35th Discussion Forum « Assessment of Water Use within LCA »

ETH Zürich, 05/06/08

LCA-based tool on potable water supply and further inputs for the LCA of water use

François Vince
Veolia Environnement R&D

VEOLIA ENVIRONNEMENT

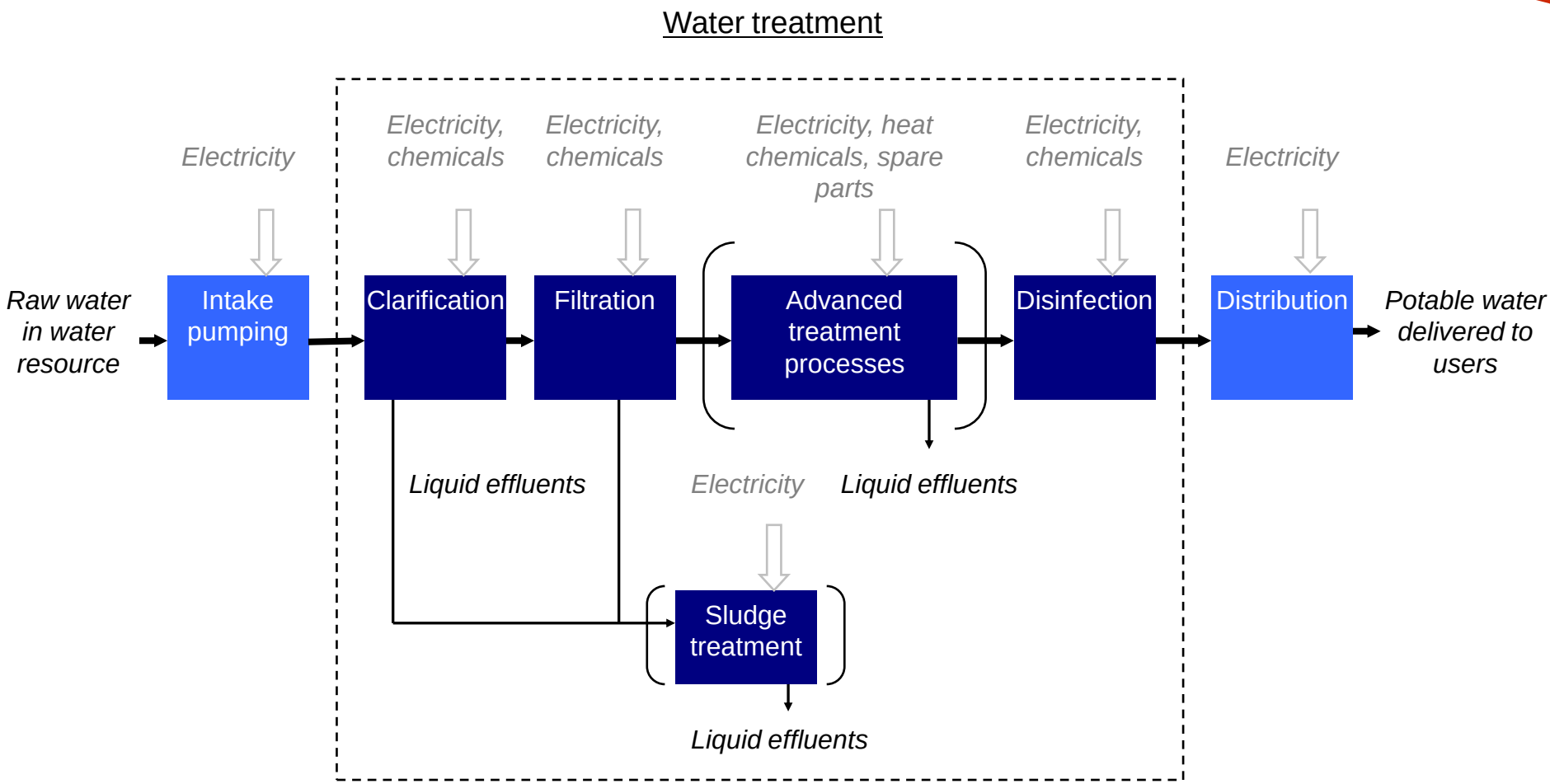
LCA purposes for Veolia Environnement

- Veolia Environnement providing environmental services for:
  - ➔ Potable water supply and wastewater management
  - ➔ Waste management
  - ➔ Energy management and efficiency
  - ➔ Public transportation

