Socio-economic interests of treated wastewater reuse in agriculture

Clermont-Ferrand case study cost-benefits analysis

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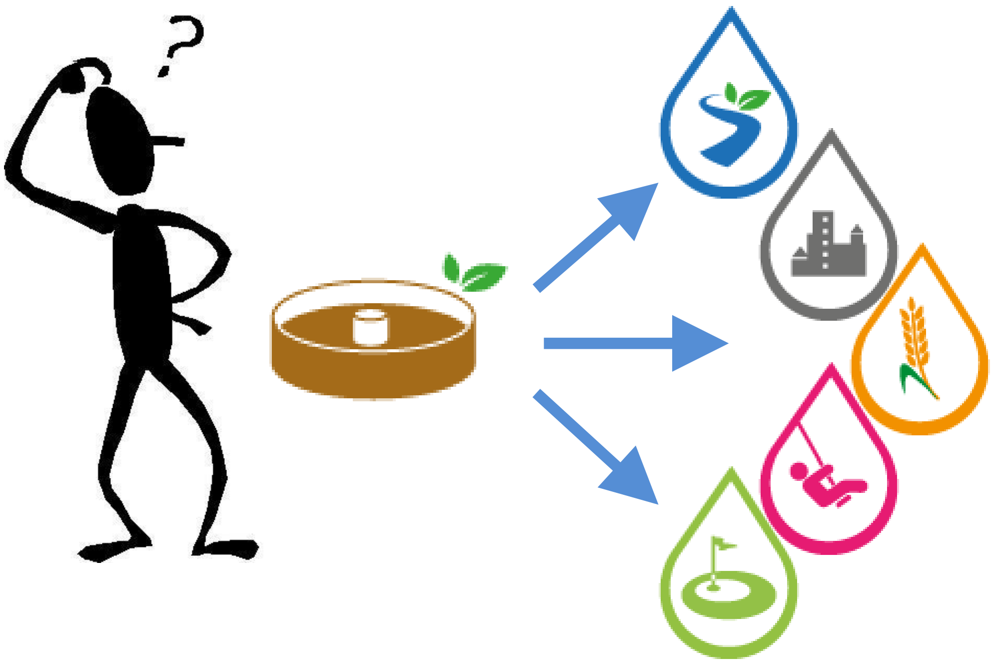
ICID2015
26th ERC & 66th IEC

Which wastewater reuse scenario?



SUSTAINABLE SCENARIOS?

THE MOST PROFITABLE SCENARIO?

Sustainability of a wastewater reuse project	=	Security	x	Profitability	x	Feasibility	x	Acceptability	x	Organisation
		sanitary agronomical environmental		economic financial viability		technical (process) regulatory		social political		legal framework institutional

Source : Ecofilae, 2015

Cost-Benefit analysis methodology

- ✓ **Used for analyzing project to determine whether or not they are of public interest (economic profitability)**
- ✓ **To identify which stakeholders lose/win and the actions to implement to reach win/win solutions**

1) Sphere analysis characterization (time line, geography, stakeholders involved)
2) Identification of the different projects scenarios (reuse scenario(s) and business-as-usual scenario)
3) Costs and benefits identification and assessment for the different scenarios
4) Net present value (NPV) calculations
5) Sensitivity analysis of NPV to the main parameters

