



World Wide Workshop for Young Environmental Scientists

Wastewater reuse in the Mediterranean region: Case of Morocco

Hirich Abdelaziz, Agronomic and Veterinary Medicine Hassan II Institute,
Morocco

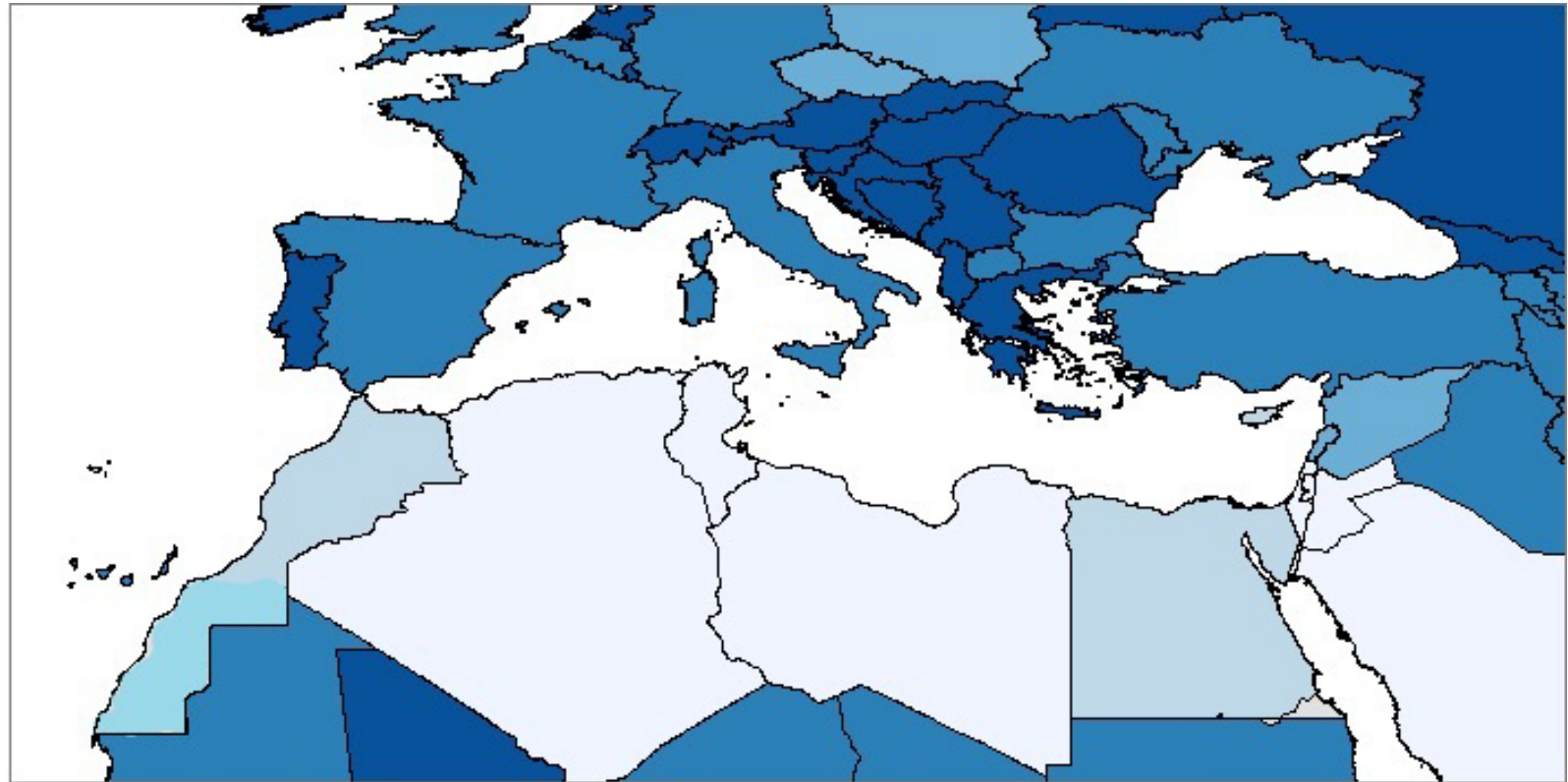