- Environmental Department within Veolia R&D
  - ➔ Evaluate the impacts of our activities
  - ➔ Compare feasible process options
  - ➔ Propose measures for impact mitigation

  - ➔ Build an expertise on LCA, biomonitoring, ERE

Potable water supply system



LCA-based tool for potable water supply

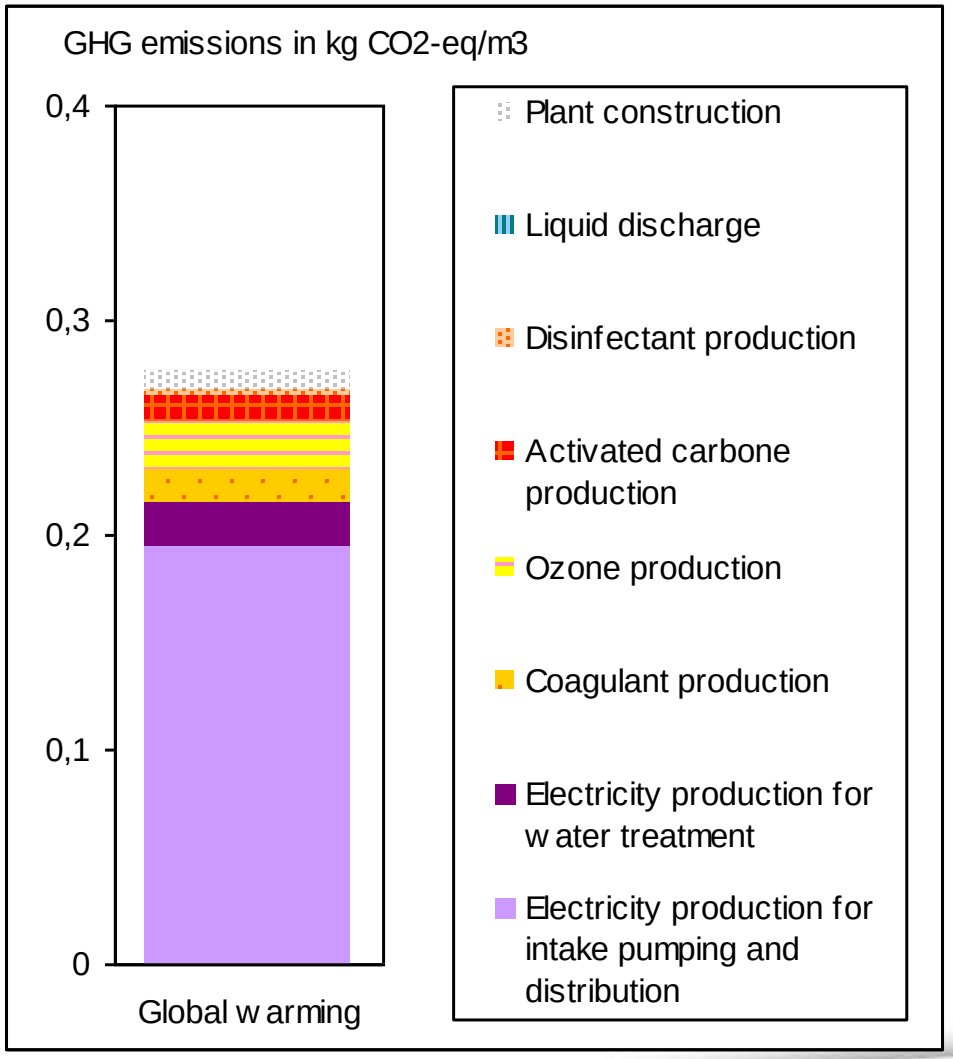
- Functional unit: 1 m^3 of potable water supplied to consumers