Net Present Value

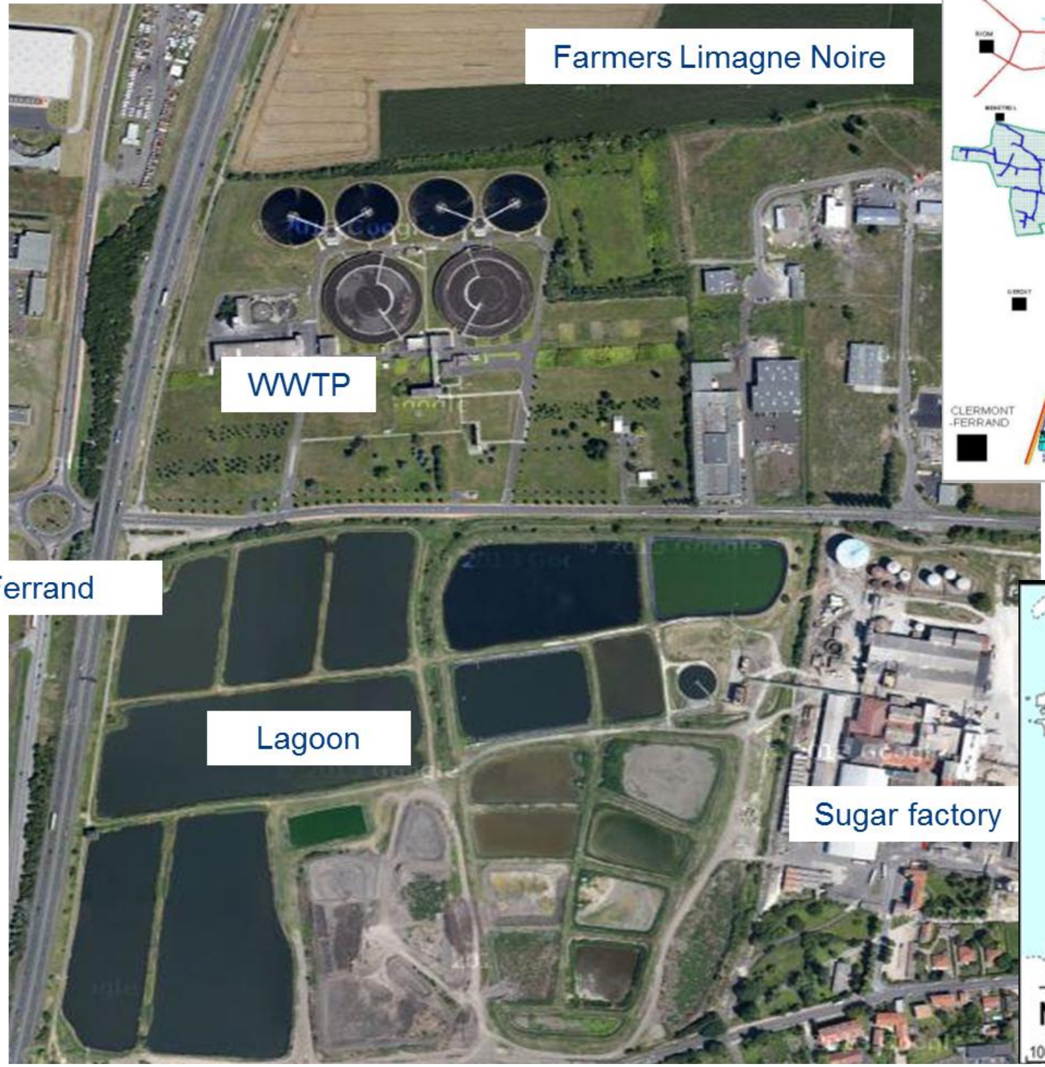
the relevant economic indicator

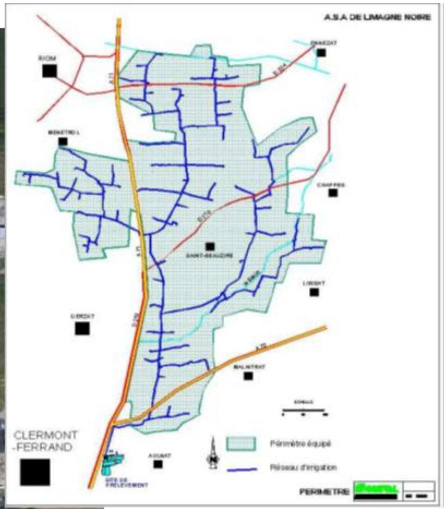
$$NPV = \sum_{t=0}^{T} \frac{B_t}{(1+r)^t} - \sum_{t=0}^{T} \frac{C_t}{(1+r)^t}$$

NPV = Net Present Value
B = Benefits
C = Costs
T = time horizon set
r = discount rate

		Private NPV	
		+	**−**
Community public NPV	**+**	**Project feasible without intervention**	**Project to subsidize**
	−	**Project to be dissuaded**	**Project not feasible**

Clermont-Ferrand case study





Treated wastewater reuse scenario

Clermont-Ferrand WWTP

Owner : Communauté d'Agglo de CF
Manager : Veolia
Capacity : 425 000 EH
Treatment : Activated sludge + (Treatment N et P)

Discharge
40 Mm3 /year

Artière – Allier

Sustain compulsory environmental flows

Step 2 : TWW
(price 0 €/m3)

