DAIRY WATER METERING PROJECT

PROGRESS MEETING: 10 AUGUST 2021

IFC International Finance Corporation WORLD BANK GROUP

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AGENDA

1. Project introduction: Raymond
2. Team introductions: Team Leaders
3. Progress updates on each component: Raymond and Jørgen
4. In-depth review on structure and content of generic guideline: Darrin
5. Feedback from all parties
6. Next steps

Project Components & Stakeholders

Dairy Water Metering

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Pilot on 4 Dairies

Shortlisting of Dairy Facilities

Consortium of Danish and SA Consultants

Dairy Water Metering & Monitoring Guidelines

Generic Metering & Monitoring Guideline for Agri-Processing

ri
RESOURCE INNOVATIONS

NCPC
NATIONAL CLEANER PRODUCTION CENTRE
SOUTH AFRICA

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Dairy shortlist progress

- Approached 16 dairies
- **Commitment from 3 dairies**
- Interest from further 4 dairies (feedback expected this week)
- 4 dairies declined
- Utilising high-level questionnaire to assist with short-listing progress
- Ideally want a combination of “basic” and “sophisticated” pilots for facilities of different sizes

COMPANY DETAILS		
Company		
Location		
Province		
Year established		
Name		
Contact Number		
Email Address		
PRODUCTION		
Capacity	litre milk/day	210 000
Products		
Cheddar Cheese	tonnes/day	6.13
Mozzarella Cheese	tonnes/day	1.59
Butter	tonnes/day	0.17
Product #4	tonnes/day	
Product #5	tonnes/day	
Product #6	tonnes/day	
ENERGY		
Annual electricity consumption	kWh	1 440 000
No. of electricity sub-meters or loggers	#	1
Type of meters (SMART, analogue, etc.)		unsure
Data storage		Yes
Data analysis		Yes
Rate your energy management systems		3
Rate your energy data management systems		4
WATER		
Annual water consumption	kl	84 000
No. of water meters	#	10
Type of meters (SMART, analogue, etc.)		Smart
Data storage		Yes
Data analysis		Yes
Rate your water management systems		2
Rate your water data management systems		4
METERING AND MONITORING PILOT		
Provide an example of where you would like assistance with *WATER* metering and monitoring		Reconciliation of water meters, understanding of exact usage per line/use to identify water loss and allocate water usage per line

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GENERIC METERING AND MONITORING GUIDELINE

DARRIN MCCOMB

International Finance Corporation
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August 10, 2021

WATER METERING AND MONITORING GUIDELINE FOR AGRI PROCESSING SECTOR IN SOUTH AFRICA

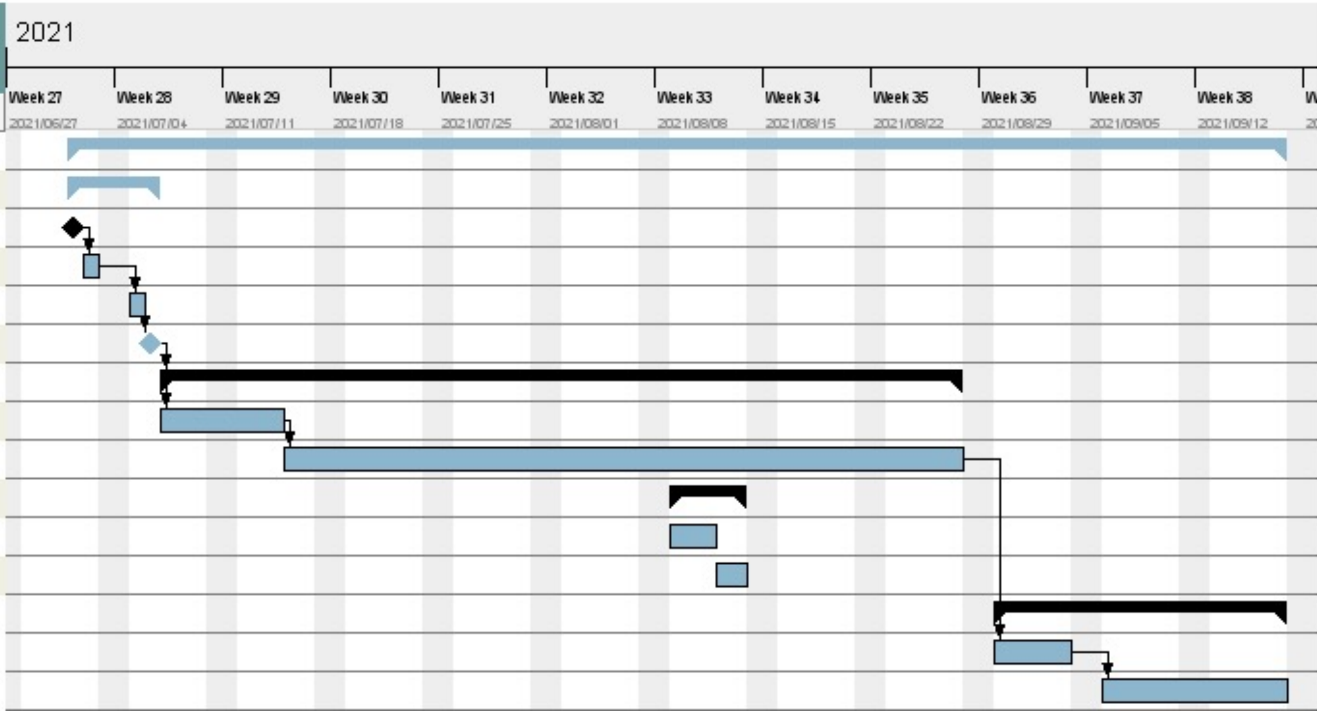
a**. Promote the use of energy and water metering and monitoring equipment** in the agri-processing industry in South Africa by showcasing the benefits of metering and monitoring equipment;

b. **Provide agri-processing firms with the basic knowledge of what equipment is suitable to their operations** and how they should go about implementing the equipment and management systems;