- Parameterized LCI approach
  - ➔ Decomposition of the supply system into process units
  - ➔ Modeling of process units LCI as a function of water quality parameters

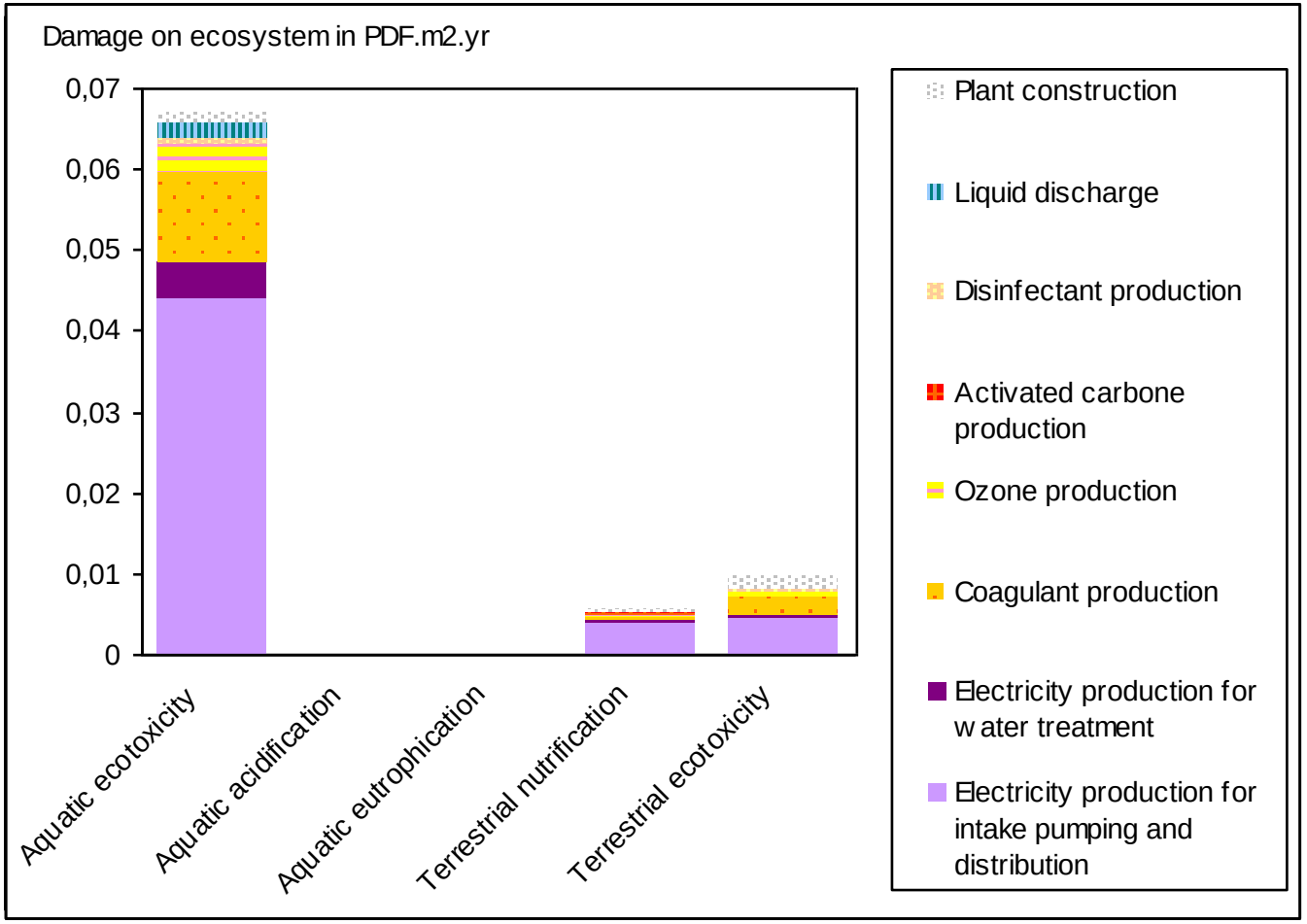
Clarification	Filtration	Membrane treatment steps	Disinfection / Oxidation
Coagulation	Sand filter	Prefiltration	Ozonation
Flocculation	GAC filter	Microfiltration	UV radiation
Settling/ Decantation	Dual filter	Ultrafiltration	Chlorination
Flotation		Nanofiltration	
		Reverse Osmosis	
Chemical treatment steps	**Thermal distillation**	**Other treatment steps**	**Water transfer**
PAC injection	Multi-stage Flash	Electrodialysis	Intake pumping
Remineralization	Multi-effects	Biological treatment	Potable water distribution
Neutralization	MVC	Ion exchange	

