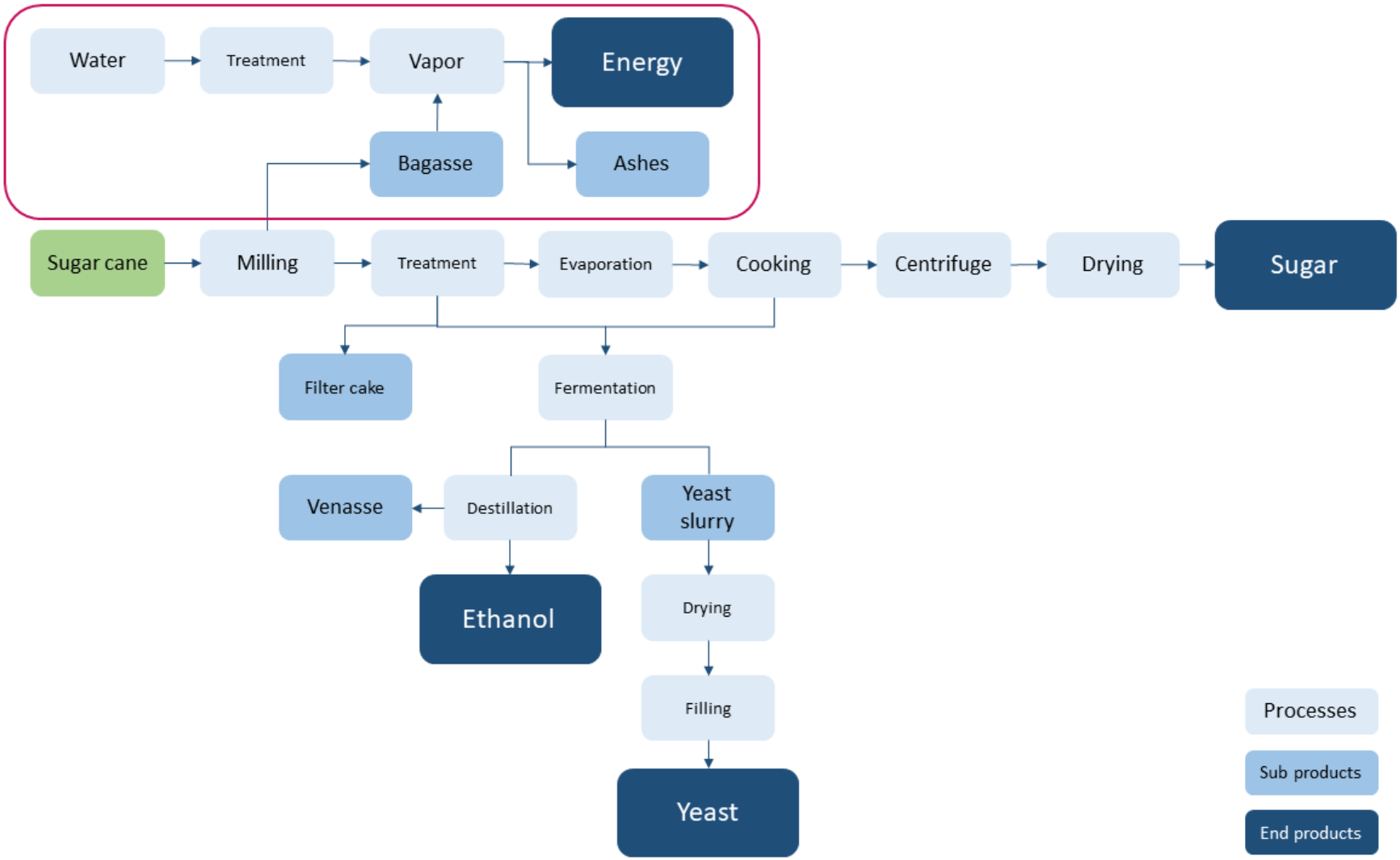
# Case study Brazil: Water use in the sugar mill