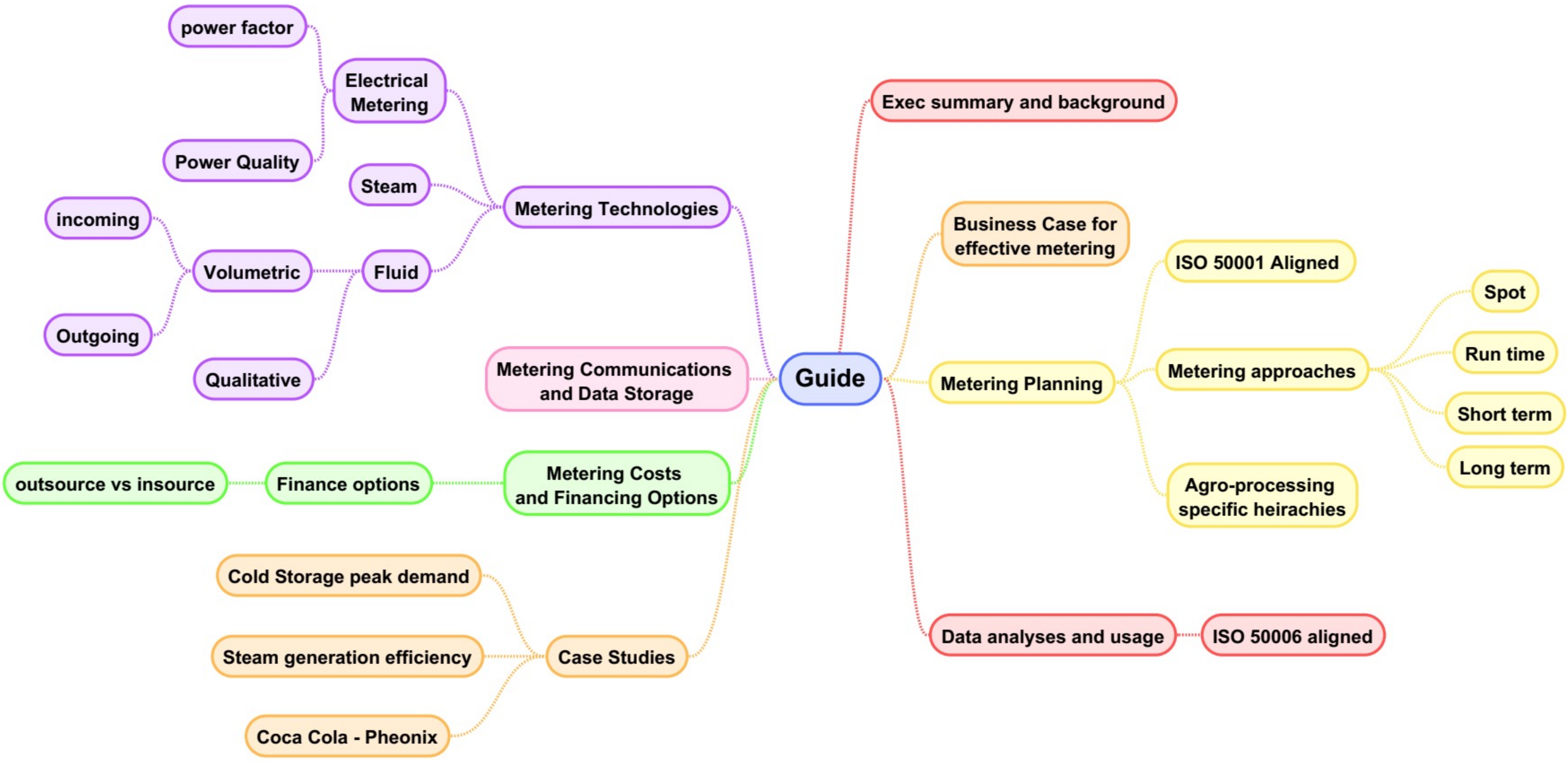
c. **Provide guidance to agri-processing firms on how to interpret and use the metering and monitoring equipment data** to manage energy and water performance within their operations.

Programme

Name	Begin date	End date
Metering Guide	2021/07/01	2021/09/17
Project Planning and Concept Development	2021/07/01	2021/07/06
Team appointed	2021/07/01	2021/07/02
Prepare Project Plan and Submit PVQ	2021/07/02	2021/07/02
Approve Project Plan	2021/07/05	2021/07/05
Agree Plan	2021/07/06	2021/07/07
Compile Initial Guide Draft	2021/07/07	2021/08/27
Compile table of contents and research previo...	2021/07/07	2021/07/14
Compile Draft Report	2021/07/15	2021/08/27
Conduct Workshop	2021/08/09	2021/08/13
Compile contents	2021/08/09	2021/08/11
Conduct Workshop	2021/08/12	2021/08/13
Finalise Guide	2021/08/30	2021/09/17
Review Guide	2021/08/30	2021/09/03
Incorporate feedback and finalise	2021/09/06	2021/09/17



Generic Metering & Monitoring Guide Overview



3 BUSINESS CASE FOR METERING

As South Africa's population has grown, the resource and capacity requirements to sustain the growth have not kept up resulting in supply constraints which inevitably impact on cost, availability and risk of interrupted supply. The electrical energy cost escalations and interrupted supply is a point in case. The chart below is the actual (blue bars) cost per kWh escalation over the past 8 years for a company in the Agro Processing industry. Eskom's published information[1] for its industrial clients (brown bars) are also included for reference.

