

## Water Services Corporation SCADA A Tool for Efficient Resource Management

*The experience of Water Service Corporation Malta for  
the Water/WasteWater Management Systems*

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## BACKGROUND

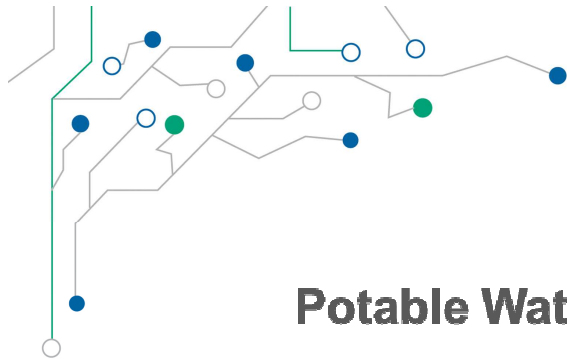
### Three Islands

#### Areas:

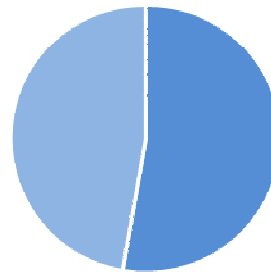
- Malta: 246km<sup>2</sup>
- Gozo and Comino: 70km<sup>2</sup>

- Population (2014):
- 421,364 (density = 1,333 p/km<sup>2</sup>)
- Temperature from 7°C to 35°C
- Rainfall: 500-600mm average
- No rivers or lakes





## Potable Water Production WSC (2014) - 30,472,000m<sup>3</sup>



- Desalination 54.2%
- Groundwater 45.8%

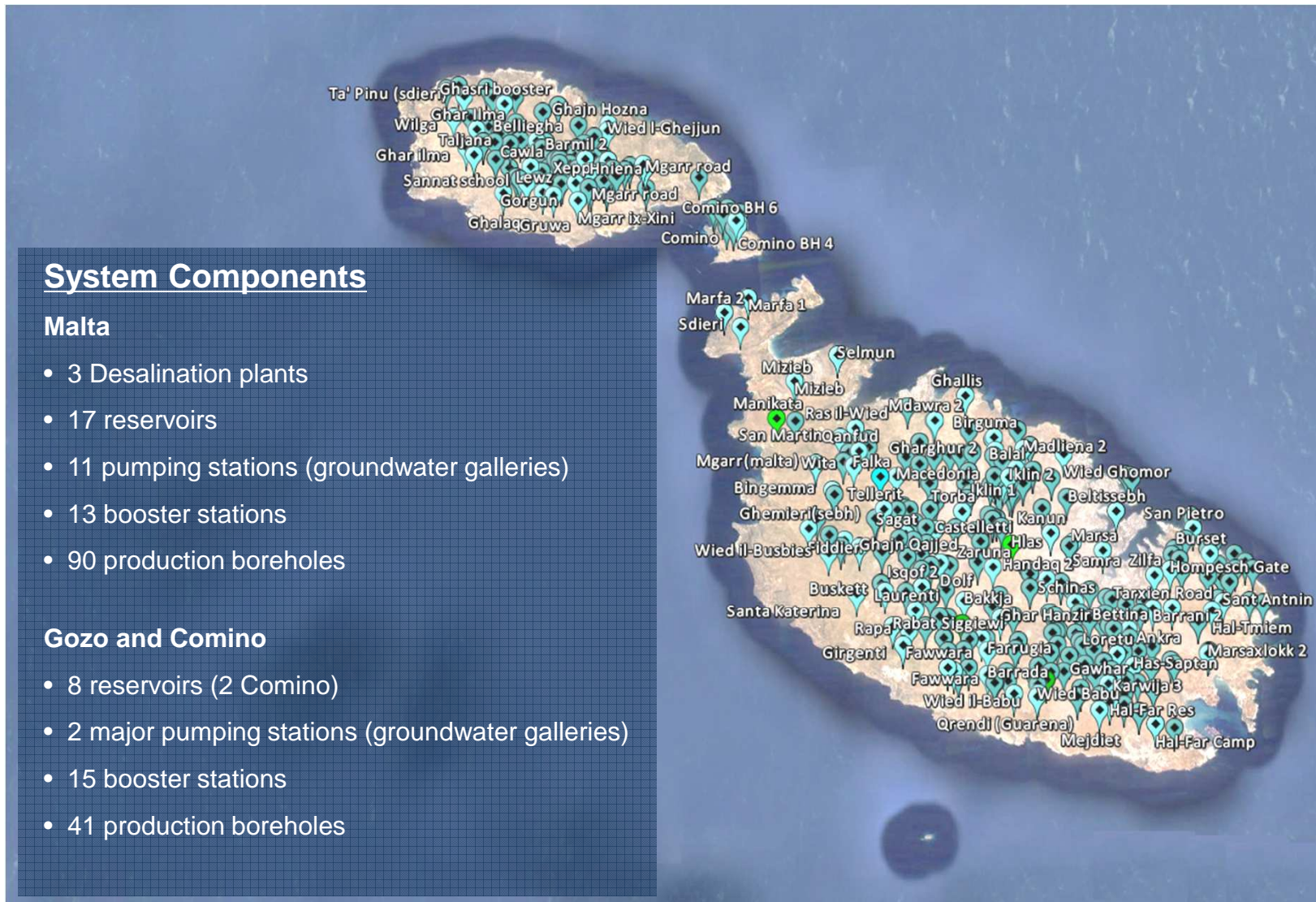
## Groundwater Status

Estimated total groundwater abstraction	Sustainable water for extraction
33 million m <sup>3</sup>	23 million m <sup>3</sup>