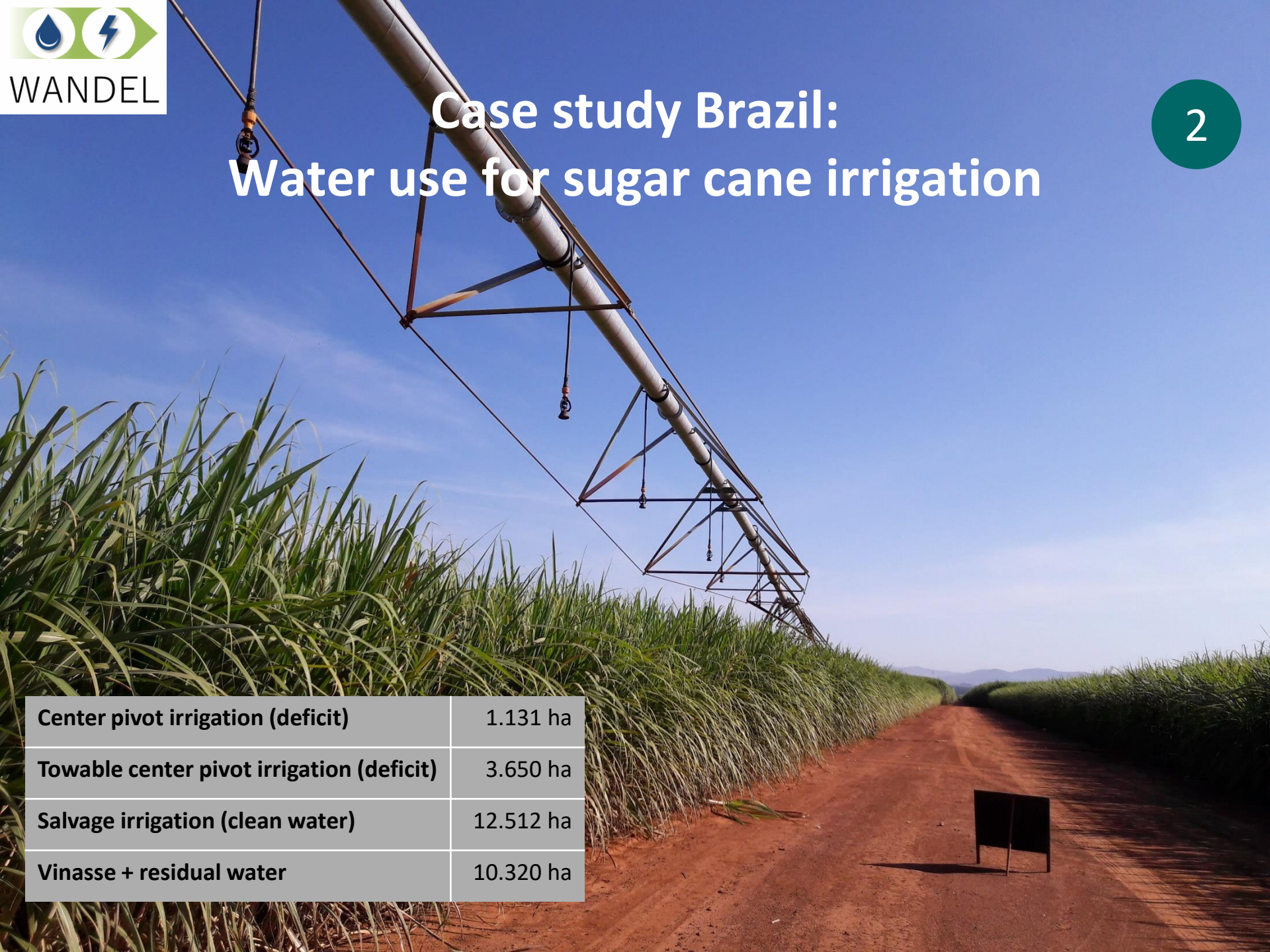

joint
ethanol production
energy generation
sugar production
input

# Water used in the sugar mill – causing direct impacts



# Case study Brazil:
# Water use for sugar cane irrigation

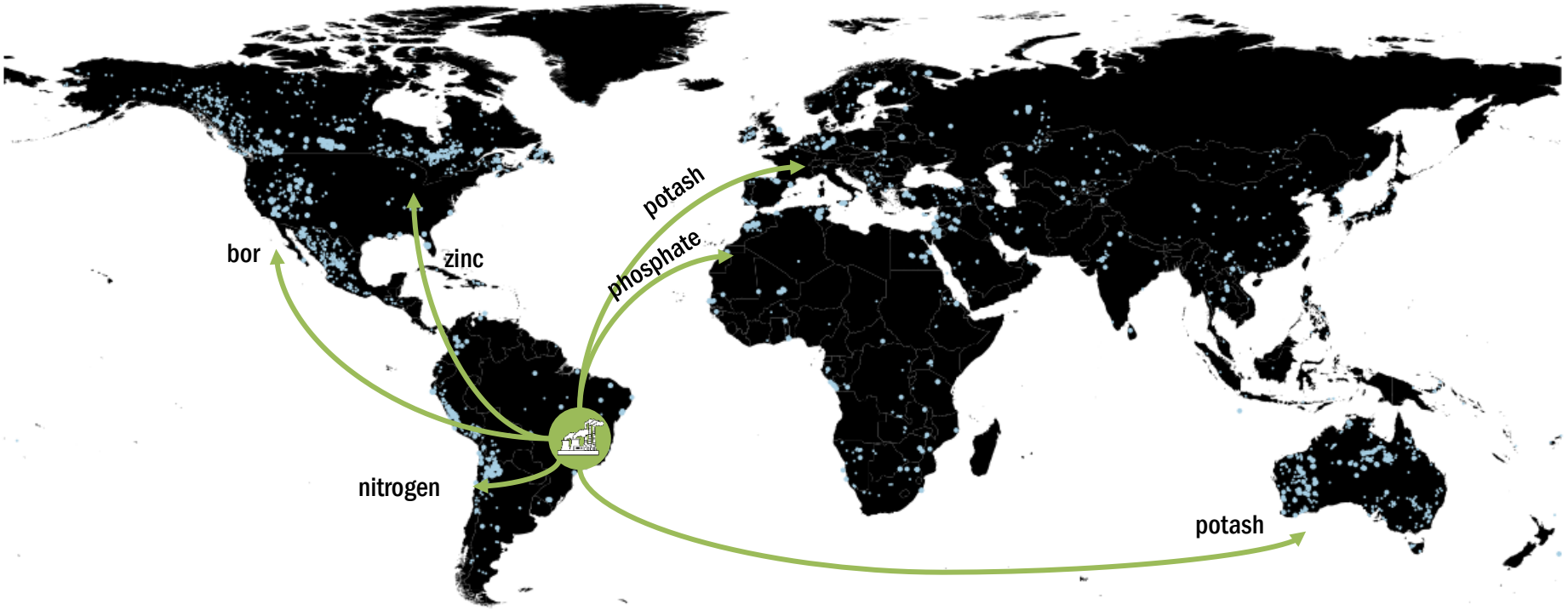




| | |
|---|---|
| **Center pivot irrigation (deficit)** | 1.131 ha |
| **Towable center pivot irrigation (deficit)** | 3.650 ha |
| **Salvage irrigation (clean water)** | 12.512 ha |
| **Vinasse + residual water** | 10.320 ha |