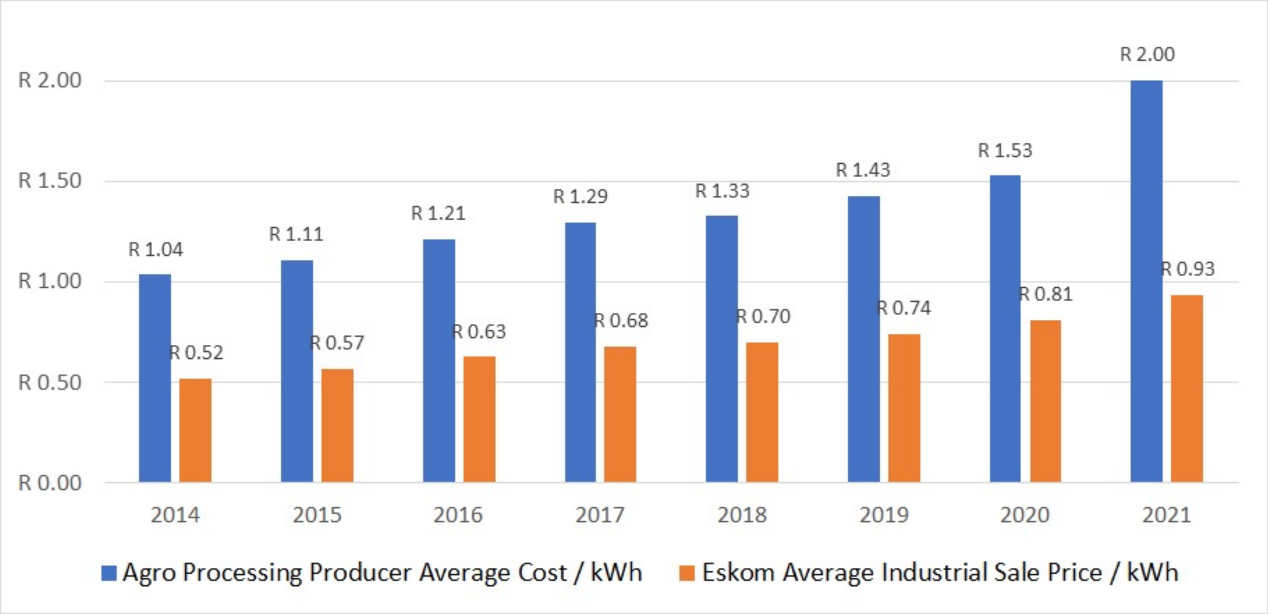


Figure 1. Comparison of cost escalation of electrical energy over the last 8 years.

While the example cited above relates to electrical energy, similar cost dynamics are being realised with water and effluent municipal services as supply and water treatment infra structure capacity constraints are realised. Two of South Africa's largest Metropoles have faced water supply issues (Cape Town and Nelson Mandela Bay) and many smaller municipalities have had to revert to ground water to supplement surface water supplies. This is highlighted by the graph below which provides an overview of water and electricity cost escalation over the past 24years as compared to inflation.

Metering Payback

Investing 1-2 % of the total utility budget back into monitoring and metering systems should realise a payback of 2 years.

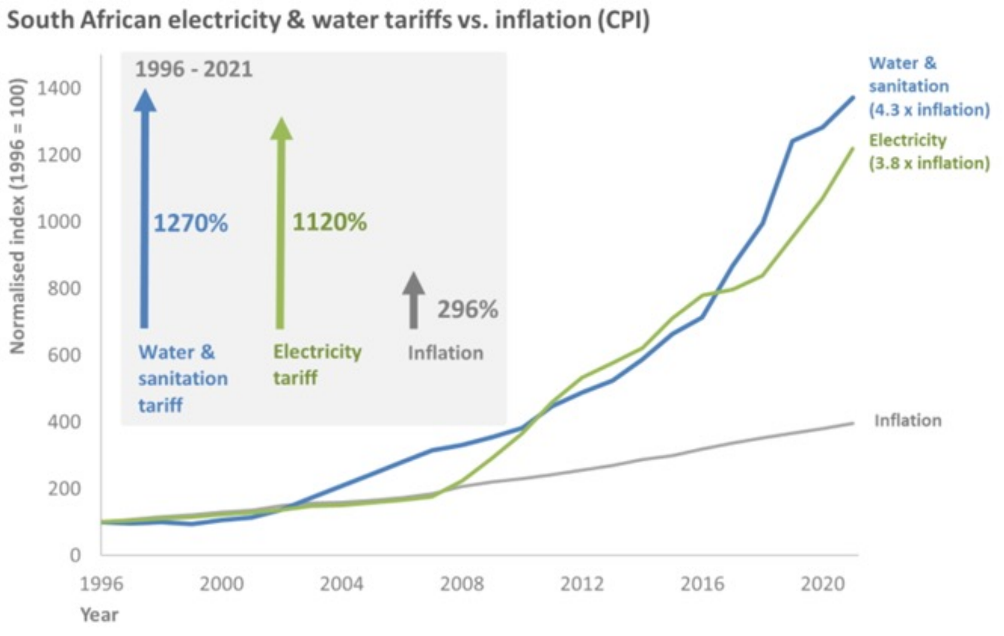


Figure 2. Indication of both water and electricity cost escalation over the past 24years.[2]

