

# WOW

Wastewater reuse Optimization  
in hot Weather urban environments

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ROSE

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# Contents

- Project context
- Objectives
- Work Plan
- Project members and partners
- Budget

# Project Context- Problem Identification

- Growing population, industrialization, agricultural practices and urbanization have increased the water demand and hence the quantity of wastewater (WW).
- Availability of drinking water, including different components of daily per capita demand in developing countries, is becoming a serious issue to manage.
- To fight growing water stress, reclamation and reuse of treated WW for various day-to-day uses except for drinking purpose is necessary.
- Reuse of WW in developing countries may bridge the gap between supply and demand of water in the future.

# Our project sites:

TUNIS



DELHI



ACCRA



# Project Context- State of the Art

## *Wastewater in Tunisia*

- Submitted to the irregularity of a semi-arid climate, Tunisia experiences relevant difficulties in efficiently managing scarcer and less reliable water resources.
- Consequently, it has become imperative to develop additional water resources and wastewater use was made an essential component of the Tunisian national water resources strategy.
- Since the 80<sup>th</sup>, an ambitious national wastewater reuse policy was launched. In 1996, more about 6,500 hectares had been equipped for irrigation with reclaimed wastewater, mainly secondary effluents. It extended to 20 000 ha in 1997.
- In 2002, nearby 150 MCM of waste water was treated (80% are mainly domestic).
- Being the biggest city producing waste water in Tunisia, Tunis has to cope with more recurrent problems of wastewater collection and reuse.
- **The research is called to propose more sustainable methods of use of wastewater in Tunis**

# Project Context- State of the Art

## *Wastewater in Ghana*

- Less than 10% of wastewater is currently being treated in Ghana.
- In Accra, only a few treatment plants are in operation, which are privately managed and located at hotels.
- Most of the wastewater originates from households – therefore mainly consists of organic material.
- At the moment, all wastewater is flowing into the ocean, resulting in pollution of the marine ecosystem.
- The exposure of Accra's residents to the untreated wastewater creates unacceptable health risks.
- There are no regulations regarding wastewater issues.
- **There is a need for research on more sustainable use of wastewater in Accra.**



# Project Context- State of the Art

## *Reclamation and reuse of wastewater in Delhi*

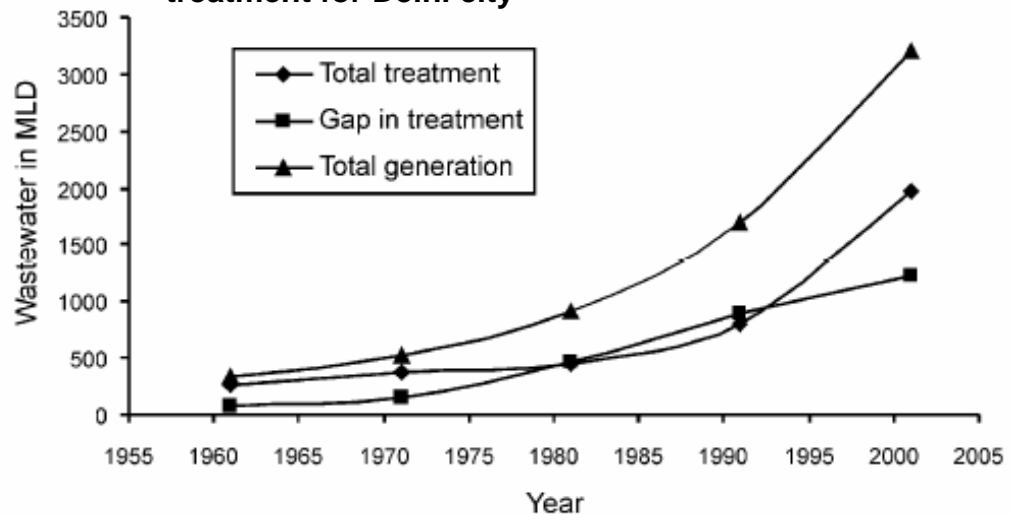
- In cities like Delhi, where WW treatment is more stringent and a major portion is treated, the reuse facility may be implemented effectively.

- The projected WW generation in Delhi will be 3500 MI/d by 2010 of which 3150 out of 3500 MI/d will reach the sewage treatment plants (STPs).

- Even 20–40% reuse of treated

WW may reduce the shortfall in the city water supply substantially. Reuse of only 20% treated WW (nearly 630 MI/d) will fulfill the need of 10% of the city's population at an average of 274 lpcd in the projected scenario.