3

# Case study Brazil
# Water use for fertilizer demand and impacts on water quality

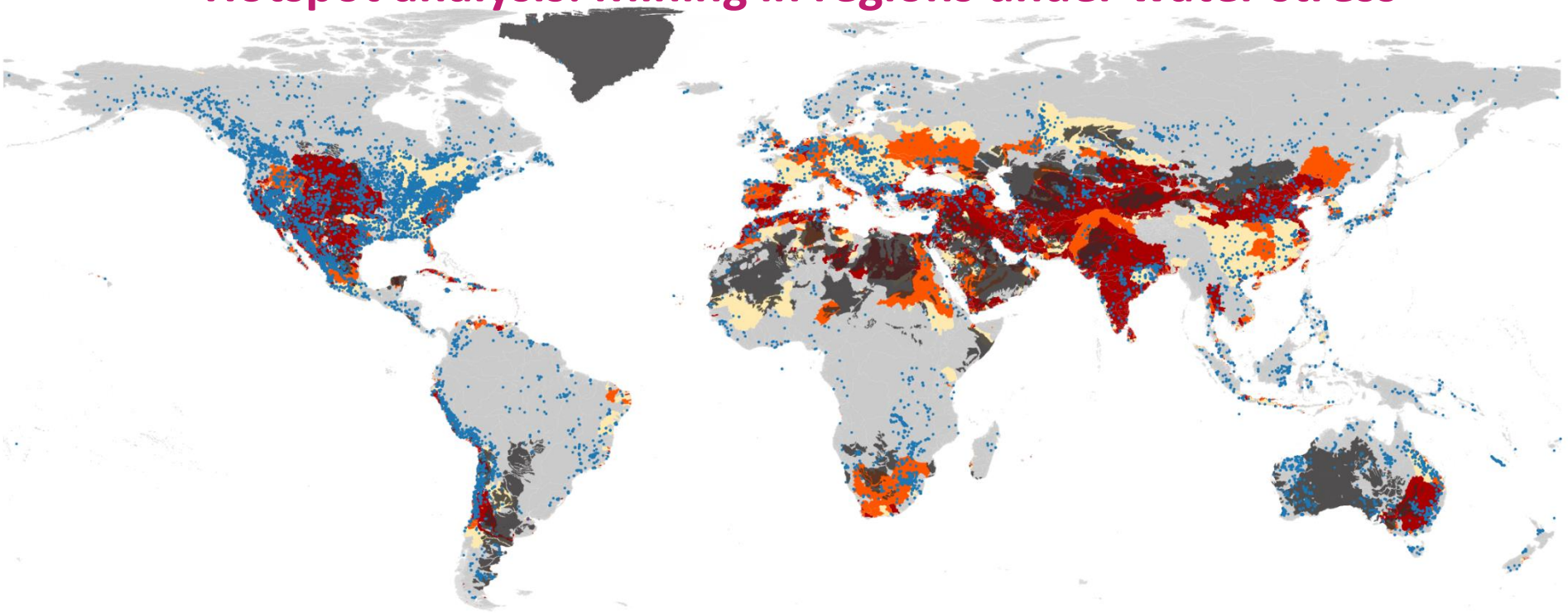



3 Fertilizer demand (bor, nitrogen, phosphate, potash, zinc); water use & water pollution

# Local partners = key actors

Pictures by Zita Sebesvari, UNU-EHS

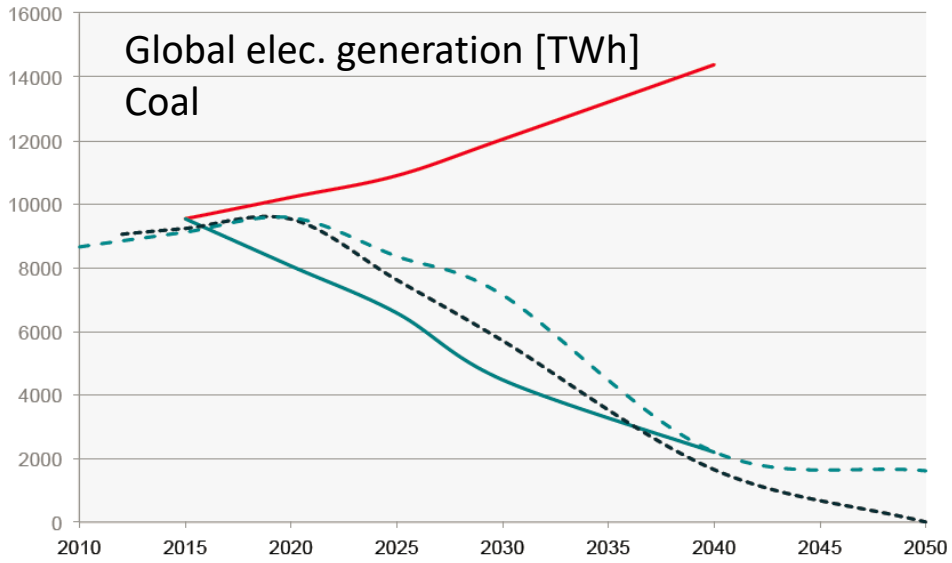
# Work in progress
# Hotspot analysis: Mining in regions under water stress

