WATenERgy CYCLE
Urban water full cycle: from its source to its end-users and back to the environment

WP4 Common methodology & tools

Joint Del. 4.1 Water Pricing under FWC recovery

Interreg
EUROPEAN UNION
Balkan-Mediterranean
WATenERgy CYCLE

PP4 - University of Thessaly-Special Account Funds for Research-Department of Civil Engineering

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WP4: Common methodology & tools

- Responsible partner: PP4 - University of Thessaly-Special Account Funds for Research-Department of Civil Engineering
- Partners involved: ALL
- Budget: 115,507.68 €

Full Water Cost (FWC)

- DC (direct cost): can be calculated from the balance sheet of operational, maintenance and depreciation cost
- RC (resource cost): is calculated as the future loss of income due to future lack of water
- EC (environmental cost): the construction, operational and depreciation cost of wastewater treatment plant per water utility is estimated; at county level, pollution from industrial use, agricultural activities and stabled livestock is calculated

Direct Cost

- DC includes the costs a water utility pays to provide water of sufficient quantity and appropriate quality to its customers. These costs are:
  - Operation and Maintenance Costs,
  - Administrative Costs,
  - Other Costs (management related)
  - Annual Equivalent Capital Costs

- Crucial parameters affecting the level of the DC form 2 groups:
  - The 1st includes parameters related to the characteristics of (the necessary waterworks): a) the water resources being used; b) the water intake works; c) the water aqueducts; d) the water treatment plants; e) the water storage tanks; and f) the water distribution network.
  - The 2nd category includes parameters related to the way the water utility operates (e.g. speed and quality of repair works).

- Its analysis proves that large portions of the DC should be considered part of the EC (WWTP costs) and the RC (new resources pursuit costs)

Environmental Cost

- **environmental taxes/charges** related to freshwater/sewage services included in water bills are the EC recovery policies applied today

- **WFD principle** states that:
  - environmental damage = cost required to restore the environment to its original condition, based on the assumption that the lowest value of an environmental good equals the necessary cost for its protection

- the most representative amount of compensation of any **water use related environmental impact**
  - environmental damage restoration cost (EDRC – ex post analysis)
  - environmental damage avoidance cost (EDAC – ex ante analysis)

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Resource Cost

- (WFD 2000/60/EC): RC occurs when a water resource reserves exploitation rate exceeds the rate of its natural renewal. This cost is conceptually defined as the damage created to natural stocks which took hundreds of years to be created
- equals to lost profits suffered by other users/uses, when a water resource exploitation rate exceeds its supplying capacity (areas facing drought)
- occurs when water is not used to its most profitable use compared to other uses (CIS-WG2.6, 2002) (areas not facing drought)

Key factors forming the optimal water allocation:

- economic criteria (local economy characteristics, productive sectors sizes)
- social criteria
- strategic interests
- The opportunity cost gets higher under scarcity conditions and decreases when water storage is possible

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WP4.1: Water Pricing under FWC Recovery

- A socially fair drinking water pricing policy could include a fair fixed charge
- An opportunity cost the consumers should pay
- A fair FWC allocation to the users

Fixed costs (proportionally) related to the water volume each customer consumes, such as water mains' (and not service pipes) repair costs, pipes and tanks washing costs, etc. should be appropriately incorporated in the unit selling price of the water use (of the first block in cases of inclining block rates applied) as they relate to the "water network percentage of use" index

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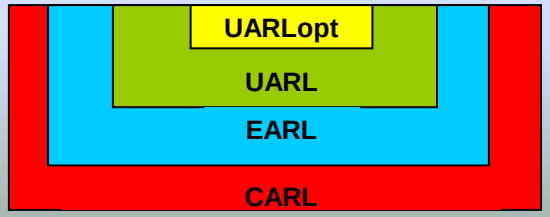
WP4.1: Socially fair allocation of NRW

Water quantities per use in the distribution network				Customer	Water Utility
				$Q_{CUST} = a \times Q_{SIV}$	$Q_{DN} = (1-a) \times Q_{SIV}$
Q_{SIV}	Q_{RW}	Q_{RW}	Q_{RW}	√	-
	Q_{NRW}	Q_{UNB}	Q_{UNB}	√	-
		Q_{AL}	Q_{WTH}	-	√
			Q_{MER}	√	-
			Q_{RER}	-	√
		Q_{RL}	$Q_{CARL-EARL}$	-	√
			$Q_{EARL-UARL}$	√ a%	√ (1-a)%
			$Q_{UARL-UARLopt}$	-	√
			$Q_{UARLopt}$	√	-

Customer

- ***Revenue Water (Q_{RW})***
- ***Unbilled consumption (Q_{UNB})***
- ***Meters' errors (Q_{MER})***
- ***Part of the difference between the Unavoidable Real Losses & the Economic ones ($Q_{EARL-UARL}$)***
- ***Optimum level of Unavoidable Real Losses ($Q_{UARLopt}$)***