Case Study – Atlantis Water Supply Scheme

The Atlantis Water Supply Scheme (AWSS)[4] and the associated groundwater recharge scheme is a good example of how improved monitoring has allowed for sustainable water extraction from the groundwater reserves. The scheme was initially augmented with treated waste water and storm water however the quality of the two streams resulted in a steady increase in the salinity of the ground water. The waste water stream was subsequently excluded from the augmentation scheme but as a result there was a reduction in ground water reserves. Treated domestic effluent was included and then low salinity industrial streams. The interventions not only saw an increase in the water levels but a decrease and in the overall salinity concentration. While the case study relates to a municipal scheme the learnings are important for companies interested in long term sustainable extraction of resources from a water catchment area and especially if ground water is utilised in lieu of limited municipal potable water supplies.

Sustainable Water Extraction

Implementing effective metering and monitoring systems is crucial for long term sustainable management of resources.

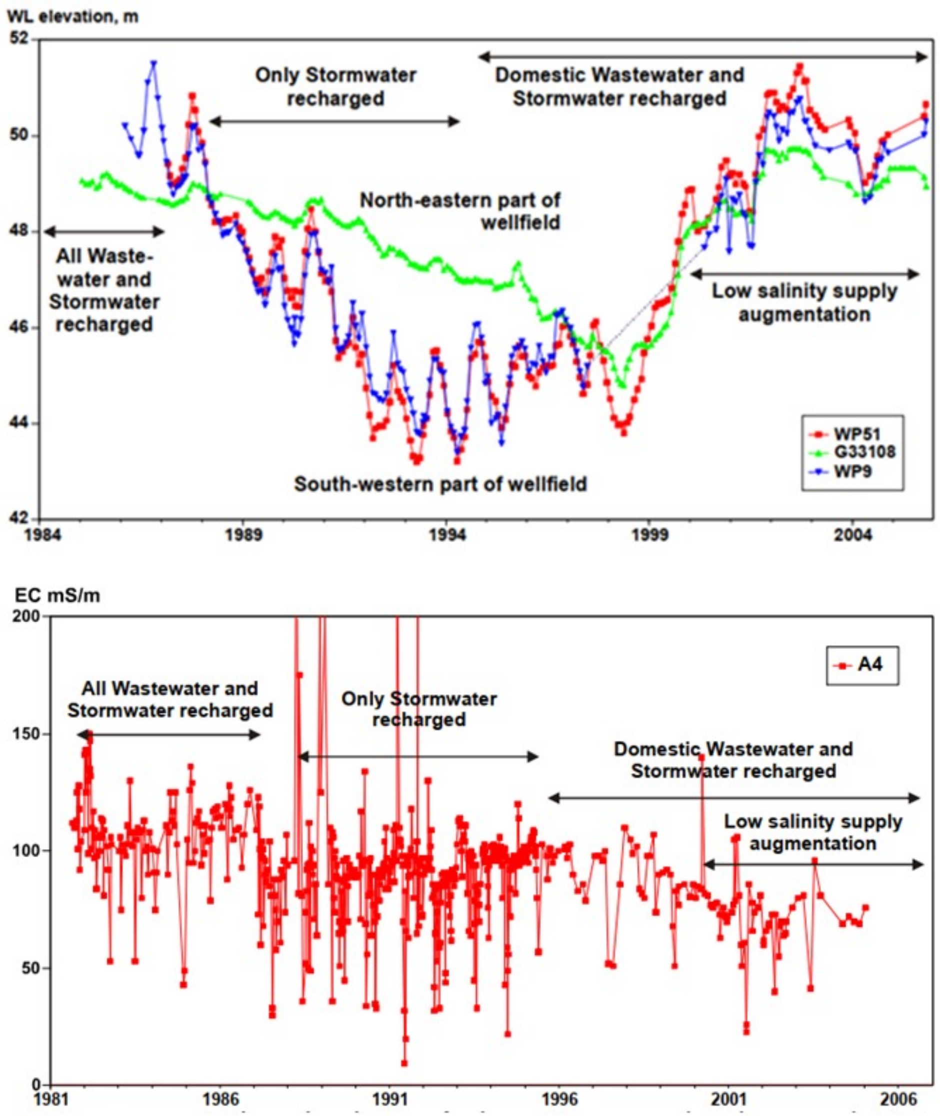


Figure 3: Atlantis Recharge Quality and Level Sampling Records

4 METERING PLANNING

An effective metering and monitoring system will take years to implement and will require both equipment and human resource. An effective metering system design must avoid the following pitfalls:

- Gathering insufficient data to enable an accurate consumption analysis
- Gathering too much data that are never used for analysis,
- Gathering data in a format that cannot be easily used.

Metering Plans

Developing a metering plan should be the first step at any site that is initiating a metering program.