Potable water supply from groundwater

- Electricity supply
  - ➔ UCTE grid mix
- LCIA method
  - ➔ IMPACT 2002+

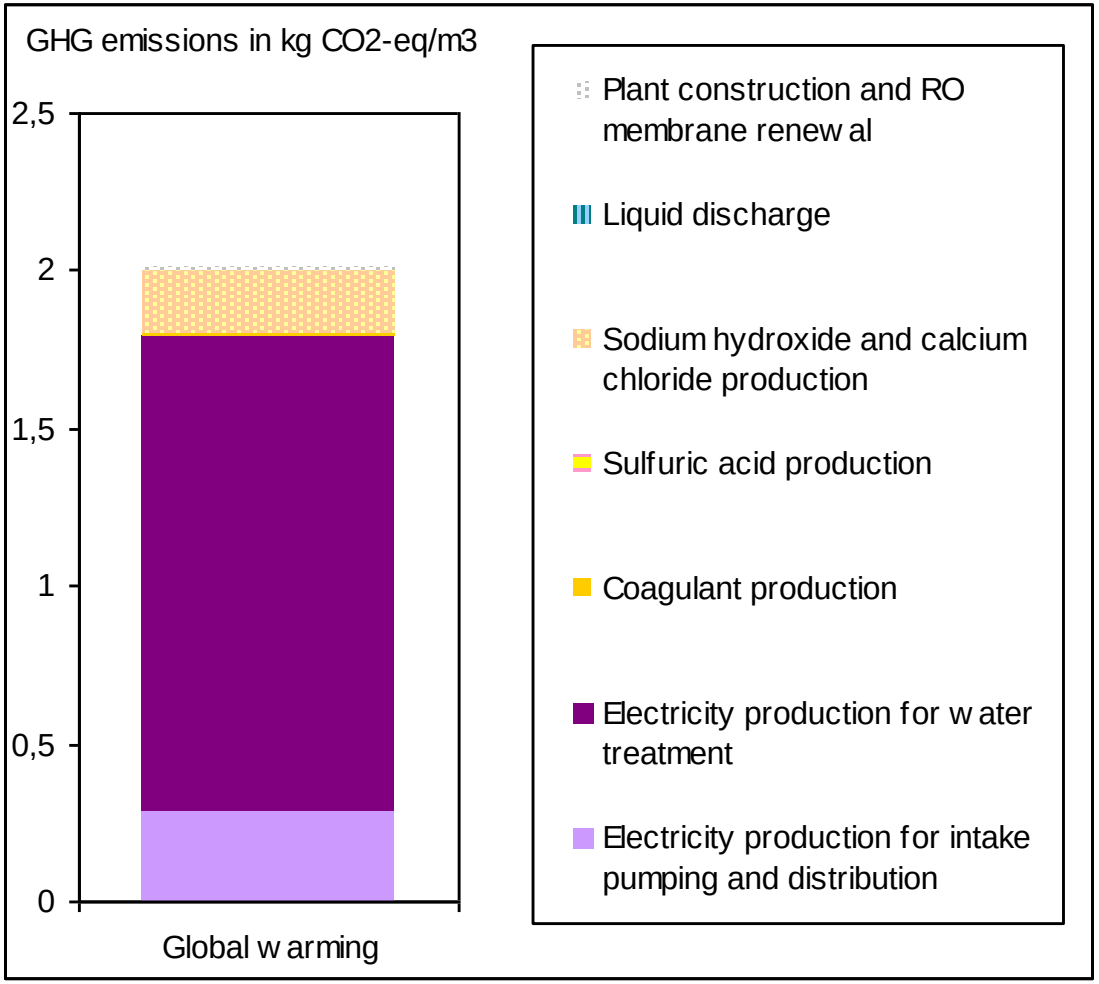


Potable water supply from groundwater