Decadal growth of wastewater treatment and gap in treatment for Delhi city



State	Wastewater generation (MI/d)	Wastewater treated (MI/d)	Untreated wastewater (MI/d)
Delhi	2700	1927	773

# Project Context- Social Added Value

- Reduction of water costs for industries
- Urban Agriculture:
  - Enhancing livelihoods of farmers (income)
  - Urban food security
- Bio-fuel production
- Reduced pollution of environment (with wastewater)
- Reduced urban water shortage



# Project Objectives

## Main Objectives

To provide decision support for waste water reuse optimization in urban areas under hot climate

## Specific objectives:

- WP 1 To assess the historic and current development of wastewater reuse.
- WP 1 To map laws and regulation of wastewater reuse.
- WP 2 To define the sectoral water demand and quality.
- WP 2 To assess social perception (behavior, acceptance,...) of wastewater reuse.
- WP 3 To develop and provide a tool (MCA, model...)

# Gantt Chart of Activities

Time	Year	Year One				Year Two				Year Three	
	Quarter	1	2	3	4	1	2	3	4	1-2	2-4
	Month	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-30	31-36

## Work Package One (IWMI, IIT Delhi, IRA, INRGREF):

1.1	To assess the historic and current development of wastewater reuse.	■	■	■	■						
1.2	To map laws and regulations of wastewater reuse.		■	■	■						

## Work Package Two (MAREH-Tunisia, MoWR-Ghana, MEWR-India):

2.1	To define the sectoral water demand and quality.				■	■	■	■			
2.2	WP 2 To assess social perception (behavior, acceptance,...) of wastewater reuse.					■	■	■	■		

## Work Package Three (IWMI, GTZ, LCPC, IRA):

3.1	To develop and provide a decision support tool (MCA, model)						■	■	■	■	■
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# Project members and partners

## Project members

- Dr. Amelene El-Mufleh** Chemist, Laboratoire Central des Ponts et Chaussees (LCPC), France  
**Dr. Nizar Omrani** Hydraulic Engineer, Institute of Arid Regions (IAR), Tunisia  
**Dr. Vijaya Singh** Wastewater Treatment Engineer, Indian Institute of Technology Delhi (IIT), India  
**Dr. Daniel Van Rooijen** Social Scientist, International Water Management Institute (IWMI), Ghana

## Local partner institutes

- GHANA:** Ministry of Water Resources (MoWR)  
Kwame Nkrumah University of Technology (KNUST)
- TUNISIA:** Ministry of Agriculture and Hydraulic Resources (MAHR)  
Institute of Research in Rural Engineering (INRGREF)
- INDIA:** Ministry of Environment and Water Resources (MEWR)  
Indian Institute of Technology Delhi, Dep of Civil Engineering (IIT Delhi)

## International partner institute

- GERMANY** Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)

# Budget

<b>Budget category</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Total</b>
Personnel	52,500	52,500	57,000	162,000
Consultants	40,000	49,200	49,200	118,400
Consumables	24,560	16,160	12,945	53,665
Durable Equipment	12,000	0	0	12,000
Travel & Subsistence	3,000	4,500	9,500	17,000
Training (students)	16,200	16,200	4,950	37,350
<b>Total in EUROS :</b>	108,260	98,560	93,595	395,915
<i>Additional Expected Funding (from IWMI, IIT, GTZ)</i>	40,000	40,000	20,000	100,000
<b>Requested from YES foundation:</b>				<b>295,915</b>

# Budget - Personnel

Personnel	Year 1	Year 2	Year 3		Total	Budget Notes
1 LCPC – Principal Researcher	6,000	6,000	6,000		18,000	Rate: 200 EUR / day, 30 days / yr
2 IAR – Principal Researcher	6,000	6,000	6,000		18,000	Rate: 200 EUR / day, 30 days / yr
3 IIT – Principal Researcher	6,000	6,000	6,000		18,000	Rate: 200 EUR / day, 30 days / yr
4 IWMI – Principal Researcher	6,000	6,000	6,000		18,000	Rate: 200 EUR / day, 30 days / yr
5 Collaborating Institution MoWR – Head of Dep	500	500	2,000		3,000	Rate: 100 EUR / day, 30 days
6 Collaborating Institution KNUST - Researcher	9,000	9,000	9,000		27,000	Rate: 100 EUR / day, 90 days / yr
7 Collaborating Institution MAHR – Head of Dep	500	500	2,000		3,000	Rate: 100 EUR / day, 30 days / yr
8 Collaborating Institution INRGREF - researcher	9,000	9,000	9,000		27,000	Rate: 100 EUR / day, 90 days / yr
9 Collaborating Institution MEWR – Head of Dep	500	500	2,000		3,000	Rate: 100 EUR / day, 30 days / yr
10 Collaborating Institution IIT-Delhi - researcher	9,000	9,000	9,000		27,000	Rate: 100 EUR / day, 90 days / yr
<b>Total in EUROS</b>	<b>52,500</b>	<b>52,500</b>	<b>57,000</b>		<b>162,000</b>	