As much consideration should be given to both what needs to be measured as well as what will be done with the data once it is collected. To this extent, developing a metering plan should be the first step at any site that is initiating a metering program.

The steps for developing an effective metering plan are outlined below.

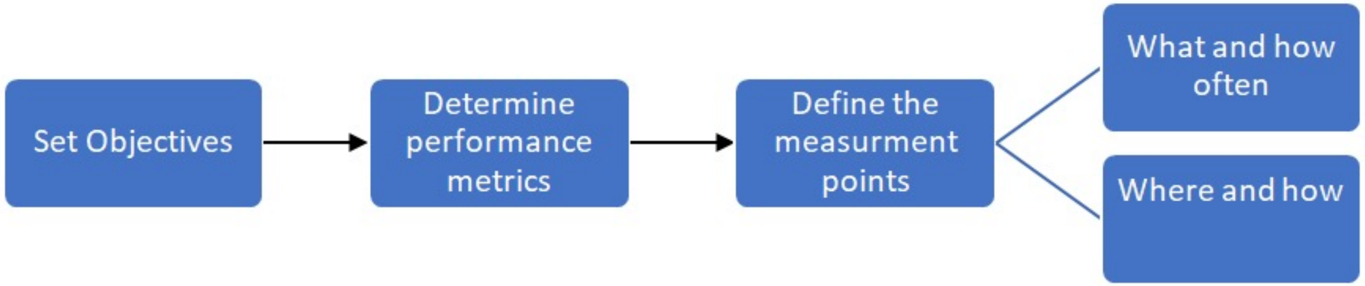


Figure 4. Setting Objectives and Targets.

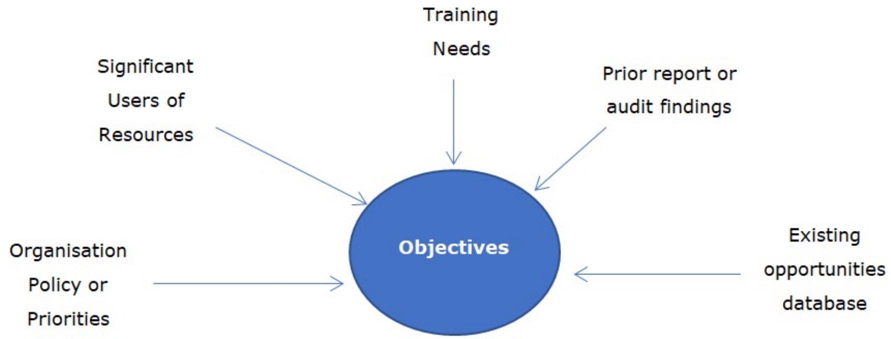


Figure 5. Steps that feed into objectives and targets.

It is important to differentiate between objectives, targets and action plans as at this point of the project cycle companies are setting long term goals which will underpin the proposed measurement plan. The figure below provides an overview of the key differences.

Figure 6. Relationship of objectives, targets and action plans.[5]

4.2 Determine Performance Metrics

Performance Indicators (PI's) can be expressed by using a simple metric, ratio, or a model, depending on the nature of the activities being measured. Some examples of performance metrics are provided below:

Types	Example	Benefit	Disadvantage
Simple metric	• Water consumption per month • Annual Carbon footprint	• Readily available • CFO's historically interested in total spend • Listed companies required to report on total consumption	• Do not account for seasonal variation or changes to production volumes • Not able to benchmark
Simple ratio	• Energy per m^2 • Water per tonne product	• Readily available • Easier to benchmark	• Static factors not taken into account • Rewards increase in production and not necessarily increase in efficiency
Statistical analyses	• A predictive equation based on historical performance	• Provides an accurate indication of savings realised • Allows for developing internal best practice targets • Aligned to International Standards (ISO50006)	• Not easy to benchmark • Requires specific skill set to work with effectively • Statistical correlation not always found