*EU LIFE+ Investing in Water – National Water Conference Report 2012*

**The water produced by 90% of Malta's aquifers no longer meets the Maltese and EU standards for safe drinking water!**

# WSC POTABLE WATER SOURCES





# SCADA BASIC FEATURES



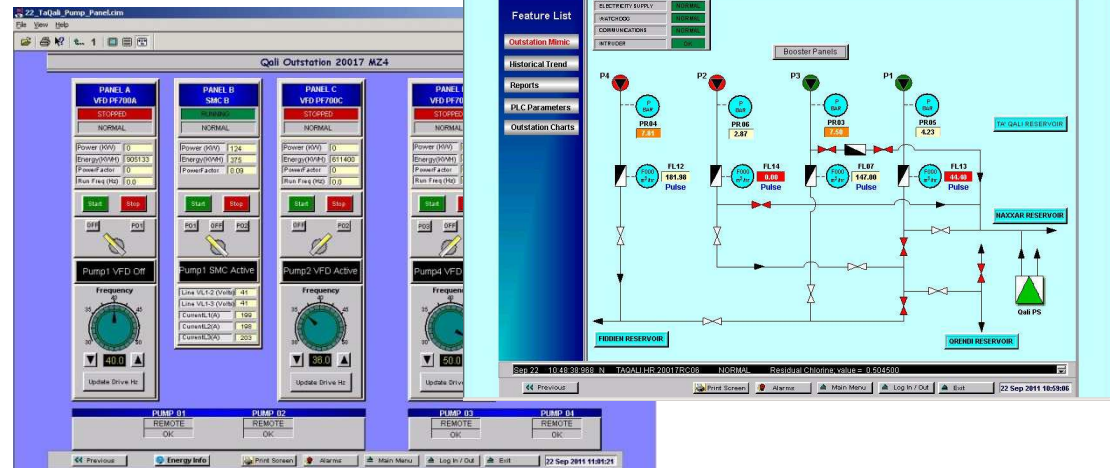
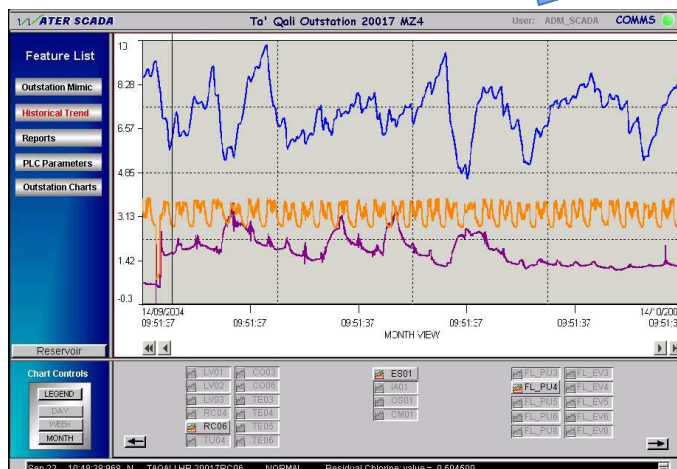
The newly refurbished WSC control Centre – 2012

