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Climate Change Mitigation and Adaptation in Public Collective Irrigated Systems

IRRIGATED AGRICULTURE

M. Moreira[1], R. C. Guimarães[1], M. Rijo[1], C. Arranja[2], D. Cordeiro[2], D. Loureiro[3], H. Cunha[3], P. Luz[4], N. Carriço[5], B. Ferreira[5], G. Rodrigues[6], C. Chibeles[7], G. Sousa[8], M. Matos[9]

1 Dep. de Engenharia Rural, ICAAM, Escola de Ciência e Tecnologia, Universidade de Évora, Pólo da Mitra, Ap. 94, 7006-554 Évora
2 FENAREG - Federação Nacional de Regantes de Portugal, Rua 5 de Outubro, 14, 2100-127 Coruche
3 Departamento de Hidráulica e Ambiente, Laboratório de Engenharia Civil, Av. Brasil, 101, 1700-066 Lisboa
4 Unidade Estratégica de Investigação e Serviços de Sistemas Agrários, INIAV, Av. da República, Quinta do Marquês 2780-157 Oeiras
5 Escola Superior de Tecnologia do Barreiro, Instituto Politécnico de Setúbal, Rua Américo da Silva Marinho, 2839-001 Lavradio
6 COTR - Centro de Competências para o Regadio Nacional, Quinta da Saúde, Ap. 354, 7801-904 Beja
7 Associação de Beneficiários da Obra de Rega de Odivelas, Av. Gago Coutinho e Sacadura Cabral, 7900-562 Ferreira do Alentejo
8 Associação de Regantes e Benificiários do Vale do Sorraia, R. 5 de Outubro, Ap. 51, 2101-901 Coruche
9 Associação de Beneficiários da Obra da Vigia, Rua da Escola, 15, 7200-053 Montoito

1. Introduction

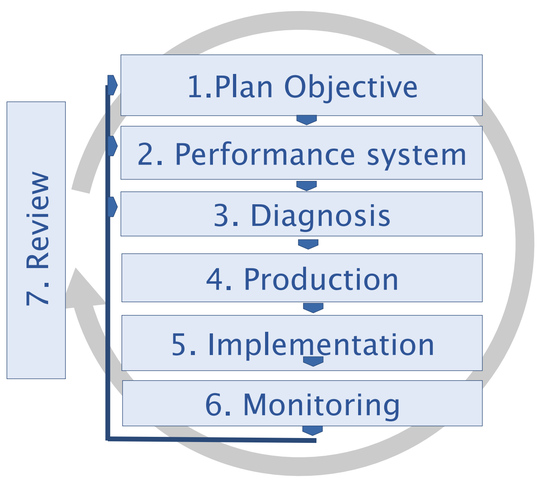
Collective Irrigated Systems are a great consumers of water and energy → Optimize water and energy efficiency → develop a climate change mitigation and adaptation Plan

2. Objective of the study

- Collective Irrigation Systems on the way to **Nearly Zero Energy**.
- A Performance System to the **Climate Change Mitigation** and **Adaptation** Plan, ensuring the water supplying and satisfaction of the agricultural irrigation users and preserving the sustainability of the service.

3. Methodology of the Climate Change Mitigation and Adaptation Plan

Step-process to create the plan
PDCA technique



4. Water Balance

Water balance of Collective Irrigation Systems (m^3)

System input volume	Authorised consumption	Billed authorized consumption	… metered	Revenue water
			… unmetered	
		Unbilled authorized consumption	… metered	Non-revenue water
			… unmetered	
	Water losses	Evaporation losses	… in channels	
			… in reservoirs	
		Apparent losses	Unauthorized consumption	
			Metering inaccuracies	
		Real losses	Leakages in pipes	
			Infiltration in channels	
			Infiltration in reservoirs	
			Overflows in channels	
			Overflows in reservoirs	

Adapted from IWA water balance

Water balance at farm scale (m^3)

			Comments
Water application	Crop consumption		Data - climatic variables
	Water losses	Evaporation	Data - climatic variables
		Runoff	Result - Risk Classes Classification of soil texture, water amounts and application rates
		Percolation	Data - soil characterization
		Wind drift	Data- climatic variables

5. Energy Balance

Energy balance (kWh)

System total energy = potential gravitic energy + Pumping energy	Energy associated with authorized consumption	Energy delivered to farmers	Minimum energy required
			Superfluous energy
		Energy dissipated associated with consumption	in channels and pipes
			in gates and valves
			in pumps
			In turbines
		Energy recovered	from authorized consumption
	Energy associated with water losses		from water losses
		Energy dissipated associated with water losses	in nodes where water losses occur
			in channels and pipes
			in gates and valves
			in pumps
			In turbines

Adapted from LNEC/IST energy balance

Energy/GHG emissions balance (kWh/ t CO_2e)

System total energy	Renewable source energy	Own renewable sources	GHGors
		Electrical grid source	GHG egs
	Nonrenewable source energy	Electrical grid source	GHG egs

6. Performance System

Water and energy efficiency performance assessment system of the collective irrigation network

Climate change mitigation and adaptation performance assessment system of the collective irrigation network

Goals	Criteria	Performance indicator	Description	Comments
Sustainability of irrigation water services	Economic and financial sustainability			These performance assessment indicators evaluate irrigation water services sustainability, despite the application of climate change mitigation and adaptation actions.
	Infrastructural Sustainability			
	Operational and maintenance sustainability			
Nearly zero energy collective irrigation systems (NZE-CIS)	Energy efficiency	CIS15-Energy efficiency of the pumping facilities	Rate between useful energy and energy supplied to pumping facilities.	Measures of improving energy efficiency in the largest energy consumers in collective irrigation systems
		CIS16- Total energy supplied to the system.	Rate between total energy supplied to the system (gravity and pumping) and minimum energy required.	Measures of improving energy efficiency at other infrastructures in collective irrigation systems.
	Reducing energy consumption	CIS17'- Energy associated with water losses inefficiency	Rate between energy associated with physical water losses and total energy supplied to the system (gravity and pumping).	Measures the reduction of energy consumption based on the reduction of physical water losses.
	Reducing GHG emissions	CIS22- Renewable energy rate	Percentage of total energy consumed from renewable sources.	Measures on own renewable energy and electrical grid renewable energy.
		CIS23- Own renewable energy sources	Percentage of total energy consumed from own renewable sources.	Measures on renewable energy autonomy (recovered when there are conditions for installing microturbines or other sources)
		CIS24- GHG emissions balance	Rate between total GHG emissions and GHG emissions planned fitting current targets.	Identify collective irrigation systems capacity to meet national and European targets.
Adequacy of service provided to irrigation water users	Accessibility of service			These performance assessment indicators evaluate continuity of the economic accessibility of the irrigation water users and service quality, despite the application of climate change mitigation and adaptation actions
	Quality of service			

7. Case Studies

ODIVELAS – VALE DO SORRAIA – VIGIA





8. Conclusions

Climate Change Mitigation and Adaptation Plan will allow the preparation, prevention and establishment of the Collective Irrigation Systems contingency plan.
This is a good example of – **Research on the strategic use of water and their impacts, and adaptation to climate change as well as mitigation measures together to** develop a tool to measure how collective irrigation systems are **prepare**d **for** climate **change** today and tomorrow.

9. References

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10. Acknowledgements

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