Sugar refinery lagoons

Tertiary treatment

Step 2 : irrigation
900 000 m3/year – 5/6 months

Step 1 : spread of effluents
200 000 m3/year – End of winter

Step 1 : sugar effluents

sucrerie BOURDON

Irrigation association perimeter

1400 Ha equiped – 700 Ha irrigated
Seed maize, maize, beetroots, wheat

Contrefactual business-as-usual scenario

Clermont-Ferrand WWTP

Owner : Communauté d'Agglo de CF
Manager : Veolia
Capacity : 425 000 EH
Treatment : Activated sludge + (Treatment N et P)

Discharge
40 Mm3 /year

Artière – Allier

Sustain compulsory environmental flows

Lagoons

Sugar refinery

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Bedat river

Individual uptakes

Irrigation
200 000 m3/year

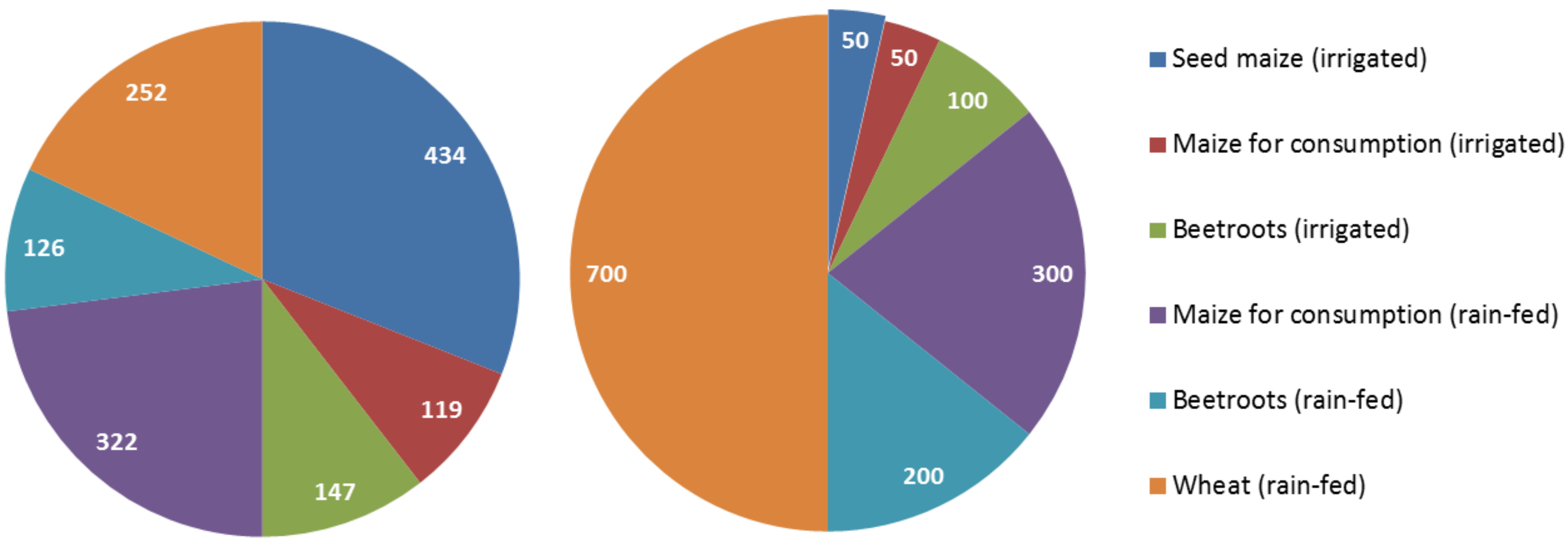
Agricultural area

200 Ha irrigated
Wheat, Maize, No seed maize

Scenario comparison

Crops distribution

Reuse scenario | **Contrefactual scenario**



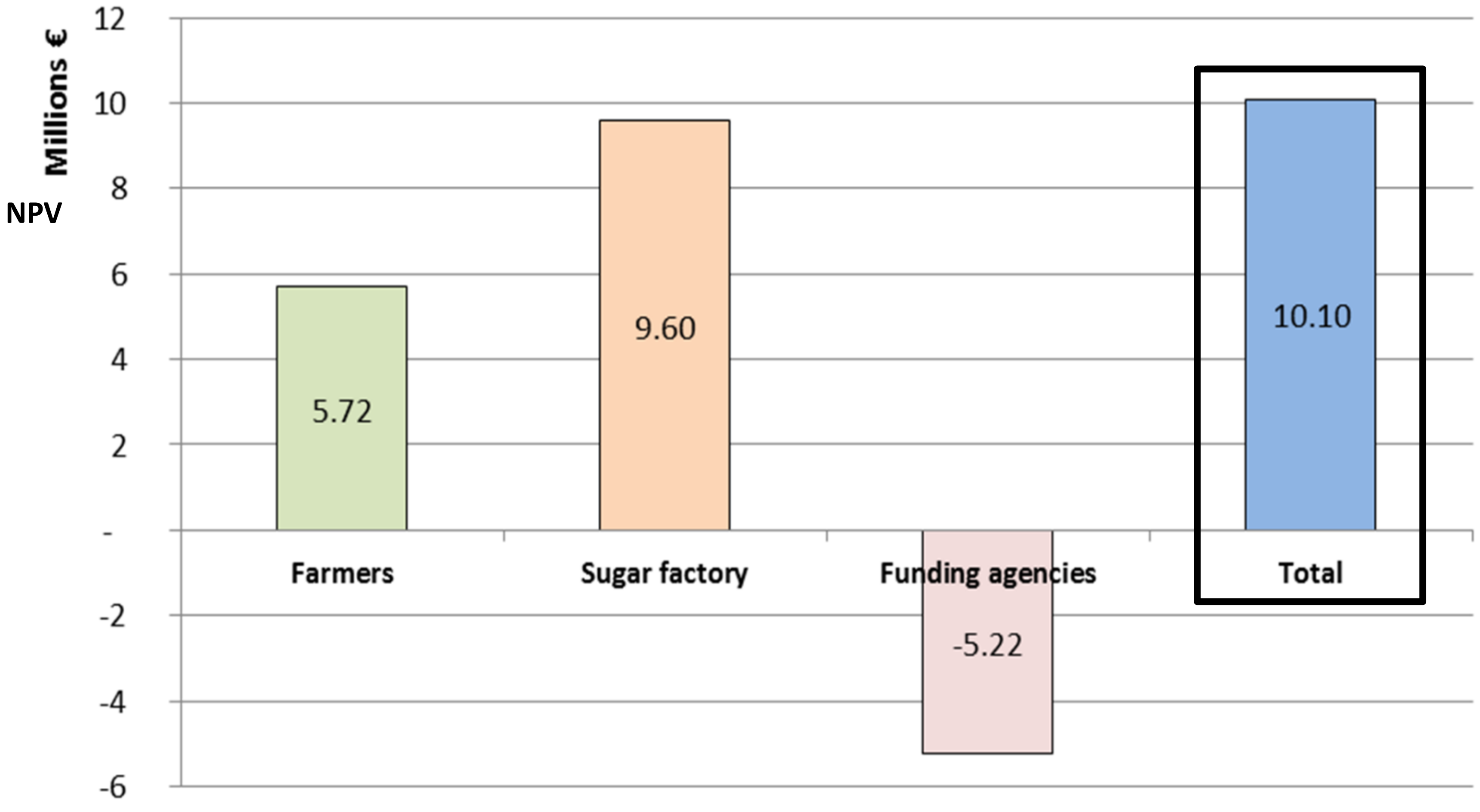
73.3 M€ | *60,6 M€*

Agricultural gross margin

Main cost and benefit considered

- ✓ **Investments** (irrigation material, lagoons rahabilitation, distribution system, sanitary studies)
- ✓ Annual **charges** (operational, maintenance, energy)
- ✓ **Agricultural gross margin**
- ✓ **Avoided cost** of treatment for the sugar factory effluents
- ✓ **Subsidies** from funding agencies

Net Present Value



Sensitivity analysis

Monte-Carlo method to deal with uncertainity

PARAMETERS	Hypothesis Deterministic approach	Uncertainties Lower and upper limit
Energy price increase rate	0%/year (0,05€/m^3)	[0% ; +5%]
Sugar factory effluents treatment costs	1,9 €/m^3	[-20% ; +30%]
Irrigation equipment life-time	20 and 50 years	[-30% : +30%]
Crops water needs	1 200 to 1 400 m^3/Ha	[-10% ; +20%]
Agricultural production price variation	180 to 270 €/T	[-30% ; +30%]
Seed maize area variation	434 Ha (reuse)	[-30% ; +10%]