## ALARMS

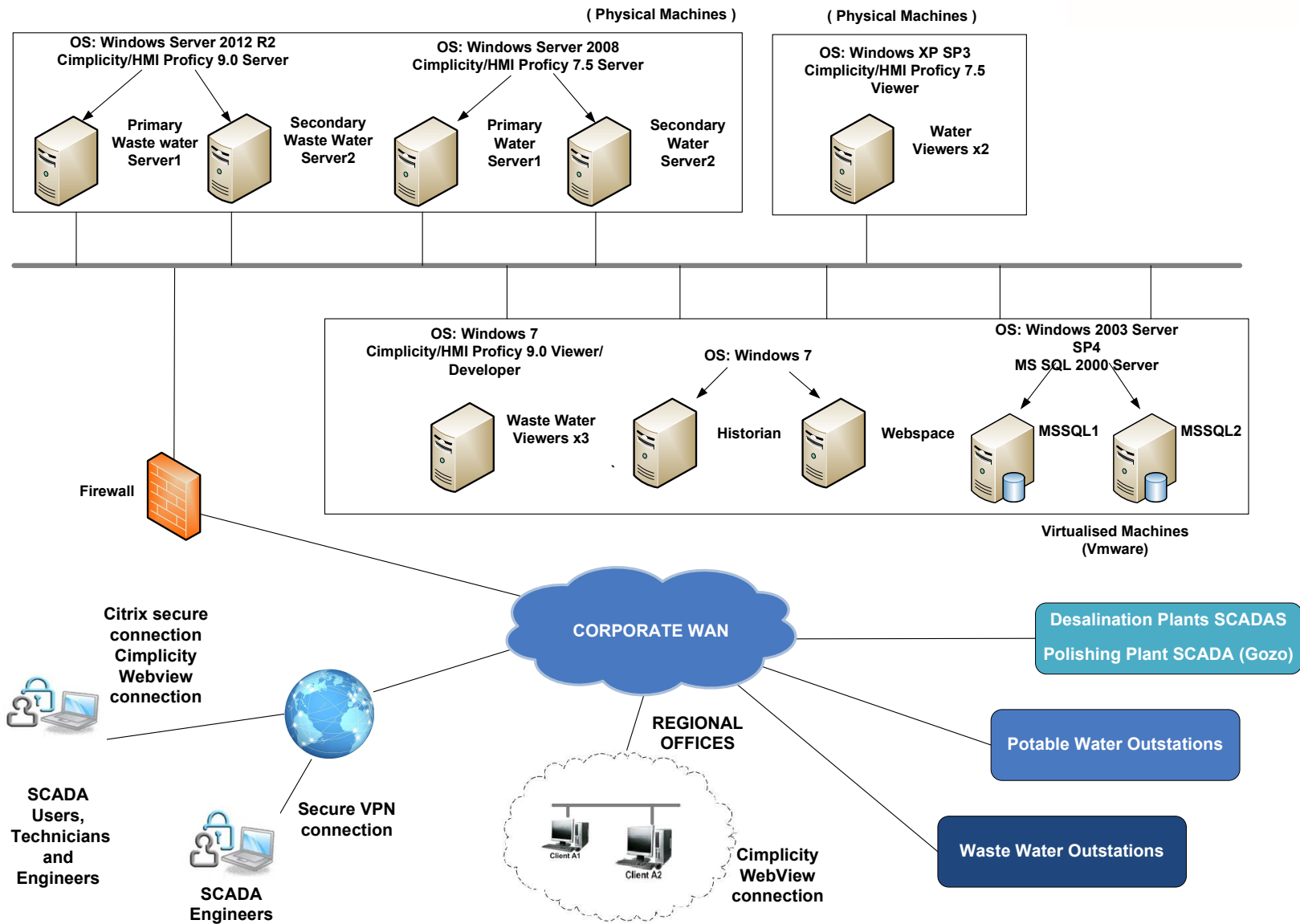
Date	Time	Ack	Alarm ID	Class	State	Message
86 Feb 12 14:00						
12-Feb-10	14:07	N	GHASEL.VR.70023LP01	ML_LP	ALARM	GHASEL.VR.70023LP01 is Lo Lo, Level Sump Percentage is Equal to 3175000 %
12-Feb-10	14:07	N	GHASEL.DI.70023NF01	ML_NF	ALARM	Pump 1 Tripped
12-Feb-10	14:06	N	HFAR.VR.70068LP01	ML_LP	ALARM	HFAR.VR.70068LP01 is Lo Lo, Level Sump Percentage is Equal to 2275000 %
12-Feb-10	14:05	N	LUNZ.VR.71001LP01	OL_LP	ALARM	LUNZ.VR.71001LP01 is Lo Lo, Level Sump Percentage is Equal to 18475000 %
12-Feb-10	14:04	N	BUGIA.VR.70067LP01	ML_LP	ALARM	BUGIA.VR.70067LP01 is Hi Hi, Level Sump Percentage is Equal to 39800000 %
12-Feb-10	14:01	N	GALENZA.VR.70076LP01	ML_LP	ALARM	GALENZA.VR.70076LP01 is Hi Hi, Level Sump Percentage is Equal to 42275000 %
12-Feb-10	14:00	N	MEDONON.VR.70048LP01	ML_LP	NORMAL	MEDONON.VR.70048LP01 is NORMAL, Level Sump Percentage is Equal to 79475000 %
12-Feb-10	13:58	N	SELMUN.VR.71004LP01	ML_LP	ALARM	SELMUN.VR.71004LP01 is Lo Lo, Level Sump Percentage is Equal to 18330000 %
12-Feb-10	13:58	N	SELMUN.VR.70017LP01	ML_LP	ALARM	SELMUN.VR.70017LP01 is Lo Lo, Level Sump Percentage is Equal to 18800000 %
12-Feb-10	13:55	N	MFORN.VR.71005LP01	OL_LP	ALARM	MFORN.VR.71005LP01 is Lo Lo, Level Sump Percentage is Equal to 46325000 %
12-Feb-10	13:54	N	MOSTAN.VR.70022LP01	ML_LP	NORMAL	MOSTAN.VR.70022LP01 is NORMAL, Level Sump Percentage is Equal to 46000000 %
12-Feb-10	13:53	N	MSCALA.VR.70074LP01	ML_LP	NORMAL	MSCALA.VR.70074LP01 is NORMAL, Level Sump Percentage is Equal to 91000000 %

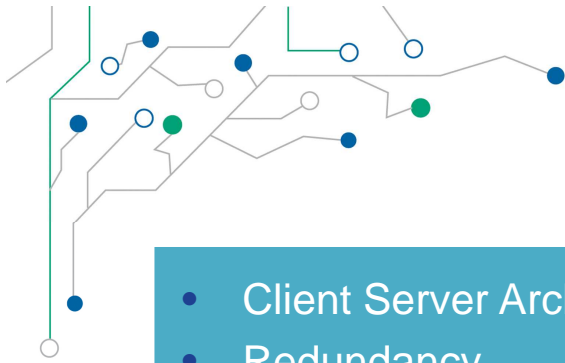
## MIMIC SCREENS

## TRENDING



# WSC SCADAS ARCHITECTURE





- Client Server Architecture
- Redundancy
- Extensive Driver Set
- Highly Scalable