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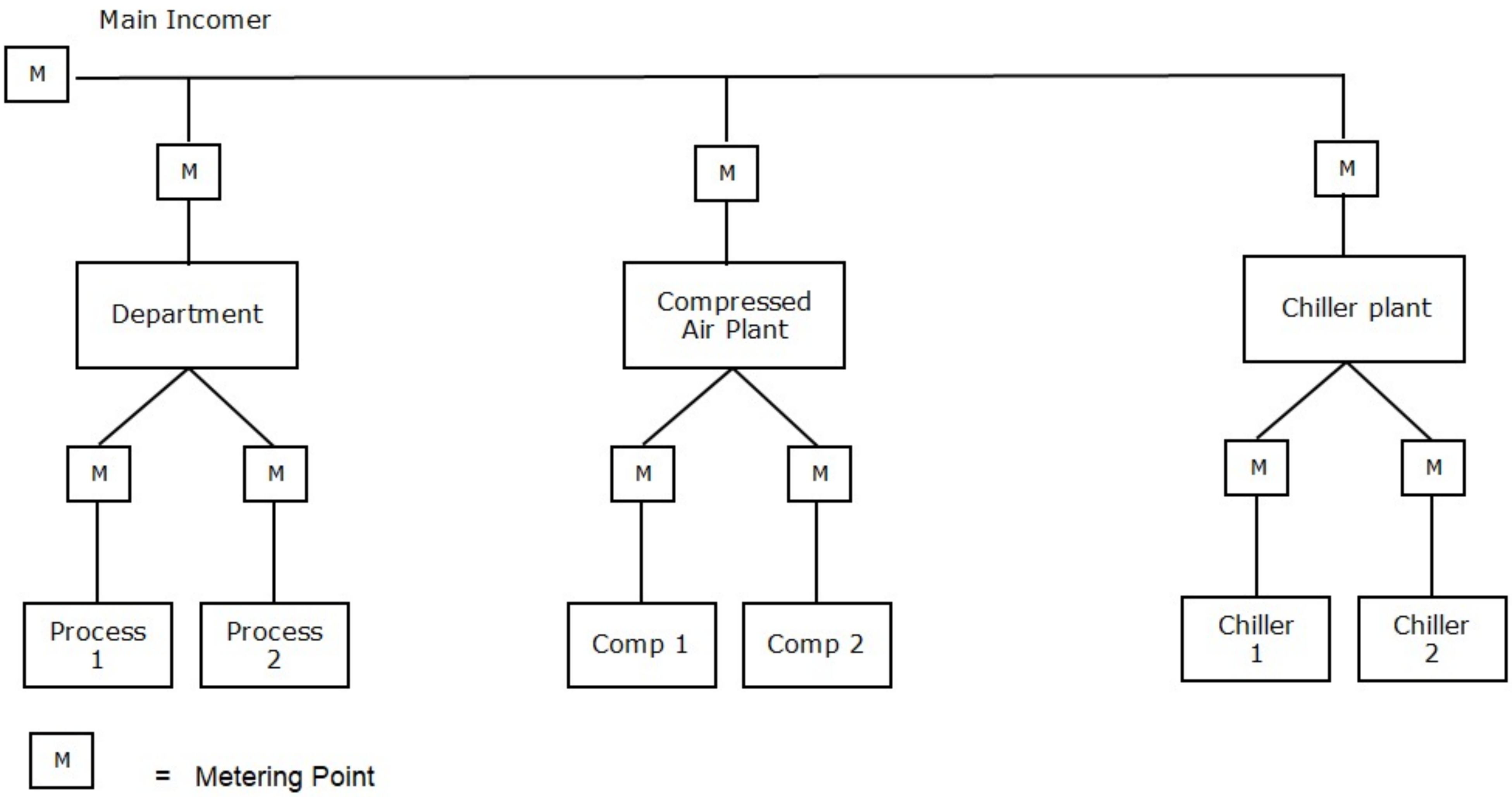
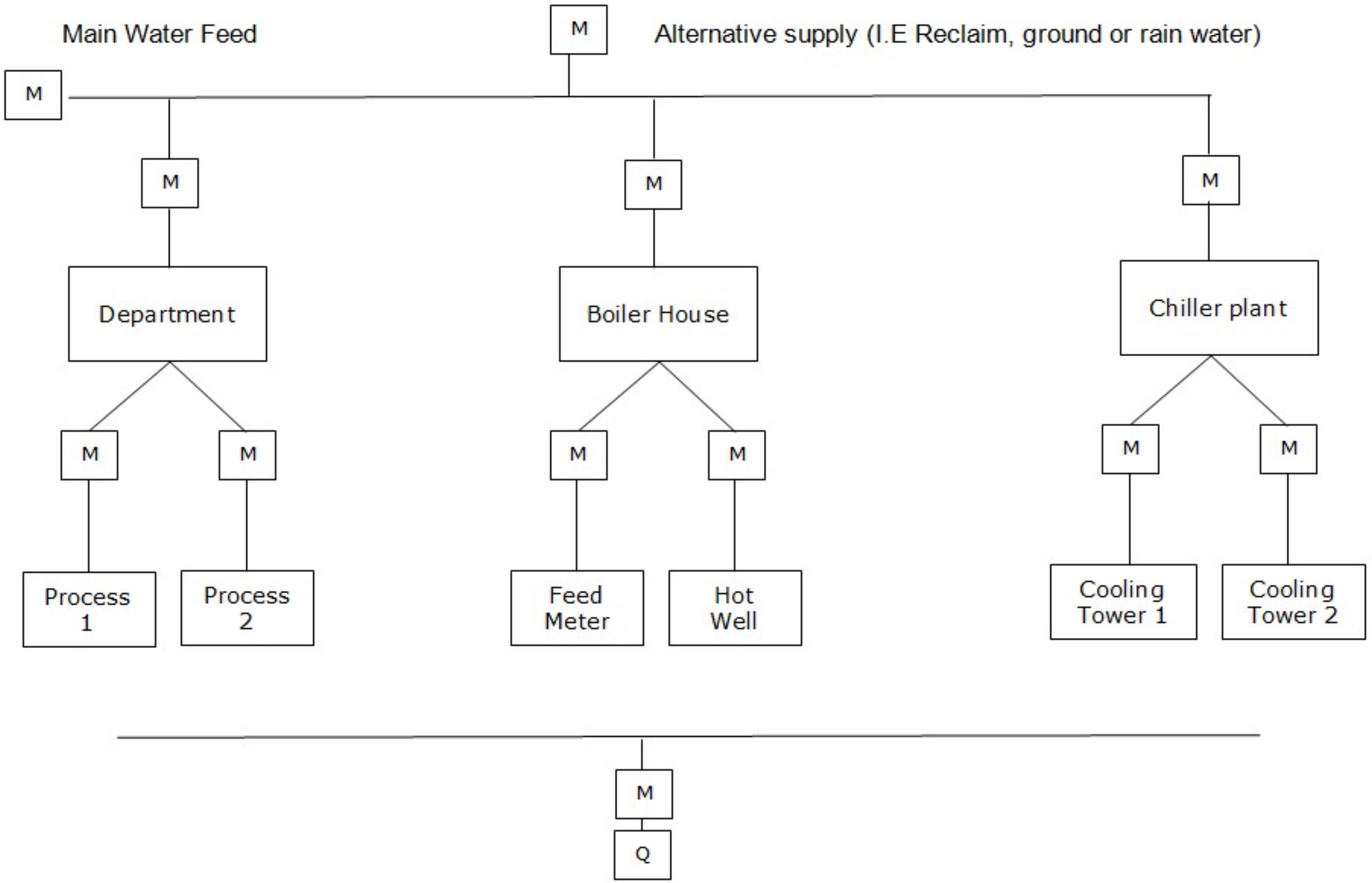
Electrical Metering Schematic (Standard Practice)