Potable water supply from seawater

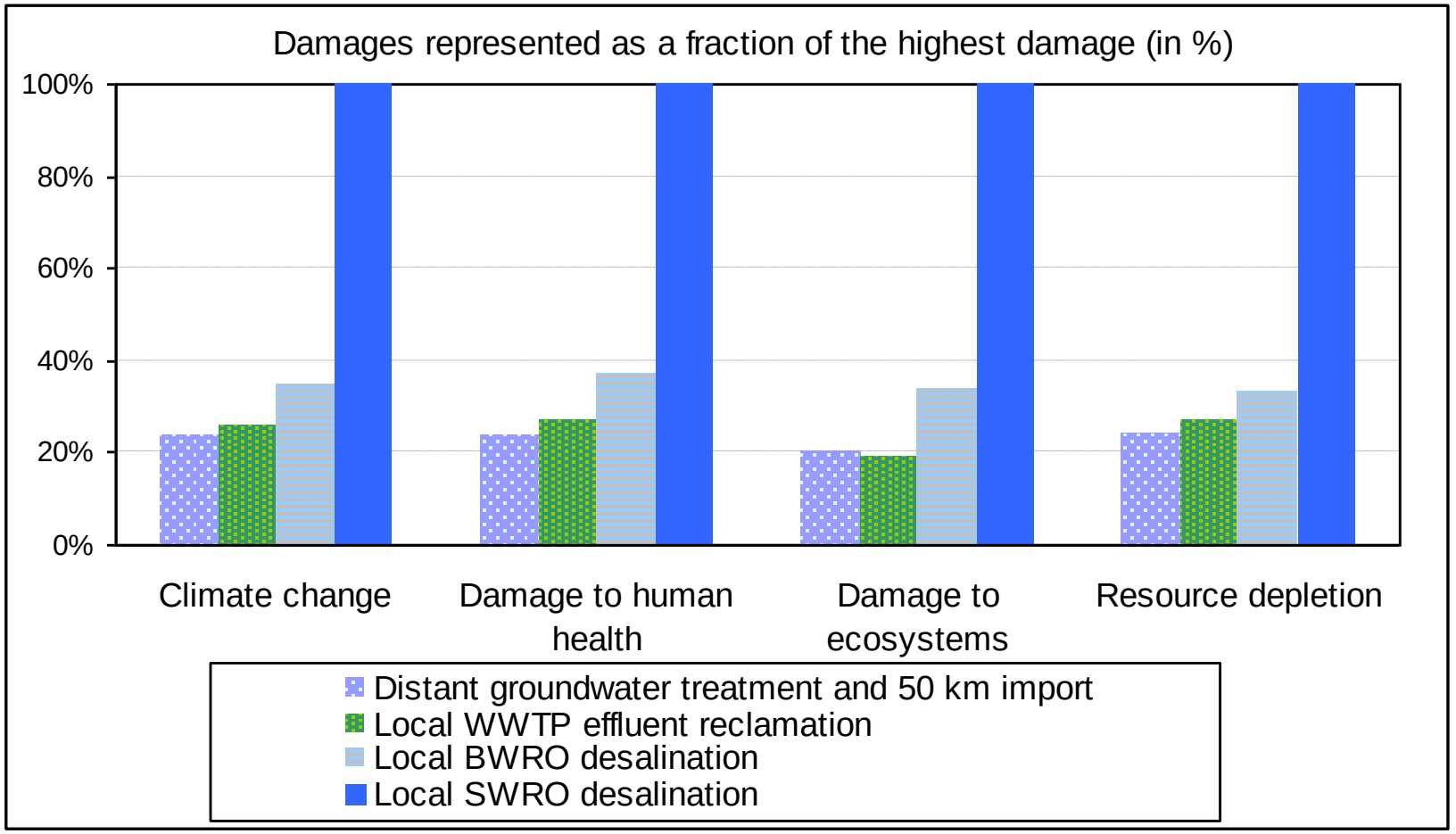
- Desalination process
  - ➔ Reverse Osmosis membranes
- Electricity supply
  - ➔ UCTE grid mix
- LCIA method
  - ➔ IMPACT 2002+