Proficy

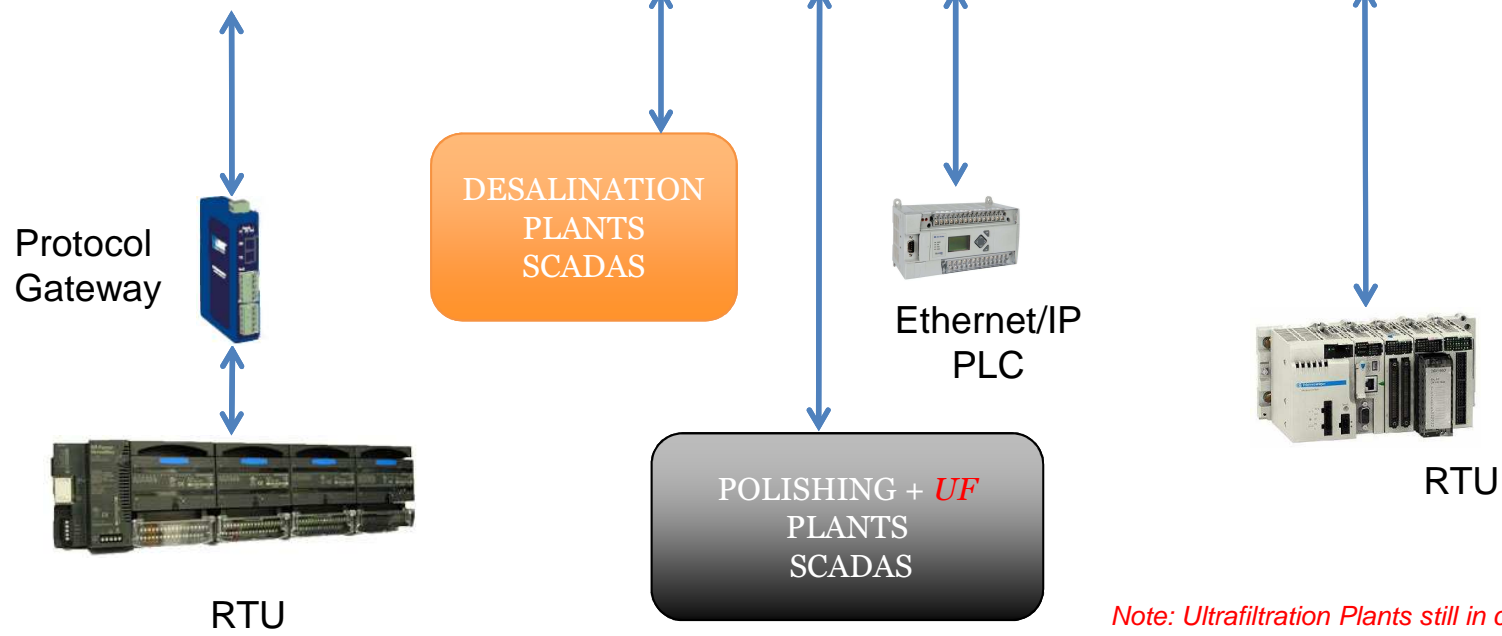
HMI/SCADA -  
SIMPLICITY

- Vector based graphics
- Digital Graphics Re-Play
- Web-Visualization
- Integrated Data Collection thru Proficy Historian

MODBUS TCP/IP

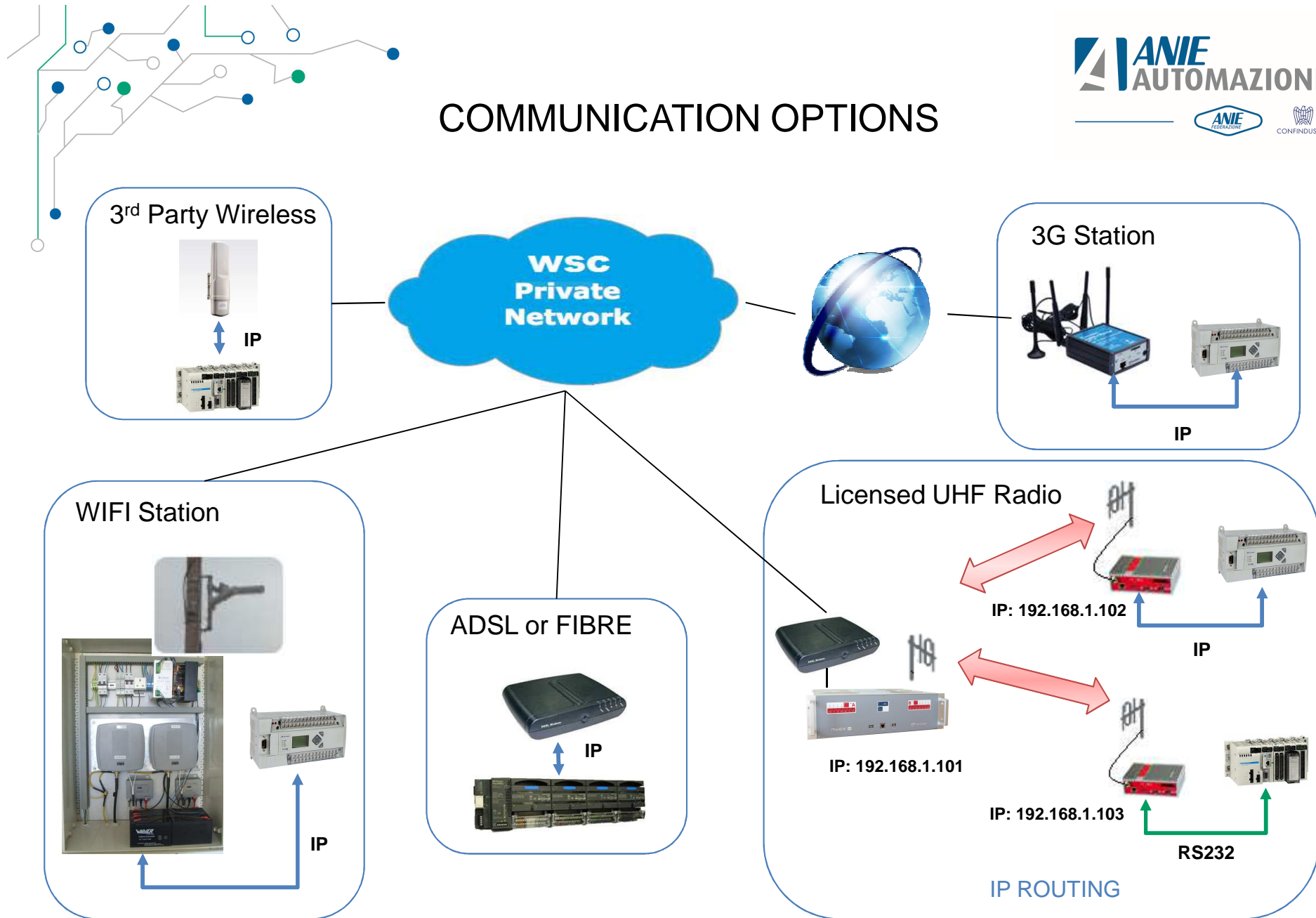
OPC DA SERVER

MODBUS RTU



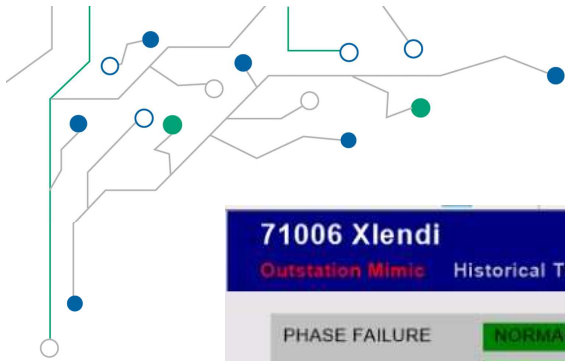
*Note: Ultrafiltration Plants still in construction Phase*