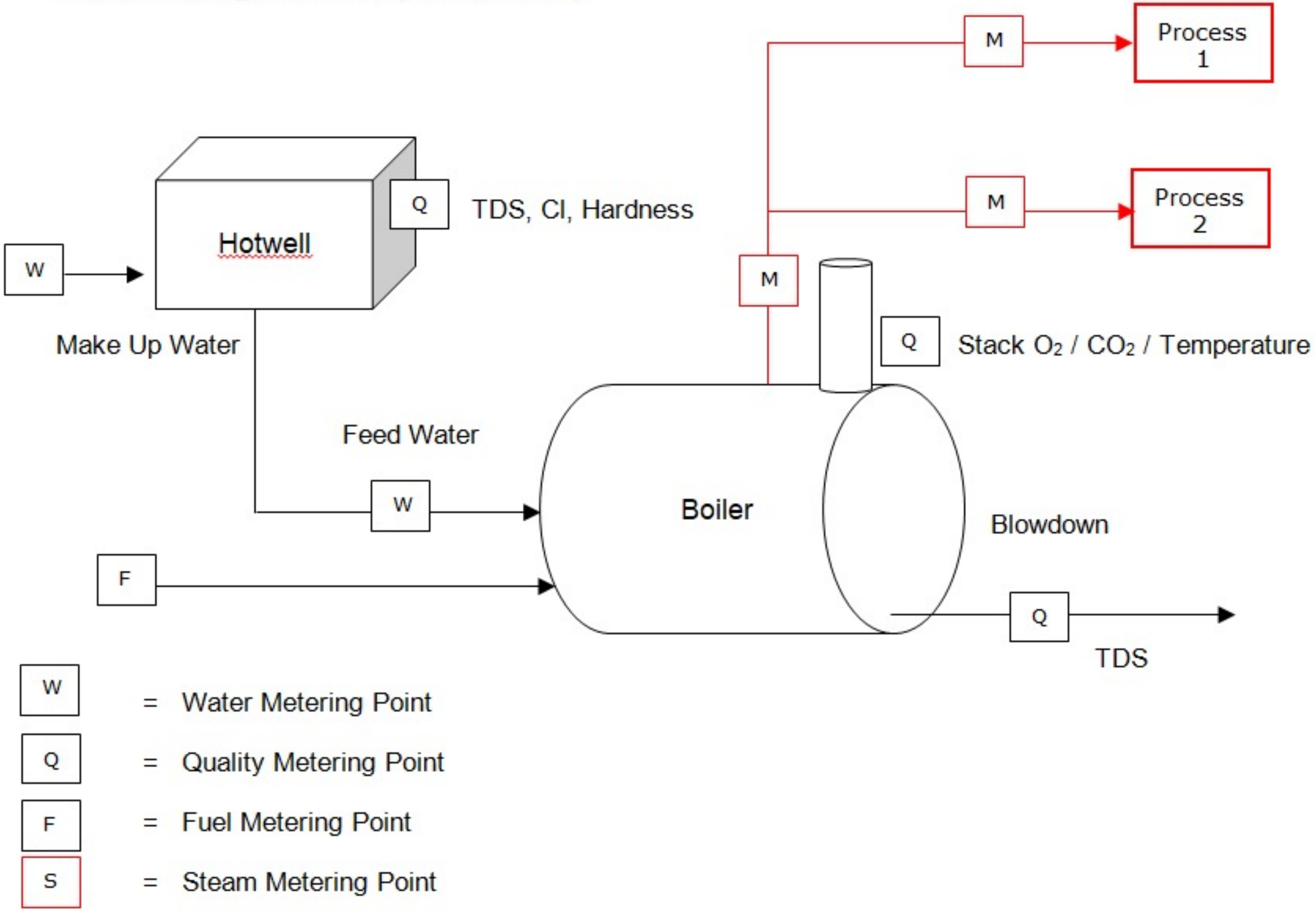
Water Metering Schematic (Standard Practice)



M = Metering Point

Q = Quality Metering Point (TDS, pH and COD)

Boiler Metering Schematic (Best Practice)



4.4 Measurement Approach

There are four levels of resource metering each with their benefits and challenges. These are summarised in the table below.