03-07 June, 2013
Paris, France

Content

Water scarcity and potential of wastewater in the Mediterranean region

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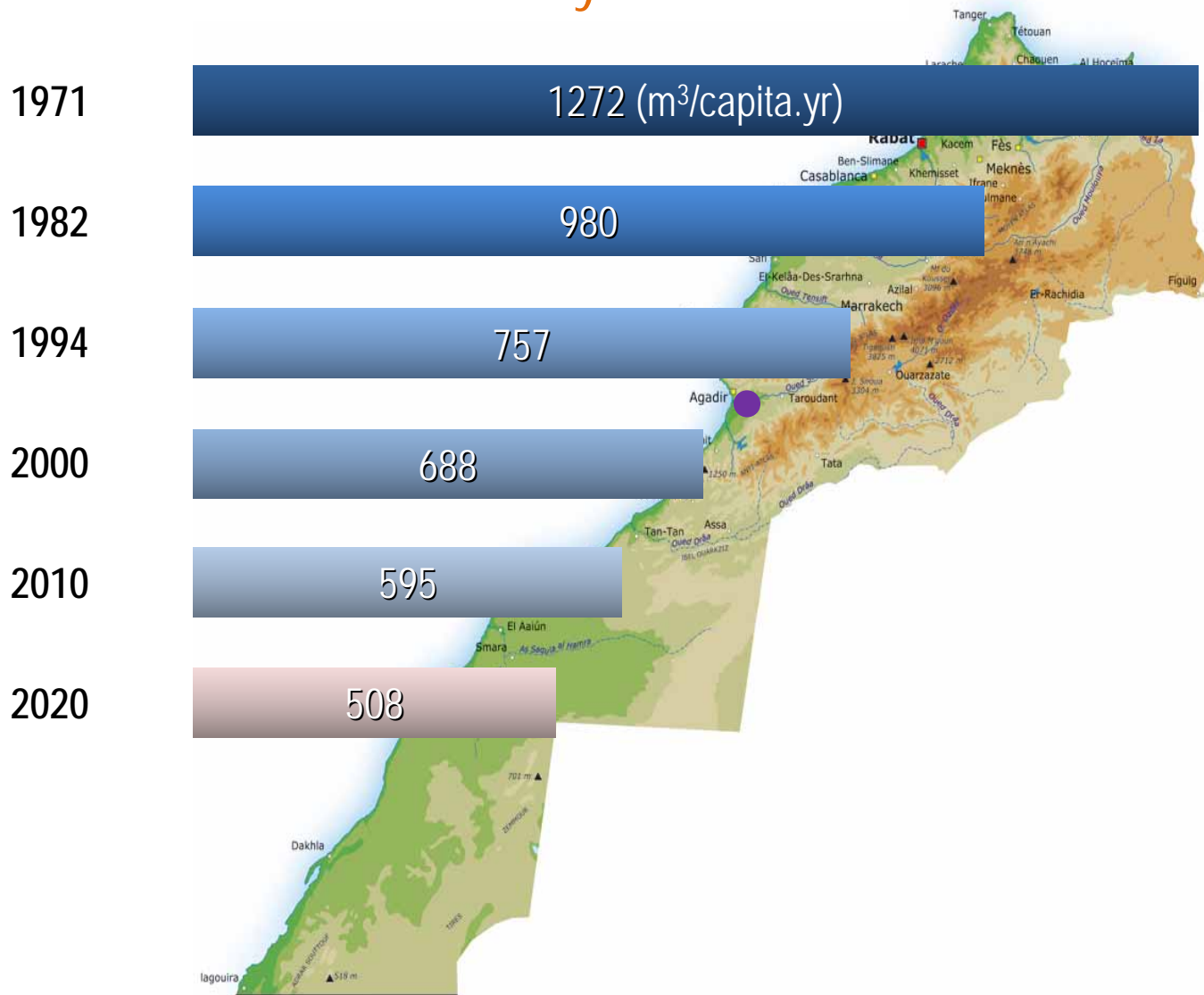