# COMMUNICATION OPTIONS



*Note: 1 Radio network – Water & Wastewater*





# TYPICAL OUTSTATION MIMIC

71006 Xlendi
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Outstation Mimic   Historical Trend   Control Parameters   Alarms

PHASE FAILURE	NORMAL
COMMUNICATIONS	NORMAL
INTRUDER	NORMAL
SURGE ARRESTOR	NORMAL
DC SUPPLY	ON MAINS

FLOW	
INFLOW TOTALIZER (m³)	2.00
INFLOW (m³/hr) - FL01	0.39
OUTFLOW (m³/hr) - FL02	0.00

LEVEL INDICATOR	CONTROL
1.00 m of 2.20 m	SENSOR
INCREASING	PLC
	AUXILIARY

LEVEL CONTROL SETTINGS			
PRIMARY PUMP		EMERGENCY PUMP	
START LEVEL	58 %	72 %	
STOP LEVEL	32 %	47 %	

STOP FLT	●
EMER FLT	●
START FLT	●

STATION VOLTAGE (V)	414.00
OUTSTATION VOLTAGE (24V)	27.20
STATION ENERGY (KWH)	82985.00

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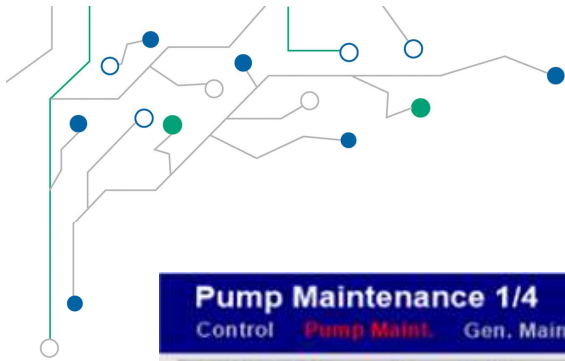
File View Help

POINT DESCRIPTION	POINT ID	CURRENT VALUE	HIGH LEVEL ALARM	LOW LEVEL ALARM
Level Sump (%)	LP01	49.00	60.00	25.00
Inflow (m³/hr)	FL01	0.48	999.00	-999.00
Outflow (m³/hr)	FL02	0.00	999.00	-999.00
Current 1 (A)	CU01	0.00	45.00	-1.00
Current 2 (A)	CU02	0.00	45.00	-1.00
Current 3 (A)	CU03	0.00	45.00	-1.00
Current 4 (A)	CU04	0.00	45.00	-1.00
Station Voltage (V <sub>L</sub> )	SV01	413.00	451.00	369.00
Spec Energy(kWh/m³)	SP01	17.54	2000.00	0.00
24V Supply (V)	DC24	27.20	28.00	24.00
Station Energy (kWh)	KWH01	82985.00	2000.00	0.00
Specific Power (kW/m³)	SP01	17.54	2000.00	0.00
Start Counts P1 / Hour	SSC_HR_P1	1.00	15.00	-1.00
Start Counts P2 / Hour	SSC_HR_P2	1.00	15.00	-1.00
Start Counts P3 / Hour	SSC_HR_P3	1.00	15.00	-1.00
Start Counts P4 / Hour	SSC_HR_P4	1.00	15.00	-1.00

To disable alarms, contact administration

Back

Jun 12 07:49:38 N DB CONN DOWN HIGH ALA



# MAINTENANCE SCREENS

**Pump Maintenance 1/4**

Control **Pump Maint.** Gen. Maint. Daily Stats Gen Stats PLC

OUTSTATION	ID	PUMP	MAINT.TIME	HR METER		OUTSTATION	ID	PUMP	MAINT.TIME	HR METER			
CAGHAQ	70024	1	000	000	R	DINGLI	70003	1	000	000	R		
		2	000	000	R			2	000	000	R		
		3	000	000	R			DINGLIH	70004	1	000	000	R
		4	000	000	R					2	000	000	R
BALLUTA	70056	1	2000	6	R	EXILES	70042	1	2000	315	R		
		2	2000	61	R			2	2000	553	R		
BAHRIJA	70031	1	000	000	R	FARRUG1	70095	1	2000	237	R		
BIRGU	70066	1	000	000	R	FARRUG2	70096	2	2000	0	R		
		2	000	000	R			1	2000	60	R		
BIRGUMA	70026	1	000	000	R	FISH	70064	2	2000	0	R		
		2	000	000	R			1	000	000	R		
B'BUGIA	70067	1	000	000	R	FEKRUNA	70005	2	000	000	R		
		2	000	000	R			1	000	000	R		
		3	000	000	R			2	000	000	R		
		4	000	000	R			1	000	000	R		
BUGIBBA	70001	1	000	000	R	GERBULIN	70006	2	000	000	R		
		2	000	000	R			1	000	000	R		
CEJLU	70058	1	2000	1777	R	GHADIRA	70007	2	000	000	R		
		2	2000	1867	R			1	2000	123	R		
COALW	70088	1	2000	29	R	GHADIRACS	70029	1	2000	123	R		
CAVALL	70040	1	000	000	R	GDWIELI	70069	1	000	000	R		
		2	000	000	R			2	000	000	R		
COTTON1	70085	1	2000	426	R	GHAZZELIN	70020	1	000	000	R		
		2	2000	79	R			2	000	000	R		
						GZNUBER	70008	1	2000	3231	R		

Jun 12 07:18:01 N FARRUG2.VR.CM01 ML CM NORMAL Device Down Alarms



# PLC CONTROL SCHEDULES

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Outstation Mimic Historical Trend Control Parameters Alarms