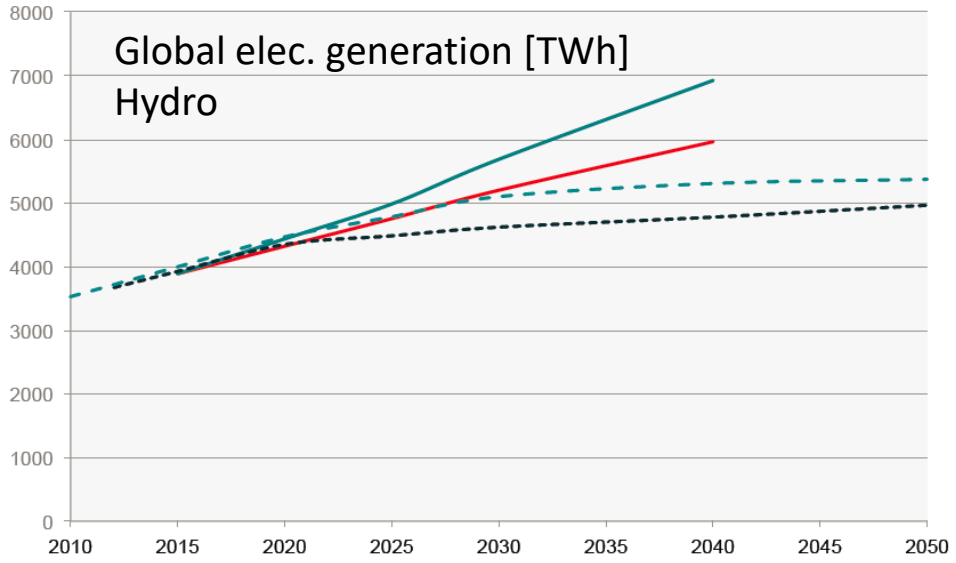


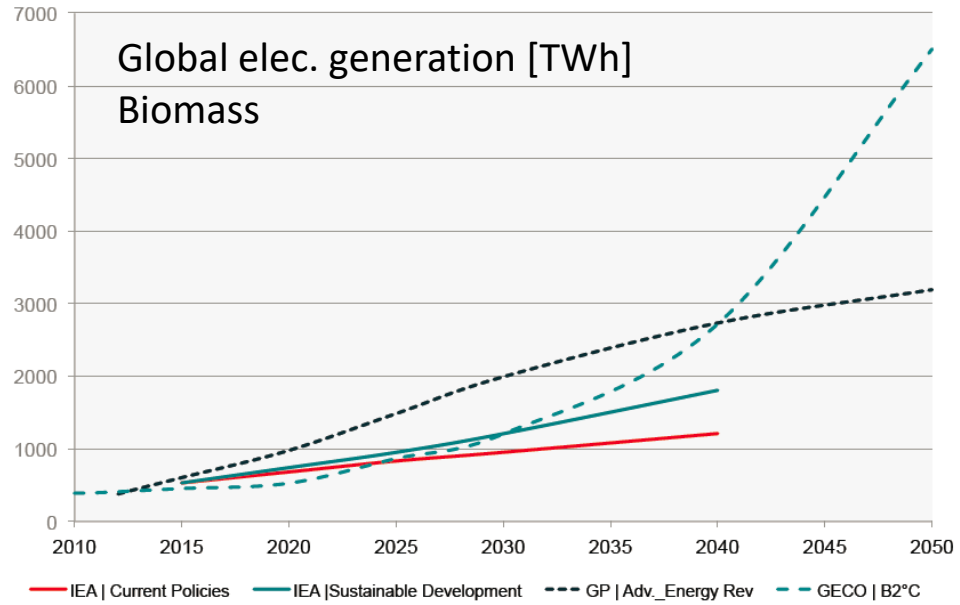
| 0 – 0.1 | 0.1 – 0.2 | 0.2 – 0.4 | more than 0.4 | drylands/no data |
|---|---|---|---|---|
| [no water stress] | [low water stress] | [mid water stress] | [high water stress] | |

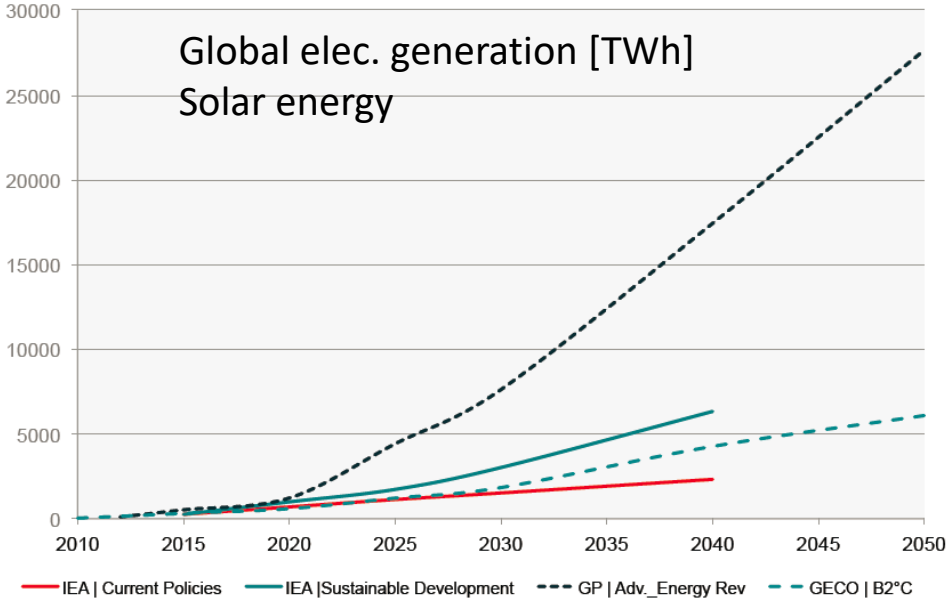
| | | | |
|---|---|---|---|
| **data source (water model)** | **WaterGAP3 (2010)** | **Water stress indicator** | WTA (withdrawal-to-availability ratio) |
| **data source (active mines)** | MiningIntelligence (2018), USGS (2003) | **Resources** | In, Te, U, Co, Ga, Pa, Mo, REE, Ag, Zn, Sn, phosphate, Li, Pb, Si, Cu, Al, Fe, coal, sand, gypsum, lime, clay, Ni, potash, Cr, B, V, Se, Cd, K |