Total actual renewable water resources per inhabitant(m³/year)

Actual renewable water and groundwater resources per inhabitant (in 2005)

Legend: No Data, Less than 500, 500 - 1000, 1000 - 1700, 1700 - 5000, Greater than 5000

Water resources availability in Morocco



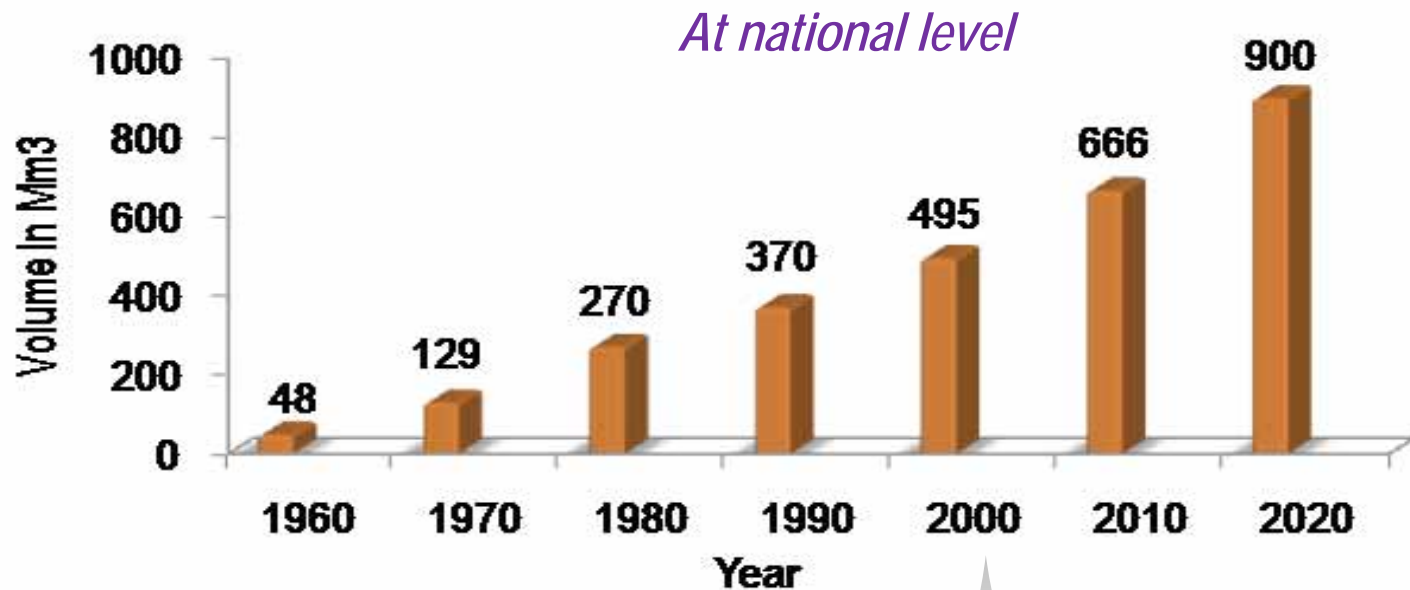
Water scarcity and potential of wastewater in the Mediterranean region