**STATION CONTROL SETTINGS**

	CURRENT	NEW	
LEVEL CONTROL	SENSOR	SENSOR	
CONTROL MODE	SCADA	SCADA	
PUMP SET 1	ENABLED	ENABLE	
PUMP SET 2	ENABLED	ENABLE	
<b>EMERGENCY PUMP:</b>			
WORKS ON POWER SUPPLY	ENABLED	DISABLE	⚠️
WORKS ON GENERATOR	DISABLED	DISABLE	
RESTORE DEFAULTS		UPDATE STATION	

Jun 12 07:18:01 N FARRUG2.VR.CM01
ML\_CM NORMAL Device Down
Alarms

# OUTSTATION COMMUNICATIONS

Online Analysers



Energy meter



PLC



VFD



SOFT  
STARTER



Modbus rs485

EM Flow meter



HMI



Protocols:  
Ethernet/IP  
Modbus TCP/IP



## TYPICAL WASTEWATER OUTSTATION



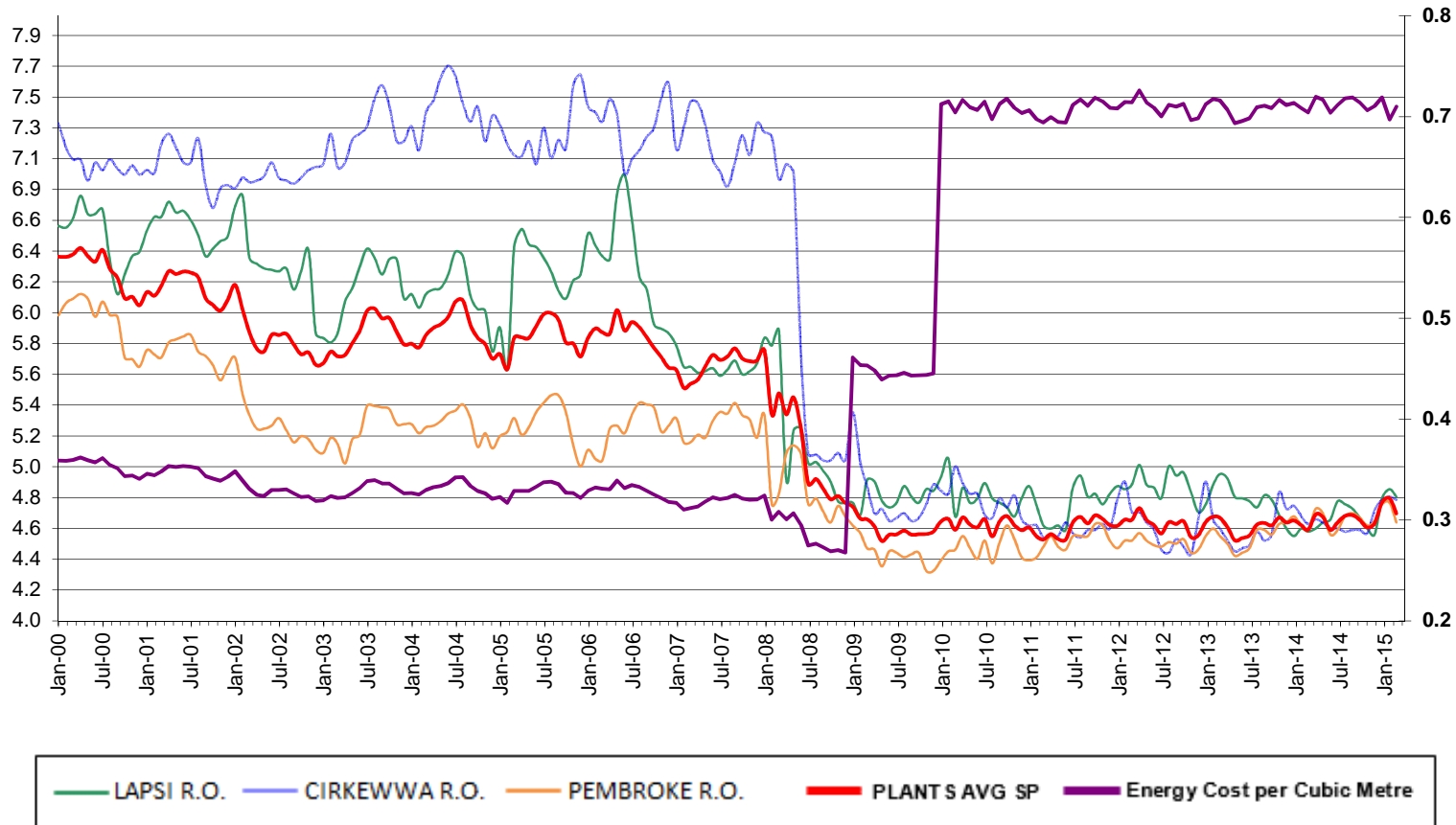
- Standard Layout - Water & Waste Water
- Modular approach
- Standard integration methodology
- Local (HMI)/SCADA for monitoring and configuration of control scheme
- Logic for pump alternation sequence, level control, pressure control, overflow and pump protection
- Calculation of Specific Energy and other KPI's



## DESALINATION PLANTS - ENERGY PERFORMANCE

Specific Power / (kWh/m<sup>3</sup>)

Energy Cost (€/m<sup>3</sup>)





Year	Action
1998	Take-over from Polymetrics Actions: Excessive valve throttling, non-matching duty points, pumps leaks, Well pumps to drain !!
2001	Installation of Pelton Turbines
2004	Pressure exchangers replaced Francis Turbine pumps. Energy recovery efficiency
2009	Upgrading of desalination plants SCADA system, energy recovery pumps and membrane replacement (i.e. 75% of membranes). (EU pre-accession funds)
2010	Installation of VFD – pressure optimisation and better control
2016	Replacement of 25% of membranes, pressure exchangers, and replacement of pumps