# Outlook 2030/2050: meta-analysis of energy scenarios

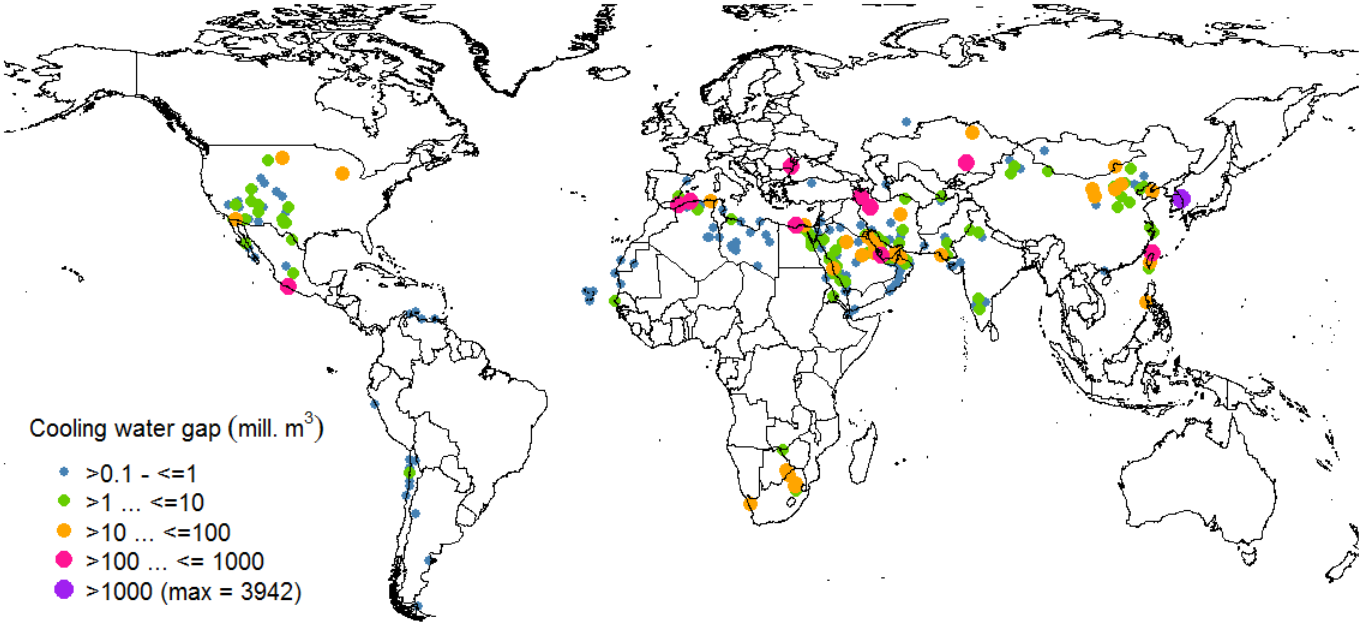


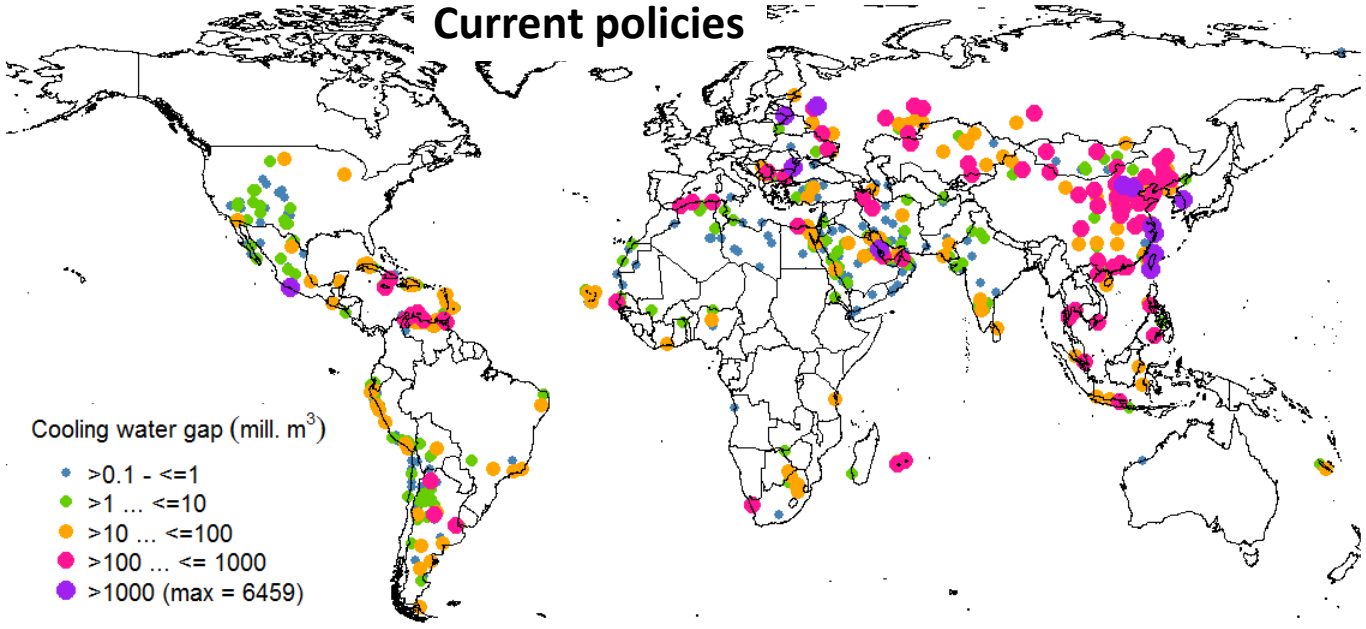
## Sustainability




# Achieving the SDGs in 2030?

Cooling water gap in 2050

## Current policies



# Key findings

- The WANDEL Water Footprint is a promising tool
  - to indicate the direct and indirect impacts of different energy systems on water resources
  - to identify and quantify the interlinkages between SDG6 and SDG7
  - to support the development of strategies to reduce these impacts

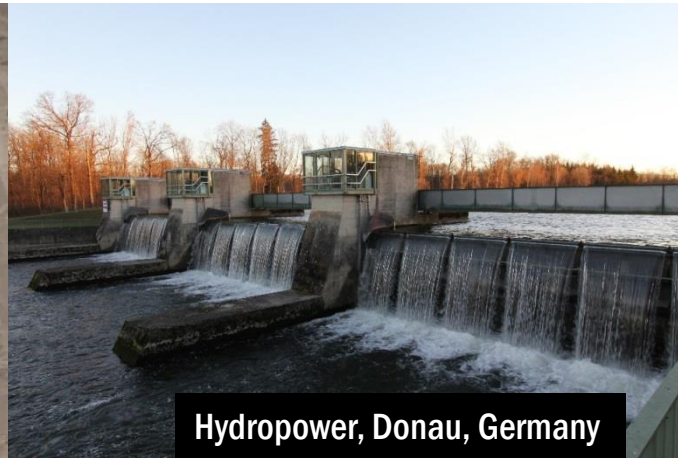
- The participation of local partners is key to perform the analysis
- The Water Footprint builds the bridge between local – national – global scales
- Other indicators taken into consideration to measure simultaneous progress on water and energy security

# Next steps

- Finalisation Water Footprint Analysis for all case studies
  - Including future projections
- Identification of hotspots (trade-offs between SDG6 and SDG7)
- Co-production of strategies to reduce impacts (synergies)
  - Stakeholder workshops in the case studies
- WANDEL Share facilitates outreach
- Contribution to cross-cutting themes (SDGs and Water Footprint)


Power plant Heyden, Weser, Germany


CSP, Draa Valley, Morocco


Hydropower, Donau, Germany

**Thank you for your attention!**

Visit our Website at http://wandel.cesr.de/en/

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