Country	Wastewater Produced 10 ⁶ m ³ /yr	% of Wastewater Treated/ Wastewater Produced	% of Wastewater reused/ Wastewater Produced	Year of WWR
Algeria	820.0	85.4	3.2	2011
Cyprus	30.0	100.0	83.3	2008
Egypt	4930.0	60.3	60.3	2001
France	7910.0	91.0	5.2	2004
Greece	719.0	62.6	1.0	2008
Israel	450.0	62.9	62.2	2008
Italy	7731.0	31.0	3.5	2008
Jordan	82.0	90.2	85.4	2010
Lebanon	249.0	1.6	0.8	1991
Libya	546.0	20.1	7.3	1999
Malta	19.0	79.3	50.0	2008
Monaco	7.3	82.5	0.0	2009
Morocco	700.0	25.3	11.4	2007
Palestine	50.0	53.8	20.0	2004
Slovenia	168.5	68.4	4.1	2009
Spain	5204.4	86.8	10.1	2008
Syria	825.0	66.7	66.7	2002
Tunisia	240.0	89.6	14.1	2001
Turkey	4289.0	57.9	23.3	2006
Total	34970.2	63.9	18.1	

Source: Guardiola et al. 2011, WWR: wastewater reuse.

Water scarcity and potential of wastewater in the Mediterranean region

Wastewater production in Morocco



*At regional level
Agadir city*

47.000 m³ /Day
2000

78.000 m³ /Day
2020

Driving Forces for Using Treated Wastewater



Reduce pressure on naturel resources/ecosystems (quality and quantity)



Cope with water demand (communities and ecosystem)



Sustainable water supply



Contribute to integrated water management



Not affected by climate change

Driving Forces for Using Treated Wastewater

Why treated urban wastewater?

Compared to desalination, it is a cost-effective and energy saving to increase water supply and mitigate the impact of climate variability and climate change

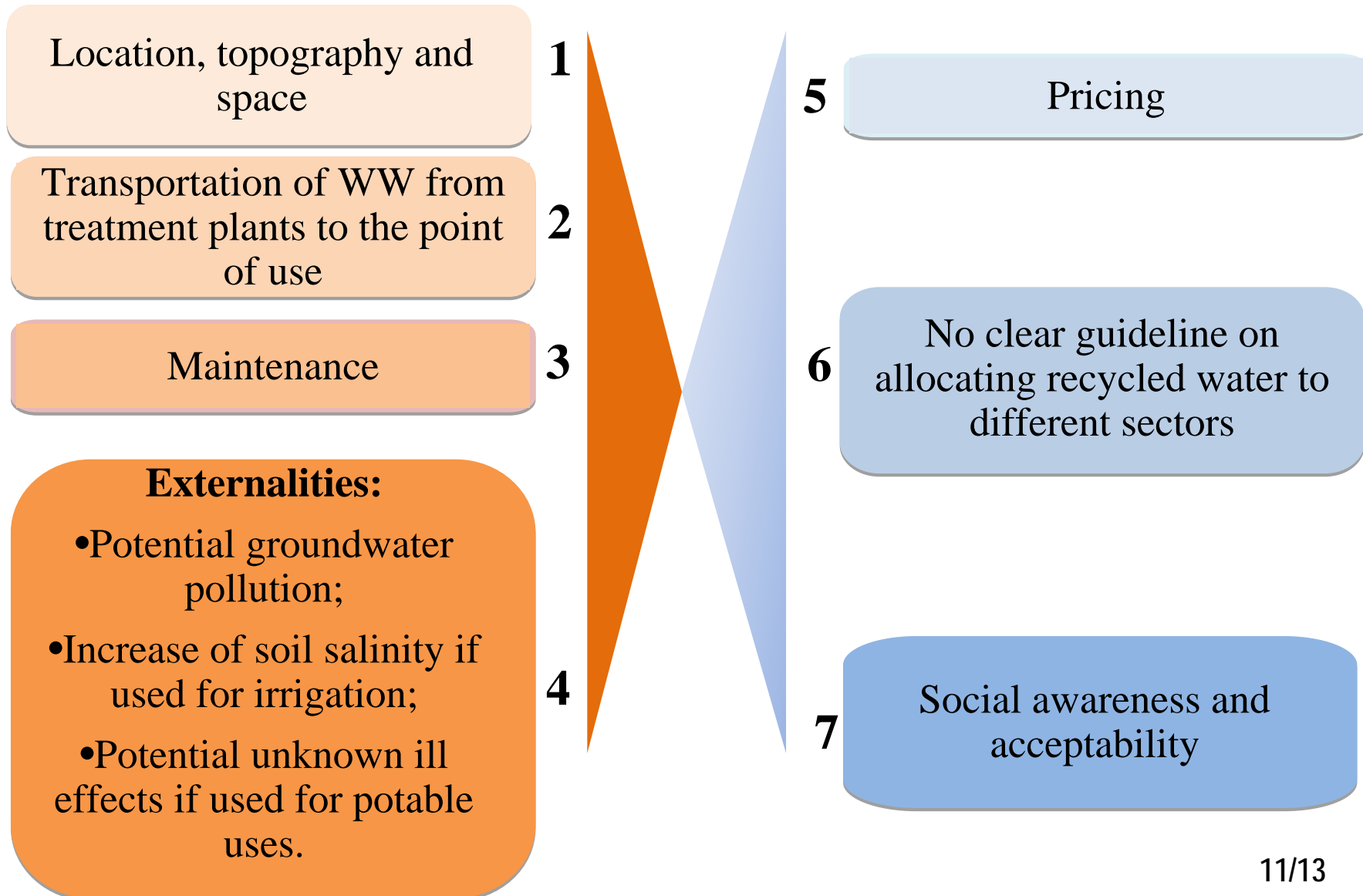
Reuse of treated wastewater means making a productive asset out of a waste production from which it is possible to recover heat, energy, nutrients and clean water (aqua environment)