Water Utility

- ***Water volume consumed illegally (Q_{WTH})***
- ***Recording errors (Q_{RER})***
- ***Difference between Current Annual Real losses & the Economic ones ($Q_{CARL-EARL}$)***
- ***Part of the difference between the Unavoidable Real Losses & the Economic ones ($Q_{EARL-UARL}$)***
- ***Difference between Unavoidable Real losses and their optimum ones ($Q_{UARL-UARLopt}$)***

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Socially fair allocation of NRW - Scenarios

Water uses in water distribution network				SCENARIO 1		SCENARIO 2		SCENARIO 3		SCENARIO 4		SCENARIO 5		SCENARIO 6		
Q_{SIV}	Q_{RW}	Q_{RW}	Q_{RW}	50%	50%	61%	61%	67%	67%	71%	71%	78%	78%	82%	82%	NRW goal=18%
	Q_{NRW}	Q_{UNB}	Q_{UNB}	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	STABLE
		Q_{AL}	Q_{WTH}	15%	5%	11%	5%	9%	4%	8%	4%	6%	3%	5%	3%	
			Q_{MER}		5%		2%		2%		2%		2%		2%	MIN=2%
			Q_{RER}		5%		4%		3%		2%		1%		0%	IT GETS ZERO WITH AMRs
		Q_{RL}	$Q_{CARL-EARL}$	32%	12%	25%	9%	21%	7%	18%	6%	13%	4%	10%	3%	DEPENDING ON THE WATER PRICE
			$Q_{EARL-UARL}$		10%		7%		6%		5%		3%		2%	DEPENDING ON THE WATER PRICE
			$Q_{UARL-UARLopt}$		5%		4%		3%		2%		1%		0%	DEPENDING ON THE AVERAGE PRESSURE
			$Q_{UARLopt}$		5%		5%		5%		5%		5%		5%	STABLE DUE TO Popt
				α=	70,00%	α=	76,34%	α=	81,91%	α=	85,26%	α=	90,72%	α=	93,88%	

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WP4.1: Water Pricing methodology

1. • **FWC estimation**
2. • **Estimation of the unit water cost based on the FWC recovery**
   • ***UWC = WP0 = (FWC/SIV)*** (eq.1)
3. • **The new unit water cost (WP_A) is calculated by charging the whole cost to the consumers based on their consumption.**
   • ***WP_A = (FWC/SIV)* (1/b) = WP0*(1/b)*** (eq.2)
4. • **Responsibility allocation and estimation of the percentage of responsibility the consumers have**
5. • **Calculation of the socially fair average water price**
   • ***WP1 = (a/b)* WP0*** (eq.3)

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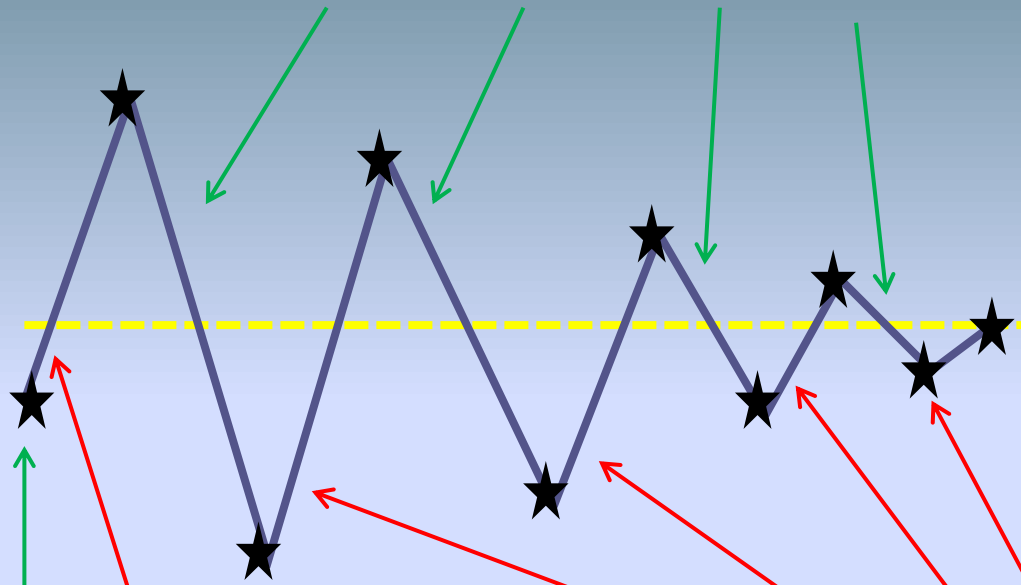
The WP of urban water drops because of the NRW reduction strategies (e.g. pressure management) and the increase of EARL levels because of the former WP's increase.



socially fair value of water

The price of urban water per cubic meter increases due to FWC recovery pursuit

These lower WP levels "force" the total actual water consumption to increase due to the water-price oriented elasticity of demand.

present "value" of water

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