# Budget - Consumables

Item of expenditure	Year 1	Year 2	Year 3	Total	Budget notes and explanations
1 ROSE - Research Support Operations	5,160	5,160	4,945	15,265	Cost of research support operations, including the use of ICT facility, library and financial services
2 ROSE - Other	5,000	5,000	5,000	15,000	Cost of consumable goods and non-capital equipment.
3 Collaborating Institution - KNUST	4,800	2,000	1,000	7,800	Training of Students // Cost of consumable goods and non-capital equipment.
4 Collaborating Institution – INRGREF - Other	4,800	2,000	1,000	7,800	Training of Students / Cost of consumable goods and non-capital equipment.
5 Collaborating Institution - IIT	4,800	2,000	1,000	7,800	Training of Students / Cost of consumable goods and non-capital equipment.
<b>TOTAL</b>	<b>24,560</b>	<b>16,160</b>	<b>12,945</b>	<b>53,665</b>	

# Budget – Durable Equipment

Item of expenditure	Year 1	Year 2	Year 3		Total	Budget notes and explanations
1 Collaborating Institution - KNUST	4,000	0	0		4,000	2 Computers at rate of USD 1750 per computer and 1 printer
2 Collaborating Institution - INGRES	4,000	0	0		4,000	2 Computers at rate of USD 1750 per computer and 1 printer
3 Collaborating Institution - IIT	4,000	0	0		4,000	2 Computers at rate of USD 1750 per computer and 1 printer
<b>Totals for Equipment</b>	12,000	0	0		12,000	



# Budget – Travel and Subsistence

Item of expenditure	Year 1	Year 2	Year 3	Total	Budget notes and explanations
1 ROSE	3,000	4,500	4,500	12,000	Project staff to visit sites twice a year at USD 1500 per trip in year 1, thrice a year in year 2 and year 3.
2 Collaborating Institution - KNUST	0	0	2,000	2,000	1 visit to present research finding at an international conference/ workshop (this includes air ticket – taxes, visa, accomodation, local transport and perdiem)
3 Collaborating Institution – INGRES	0	0	1,500	1,500	1 visit to present research finding at a regional conference/ workshop ((this includes cost of return air ticket – taxes, visa, accomodation, local transprt &perdiem)
4 Collaborating Institution – IIT	0	0	1,500	1,500	1 visit to the project final synthesis workshop (this includes cost of return air ticket – taxes, visa, accomodation, local transprt and perdiem)
<b>Totals for Travel</b>	<b>3,000</b>	<b>4,500</b>	<b>9,500</b>	<b>17,000</b>	

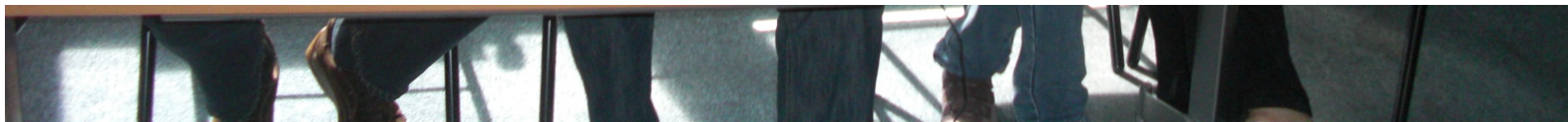
# Budget – Training

Item of expenditure	Year 1	Year 2	Year 3	Total	Budget notes and explanations
1 IWMI - PhD	5,400	5,400	1,650	12,450	Student field work. Rate USD 30 per day WP1: Total 215 days for 3yrs WP2: Total 200 days for 3yrs
2 Other Collaborating Institution AAU – Students Masters Degree	5,400	5,400	1,650	12,450	Student field work. Rate USD 30 per day WP1: Total 215 days for 3yrs WP2: Total 200 days for 3yrs
3 Other Collaborating Institution WRI – Students Masters Degree	5,400	5,400	1,650	12,450	Student field work. Rate USD 30 per day WP1: Total 215 days for 3yrs WP2: Total 200 days for 3yrs
<b>Totals for Training</b>	16,200	16,200	4,950	55,400	

**YES we can!** , if you choose our proposal!



**Don't hesitate to contact us for all your water related problems: [www.rose.org](http://www.rose.org)**



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