## DESALINATION PLANTS MAINTENANCE THROUGH SCADAS

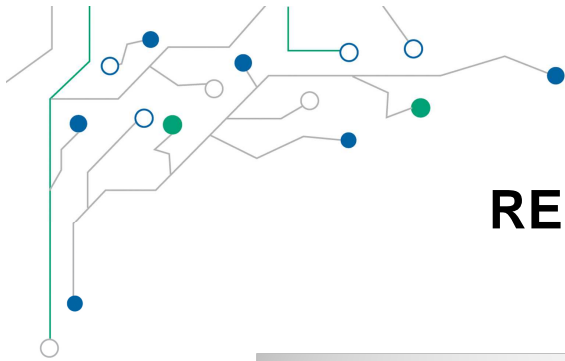
### *Condition based maintenance:*

- Monitoring of bearing and winding temperature – 2 Alarms
- High temperature Alarm
- Shut-down Alarm
- Manual work order

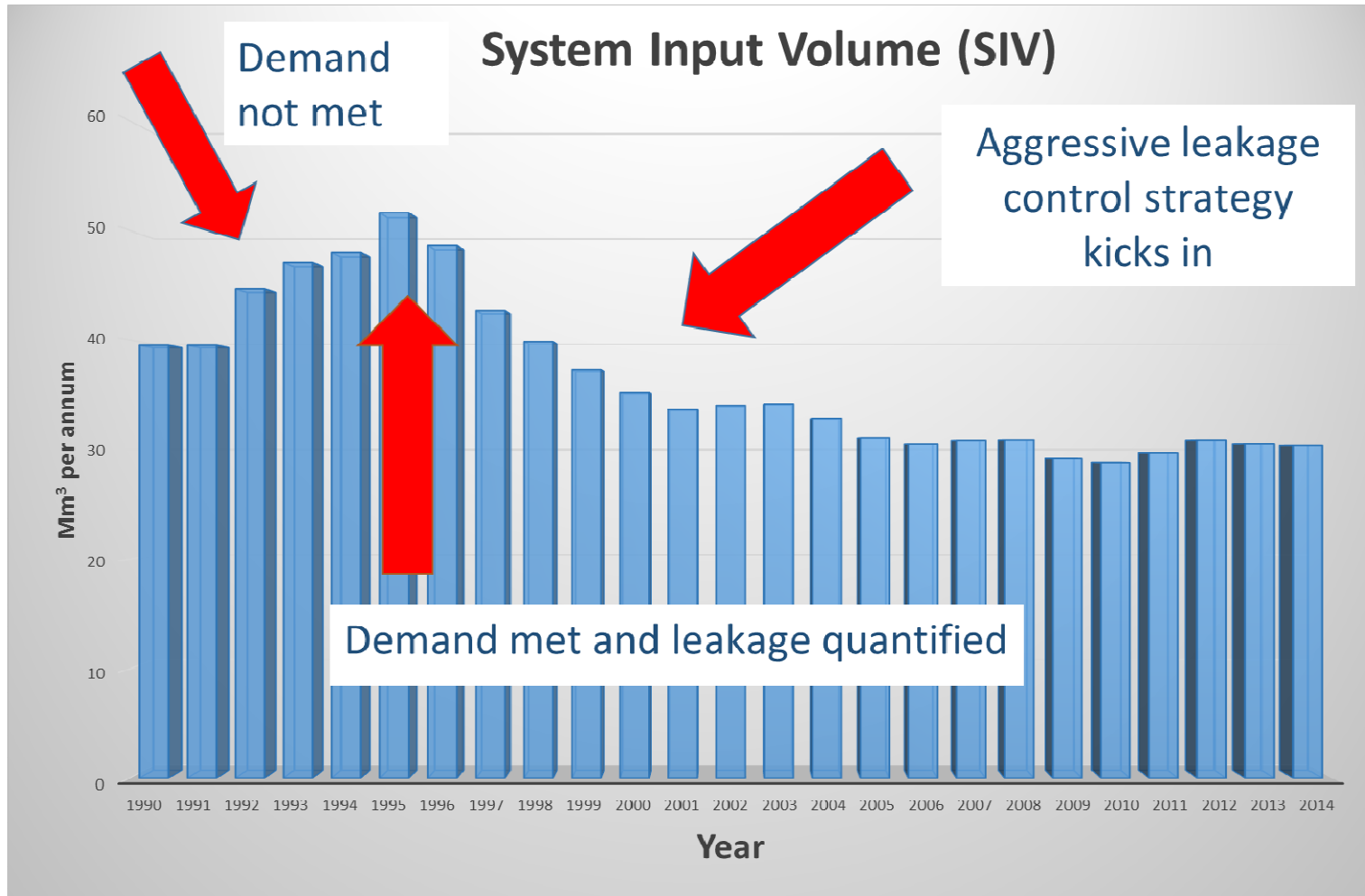
### *Time based maintenance:*

- Automatic SAP notifications for maintenance on electric switchgear, oil changes, calibration checks, etc.