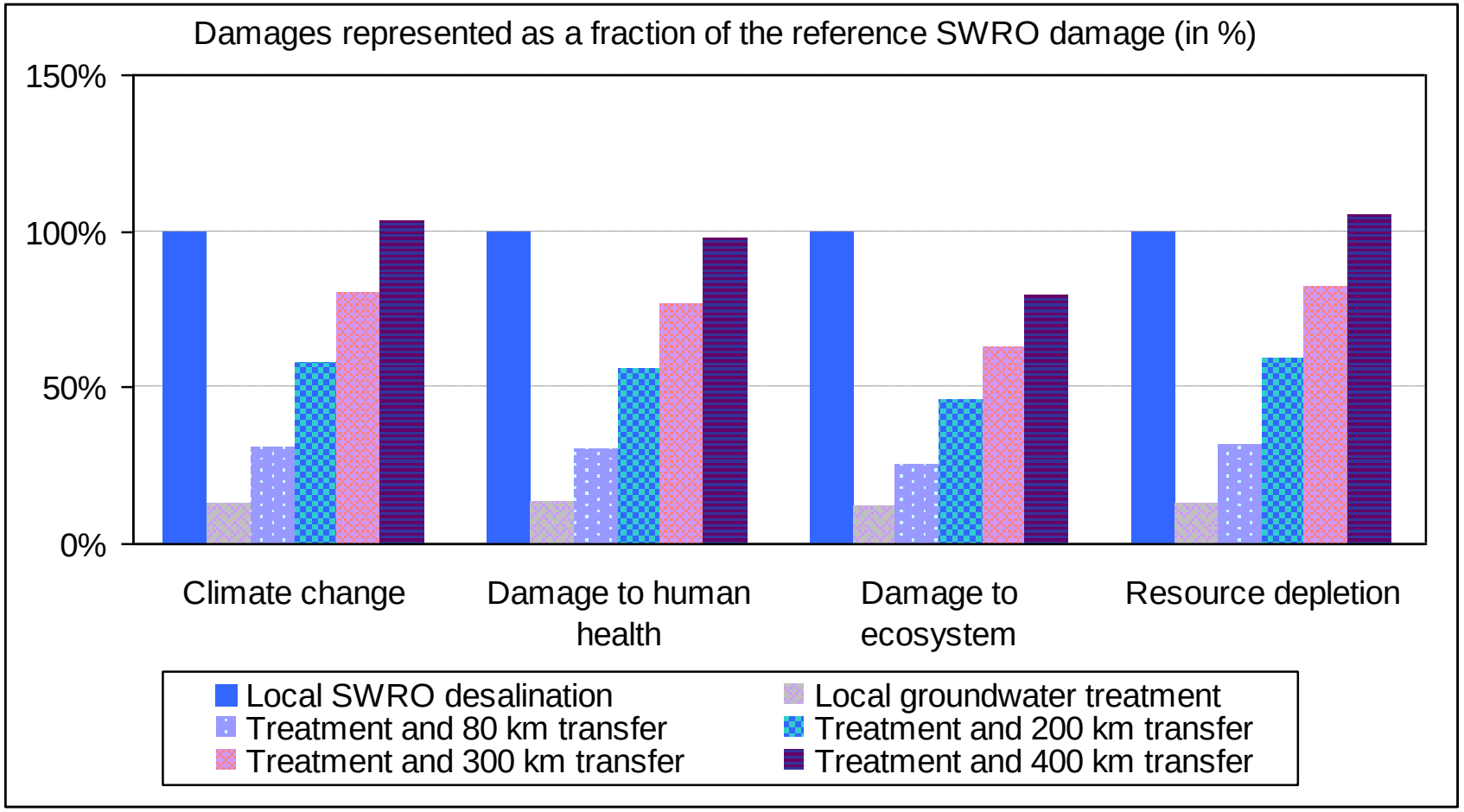
Life-cycle water withdrawals

Potable water supply using	Water treatment conversion rate in %	Direct water withdrawal in m^3 of raw water / m^3 of potable water	Indirect water withdrawal in m^3 of raw water / m^3 of potable water
Groundwater treatment using conventional treatment	90%	1,1	0,01
Surface water using UF treatment	85%	1,2	0,01
LQ surface water / WWTP effluent using NF treatment	76%	1,3	0,02
Brackish water using BWRO desalination	70%	1,5	0,03
Seawater using SWRO desalination	38%	2,6	0,11
Seawater using Multi-effect evaporation (MEE)	35%	2,8	0,25
Seawater using Multi-stage flash distillation (MSF)	35%	2,8	0,55
100 km water transfer by gravity from groundwater resources	-	-	0,02
300 km water transfer by gravity from groundwater resources	-	-	0,08