Table 1. Overview of Metering Period Strategies

	One time / Spot Measurements	Run time Measurements	Short Term Measurements	Long Term Monitoring
Description	Useful in determining "baseline" activities and instantaneous resource use, equipment performance, or loading	Normally used where hours of operation are the relevant variable	Equipment installed for a limited period of time	Term is typically more than a year and often the installation is permanent
Examples	• Boiler flue gas analyses • Lighting load	• Run time of fans or pumps	• Fan or pump system efficiency assessment • Flow metering on cleaning applications	• Incoming electrical and water supply • Boiler steam meters
Advantages	• Lowest capital cost • Equipment usually easy to use • Non-intrusive • Fast results	• Low capital cost • Equipment usually easy to use • Non-intrusive • Useful for constant loads • Information can be collected automatically	• Mid-level cost • Capable of assessing load variations • Relatively fast results	• Highest accuracy • Data can be collected automatically • Long term trends can be identified (seasonality and load variance)
Disadvantages	• Low accuracy • Limited application • Typically single operating parameter • Information usually manually processed	• Useful applications are limited • Measures single operating parameter • Requires additional calculations/assumptions	• Mid-level accuracy as portable equipment is utilised • Seasonal or occupancy variance deficient • More difficult to install/monitor	• High cost • Most difficult to install • Installation process will take longer if CAPEX expenditure is required.

Table 2. Basic Measurement Plan - Expect a 2% saving on costs.

Objective	Utility	Performance Indicator	Static factor	Relevant Variable	Frequency	Measurement Method	Location
Thermal Energy Cost Reduction	Thermal Energy	Steam usage	Steam Pressure	Process demand Weather conditions	Weekly	Direct metering or indirect	Boiler House
Thermal Energy Cost Reduction	Thermal Energy	Boiler efficiency	Boiler Insulation Losses Stack Temperature	Process demand Boiler Load Feedwater temperature	Weekly	Direct metering and indirect	Boiler House
Electrical Energy Cost Reduction	Electrical energy	Site electrical energy	Ventilation Lighting	Production Weather conditions	Weekly	Direct metering	Main Incomer
Water Cost Reduction	Water	Site water usage	Staff usage Leaks	Production Weather conditions	Weekly	Direct metering	Main Incomer
Effluent Cost Reduction	Water	Site water usage Qualitative parameters (COD, PH, TDS)	Daily cleaning schedule	Production	Monthly	Grab sample or composite sample	Effluent Discharge Line

Table 3. Standard Measurement Plan - Expect a 5% saving on costs

Objective	Utility	Performance Indicator	Static factor	Relevant Variable	Frequency	Measurement Method	Location
Thermal Energy Cost Reduction	Thermal Energy	Steam usage	Steam Pressure	Process demand Weather conditions	30min	Direct metering or indirect	Boiler House
Thermal Energy Cost Reduction	Thermal Energy	Boiler efficiency	Boiler Insulation Losses Stack Temperature	Stack O2 levels Stack Temperature	30min	Direct metering and indirect	Boiler House
Chiller Plant Optimisation	Electrical energy	Chiller plant COP	Circulation pumps and cooling fans	Production Weather conditions	30min	Direct metering	Chiller plant
Compressed air plant optimisation	Electrical energy	kWh / m3 air produced	Compressed air leaks	Compressed air demand	30min	Direct metering	Compressed air plant
Water Cost Reduction	Water	Site water usage	Staff usage Leaks	Production Weather conditions	Hourly	Direct metering	Main Incomer
Water Cost Reduction	Water	Department / Process water usage	Staff usage Daily cleaning schedule	Production Weather conditions	Hourly	Direct metering	Different Departments / Processes
Water Cost Reduction	Water	Cooling system water usage	Cooling tower bleed rates	Refrigeration load Weather conditions	Daily	Direct metering	CIP plant feed
Effluent Cost Reduction	Water	Site water usage Qualitative parameters (COD, PH, TDS)	Daily cleaning schedule	Production	Weekly	Grab sample or composite sample	Effluent Discharge Line

Table 4. Advanced Measurement Plan - Expect a 10% saving on costs.

Objective	Utility	Performance Indicator	Static factor	Relevant Variable	Frequency	Measurement Method	Location
Chiller plant optimisation	Electrical energy	Chiller COP and System COP	Circulation pumps and cooling fans	Production Weather conditions	30min	Direct metering	Chiller plant
Compressed air plant optimisation	Electrical energy	Compressor kWh / m3 produced	Compressed air leaks	Compressed air demand	1 second	Direct metering	Compressed air plant
Fan system optimisation	Electrical energy	Electrical energy usage		Process air demand	Annual	Temporary Metering	Fan Location
Pump system optimisation	Electrical energy	Electrical energy usage		Process demand	Annual	Temporary Metering	Pump location
Water Cost Reduction	Water	Cleaning water usage	Scheduled cleaning	Production	Daily	Direct metering	CIP plant feed
Effluent Cost Reduction	Water	Site water usage Qualitative parameters (COD, PH, TDS)	Daily cleaning schedule	Production	Hourly	Direct metering	Effluent Discharge Line

5 METERING TECHNOLOGIES AND STRATEGIES

5.1 Electrical Metering

5.1.1 Power Factor

5.1.2 Power Quality

5.2 Steam Metering

5.3 Fluid Metering

5.3.1 Volumetric

5.3.2 Qualitative

6 METERING COMMUNICATIONS AND STORAGE

7 METERING COSTS AND FINANCING OPTIONS

8 DATA ANALYSES AND USAGE

9 CASE STUDIES

NEXT STEPS

1. Project steering committee
   a. Members
   b. Meeting dates
2. Generic guideline
   a. Feedback from today’s workshop
   b. Draft report – end August
3. Short list of dairies
4. Start of pilot projects