↓

10 000 random draws

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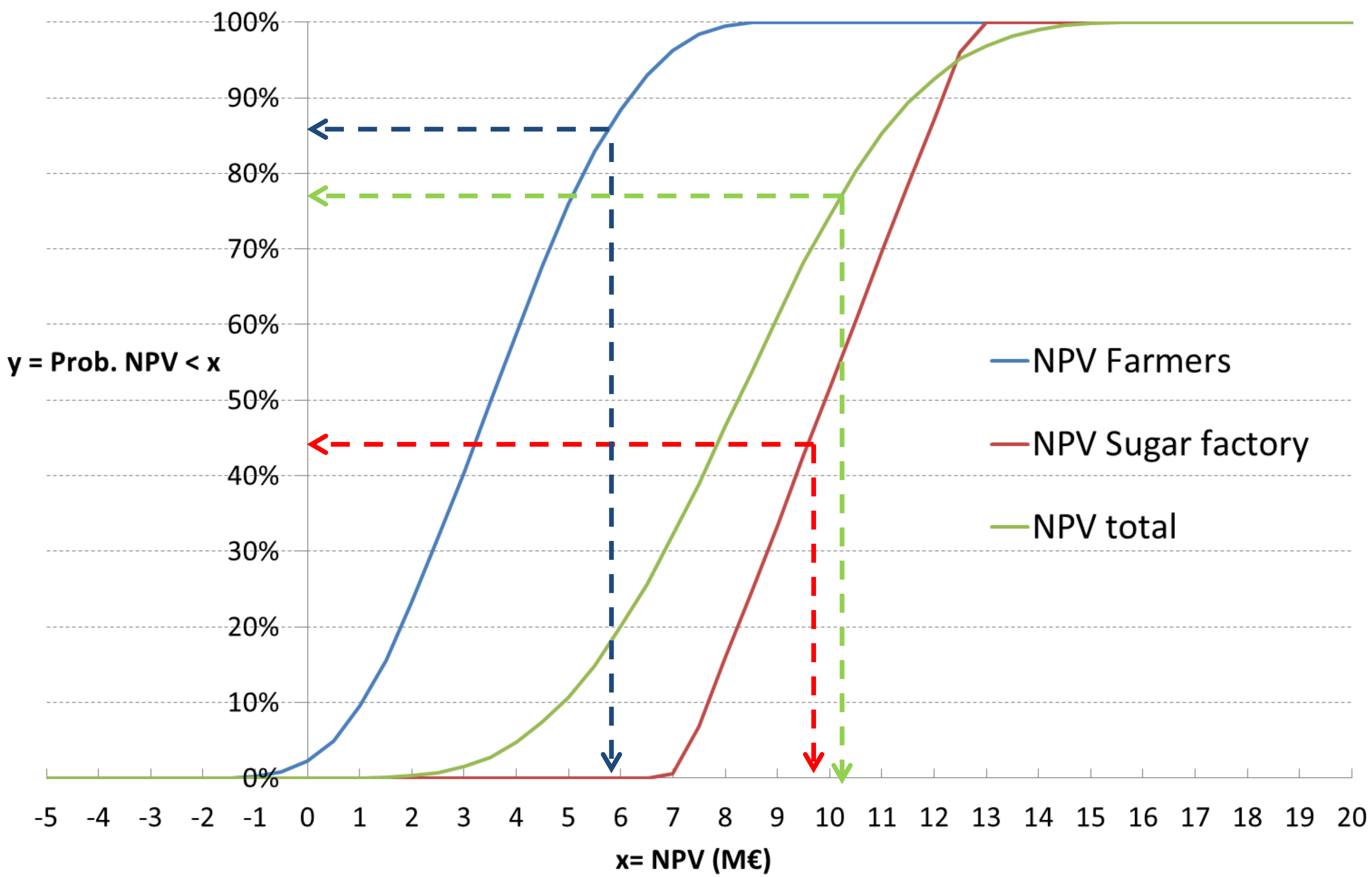
NPV dispersion

Sensitivity analysis

NPV dispersion



To go further…

- ✓ CBA = An economic support tool for decision-makers

- ✓ In Clermont-Ferrand TWWR is profitable but collective incentives could be implemented to allocate equally the collective net benefit
- ✓ Investment subsidies could have been lower
- ✓ Need to consider different time horizons and present time preference from the collectivity and the private point of view
- ✓ Difficulties to account for the possibility that agricultural land would be used for another activity in the business-as-usual scenario

- ✓ Need for further methodological developments → TWWR tailored environmental and social indicators
- ✓ Need for more feedbacks / lessons from experiences

Thank you for your attention