Supply scenarios comparison



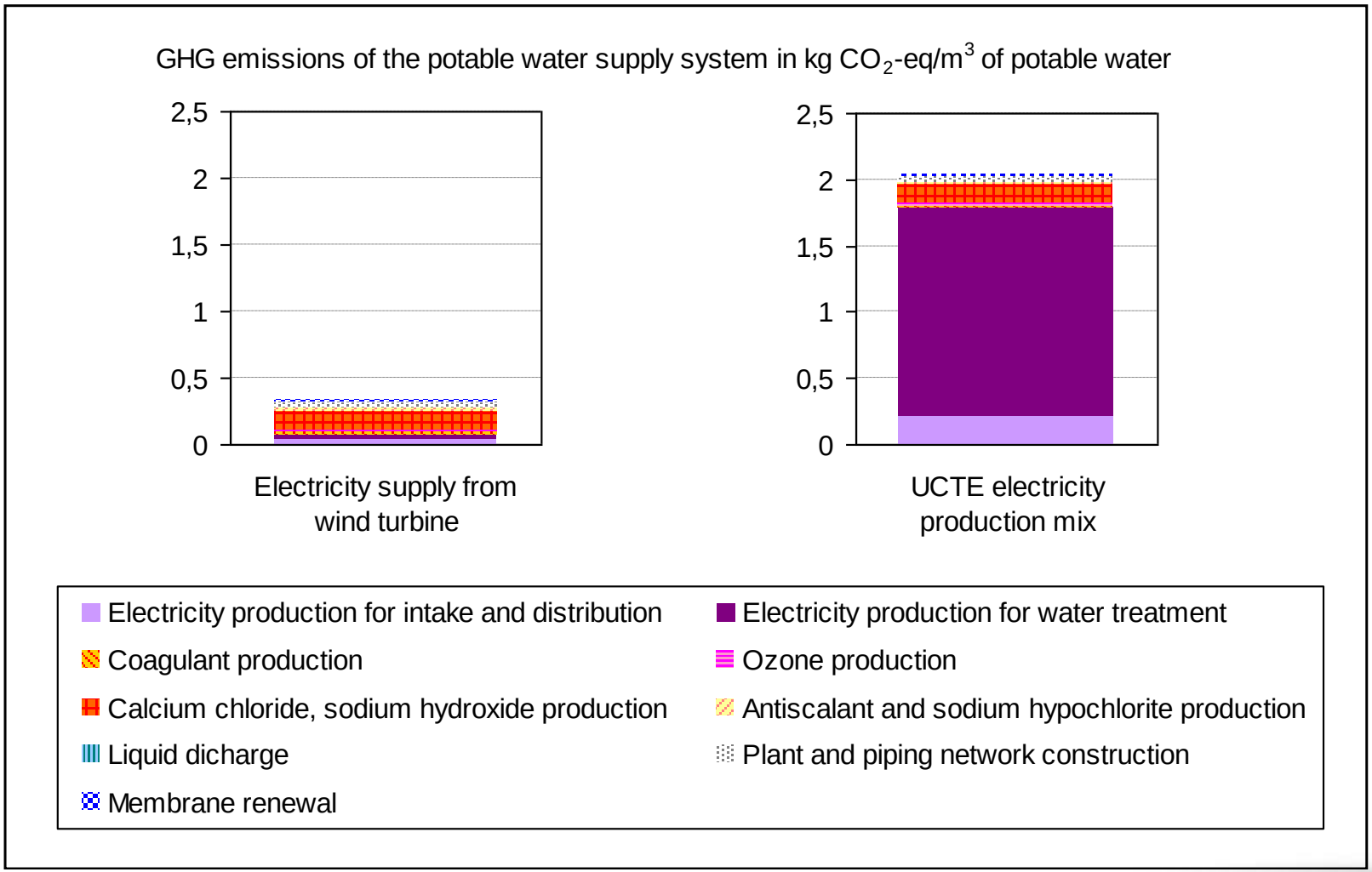
Sensitivity analysis on import distance



Break-even distance

	Break even transfer distance				Break-even pumping height
Import solution / Alternative supply from	Trucks	Freight trains	Boats	Pumping by gravity	Pumping
WWTP effluent using NF treatment	3 km	15 km	60 km	60 km	*180 m*
Brackish water using BWRO desalination	5 km	25 km	80 km	80 km	*240 m*
Seawater using SWRO desalination	14 km	60 km	400 km	400 km	*1200 m*
Seawater using MEE desalination	30 km	130 km	900 km	900 km	*2500 m*
Seawater using MSF desalination	60 km	260 km	1800 km	1800 km	*5000 m*

Impact mitigation for seawater desalination



Accounting for water use within LCA

Critical need for the activities of Veolia Environnement:

- Water services
  - ➔ Potable water supply
  - ➔ Wastewater treatment
  - ➔ Water cycle management
- Energy services
  - ➔ Biofuels production
  - ➔ Biomass cogeneration

Contributions to the LCA of water use

- Typology of LCI flows characterizing human water use
  - ➔ Key water quality parameters
  - ➔ Treatment differential between two water quality levels (e.g. energy surplus)
- Detailed LCI for backup scenarios on water related activities
  - ➔ Potable/industrial water supply systems
  - ➔ Wastewater treatment
  - ➔ Water transfer schemes
- Support for LCIA method development
  - ➔ Co-financing of CIRAIG
  - ➔ UNEP/SETAC LCI Initiative
- Application on a industrial case study

Conclusions

- LCA practitioners need a standardized metric accounting for water use
  - ➔ To be compared with economic costs
  - ➔ To be compared with other environmental impacts (e.g. climate change)
  - ➔ To communicate with public stakeholders

- Veolia Environnement is willing to contribute by sharing its knowledge on:
  - ➔ Water cycle management
  - ➔ Potable water and waste water treatment processes

François Vince

Veolia Environnement Recherche et Innovation

Direction de l'Environnement
Centre de recherche sur l'Eau
francois.vince@veolia.com
+33 (0)1 71 75 18 30

VEOLIA
ENVIRONNEMENT