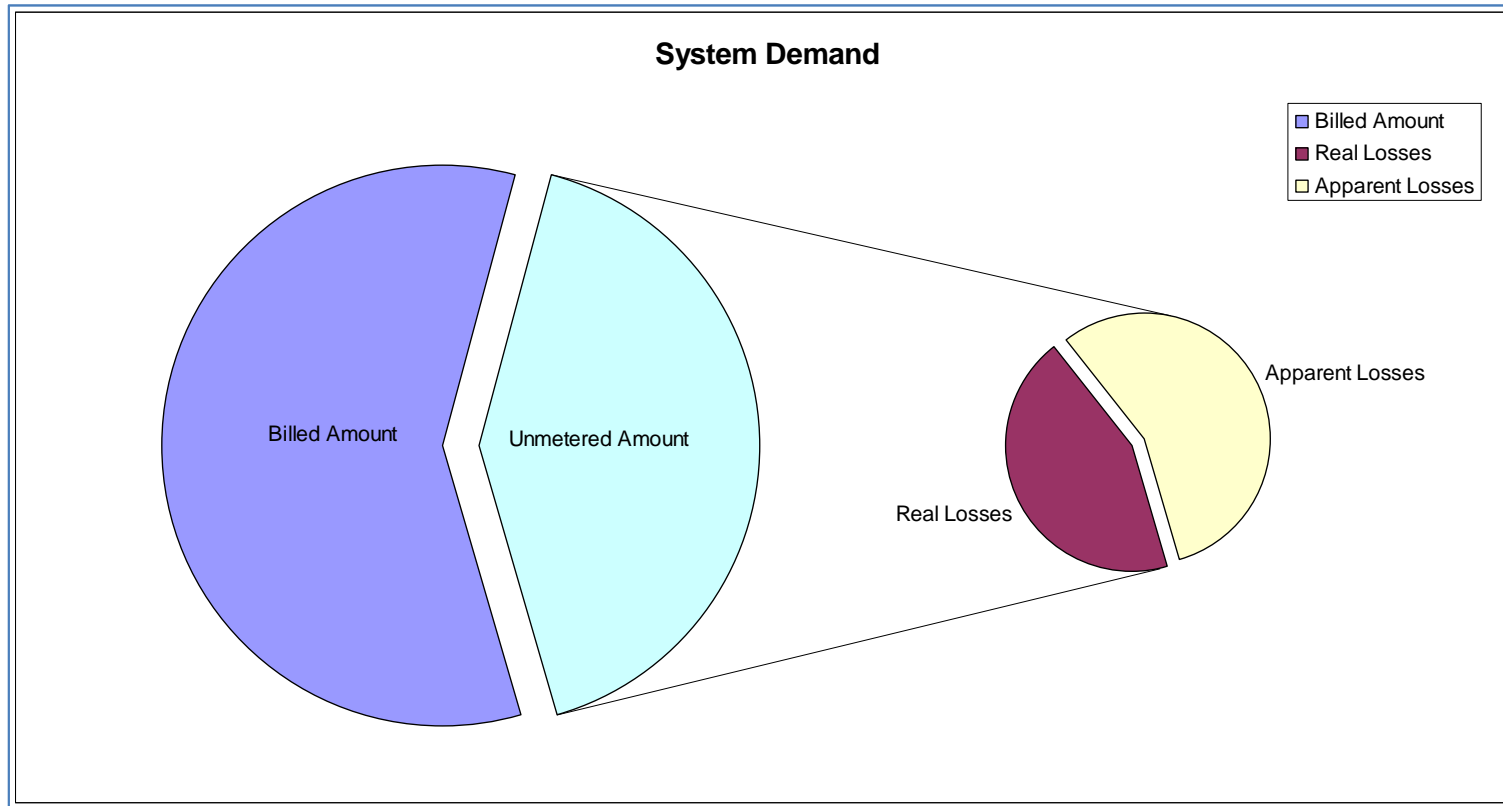


## REDUCTION IN WATER PRODUCED





## LOOKING AT THE WHOLE PICTURE !



*The Problem of Apparent Losses !*

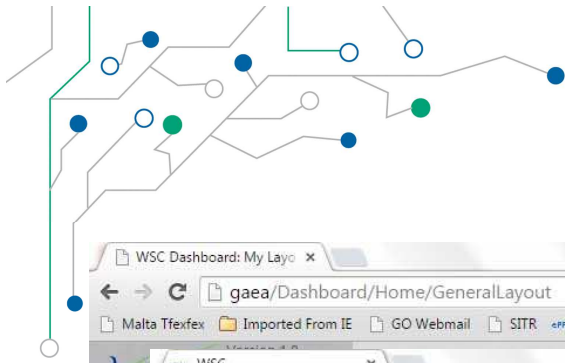
## AUTOMATED METER MANAGEMENT PROJECT

- Started off in April 2010
- Target for 100% coverage
- Current status:

Total Accounts	Meters fitted with AMM	% fitted	Reachable (over 3 days)	% Reachable (over 3 days)	Billable	% Billable
262k	216k	82.5%	196k	93.08%	190k	87.8%



*Completing the  
Water Balance!*



# INTEGRATION GIS - AMM

The screenshot displays a web browser window with the URL `gaea/gisammreporting`. The interface includes a navigation menu on the left with categories like Gateways, Meters, AMM, Consumption, Leakages, Pipes, and Services. A central map shows the island of Malta with various locations marked by blue triangles. A red circle highlights a specific gateway area, with a 'Gateway Coverage' popup window displaying the following data:

Colour	Distance	Meters
Light Green	1 km	8
Green	3 kms	1388
Red	4 kms	2774

Below the table, a text box states: "The total number of meters reached by the **Falka** gateway within the period of **08/03/2015** to **14/03/2015** and with a distance of **4km(s)**, is that of **2774**."

On the right side of the interface, there is a 'Table of Contents' panel with a 'Distribution' section containing a list of layers with checkboxes and expand/collapse icons:

- Master
- Strainer
- PRV
- Sluice Valve
- Services
- Meters
- Endcap
- Pipes
- Service Point
- Gateways

Below this list are buttons for 'Areas', 'Basemaps', and 'Current Reports Layer'. The bottom of the browser window shows a Windows taskbar with various application icons and a system tray displaying the time 12:22 and date 24/03/2015.

## CONCLUSION

### □ Future Projects:

- All functional stations will be upgraded with PLC and VFD control
- Addition of 127 new water SCADA outstations
- Implementation of a new UHF radio infrastructure common to Water and Wastewater outstation

*Estimate (> €7 million)*

### □ Our Vision: Continuous efforts to unlock the numerous opportunities that exist in bridging the data: *SCADA – **HISTORIAN** - AMM – GIS – CRM – EAM*

- Provide real-time and historical data for efficient resource management
- Reducing data redundancy (**Corporate Historian**)
- Create a complete water balance – Manage better leakages and *eliminating the unknowns!*

### □ Creating more in-house expertise! Team of 3 Engineers & 13 technicians



Thanks for listening !

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