Different reuse opportunities with social, economic and environmental values

Wastewater Reuse in Morocco



Factors Impeding the Implementation of Water Reuse Strategies in Med Region



Question ?



Irrigation with
treated
wastewater



Transformation



If you already know
that! will you consume
that bread ?



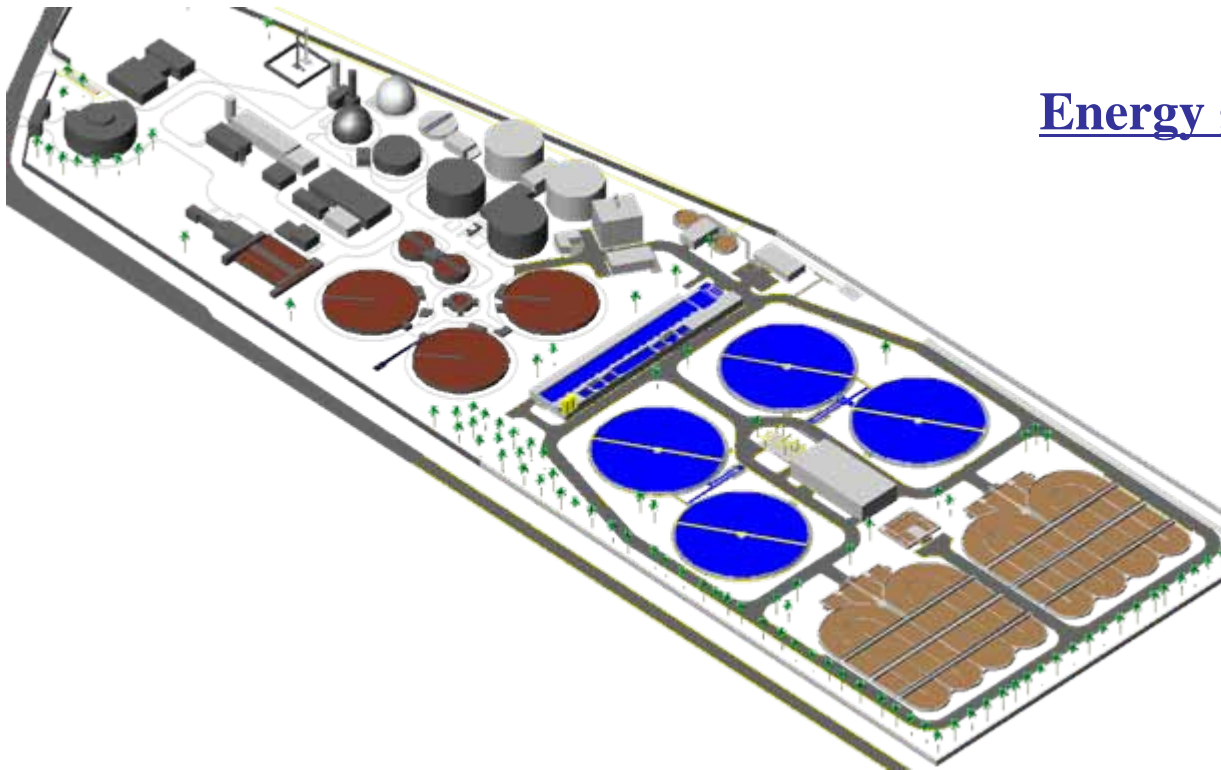
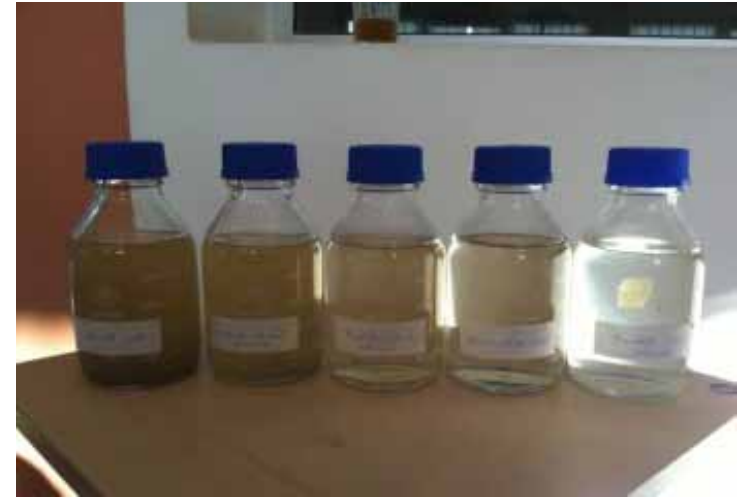
Thanks for your attention!
Questions !

hirich_aziz@yahoo.fr

Wastewater treatment in Marrakech

Treatment yield:

DBO5 > 95 %
MES > 95 %



Energy generating :

30 000 KWHe/day

	Raw wastewaetr	Primary treatment	Secondary treatment	Standards	Yield
Suspended matter	700	380	14	50	98%
BOD5	800	360	17	100	98%
COD	1600	700	46	500	97%
Fecal coliforms	3,7E + 07	4,3E + 06	80 (x)	1.000	7,0 ULog

X after treatment with UV

Response of several crops to irrigation using treated wastewater

Treatments	Chrysanthemum	Zucchini	Egg plant	Maize	Bread wheat	Durum wheat
	Flower/plant	Kg/plant	Kg/m ²	Qx/ha	Qx/ha	Qx/ha
Control*	69	1.29	3.17	12.43	5.107	0
Treated wastewater	80	2.18	3.41	12.62	48.69	31.83

Economic gain from treated wastewaters irrigation

Crops	Net gain of water (DH/year.inhab)*	Benefit in fertilizers (DH/year.inhab)**	Total Benefit (DH/year.inhab)
Tender wheat	750	1492	2242
Unground corn	1588	3614	5202
Fodder corn	1568	3572	5140
Clover (Berseem)	774	1539	2313
Zucchini	677	1545	2222
Marrow	611	1216	1827
Tomato	1553	3542	5095
Potato	940	2140	3080