Energy Management In Large Industrial Operations

Bill Tubbs

B. Tubbs & Associates Consulting Inc.

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Saskatoon, SK

Objectives

- What is energy management?
- Overview of the tools and best practices
- The potential benefits
- How relevant is energy to your business?
- How to identify your needs
- SaskPower IEOP program offerings

My Background

Technical Support Engineer

Operations Management Implementation Consultant

Climate Change & Energy Efficiency Specialist

Manager, Environmental Permitting & Regulation

Senior Manager, Energy & Climate

Independent Consultant

ICI Chemicals & Polymers Ltd.

CELERANT CONSULTING
Operational strategy and implementation

Scottish Water
Always serving Scotland

HYDRO

Spectra Energy

ICF INTERNATIONAL

SaskPower

What Is Energy Management?

What Is Energy Management?

The Integration Of Energy Efficiency Into Operations Performance Management Systems and Practices

Goal:

A Systematic Approach To Controlling, Optimizing and Continually Improving Energy Performance

What Is Energy Management?

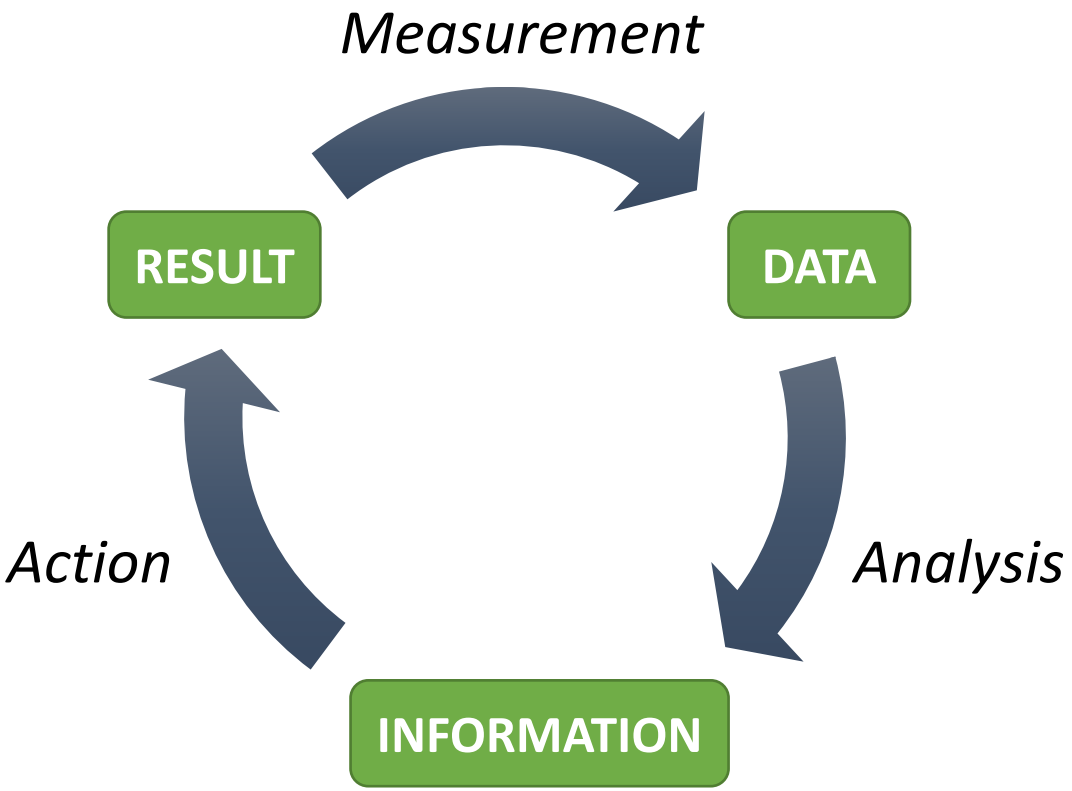
The Integration Of Energy Efficiency Into Operations Performance Management Systems and Practices

Typical activities:

- Measurement
- Data analysis
- Reporting
- Defining roles and responsibilities
- Taking action
- Identification of project opportunities
- Policy and planning
- Investment decision-making
- Verification of savings

What Is Energy Management?

Key Concept: Performance Management



What Is Energy Management?

Key Issue: Energy Is Not Visible

Safety	What does an *accident* look like?
Environment	What does a *spill* look like?
Quality	What does a *defect* look like?
Energy	What does an ***energy loss*** or ***inefficiency*** look like?

Tools and Best Practices

Tools and Best Practices

Energy Management - Most Basic Level

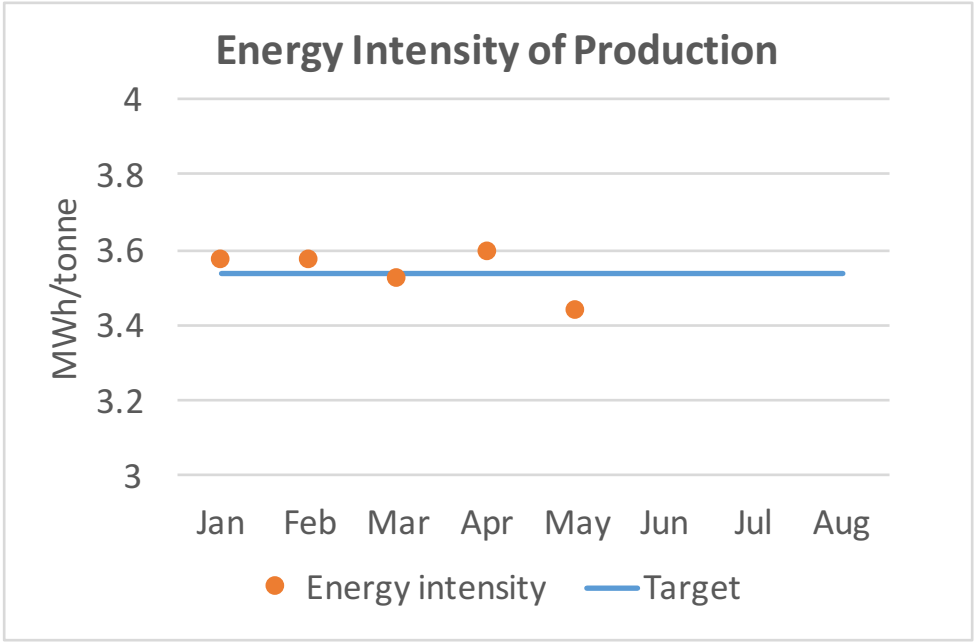
Goal: Raise awareness of consumption and costs

1. Start with available data
   - E.g. Utility bills - monthly total consumption
2. Produce a simple performance indicator
   - E.g. $/tonne
3. Review in your monthly management team meeting

Tools and Best Practices

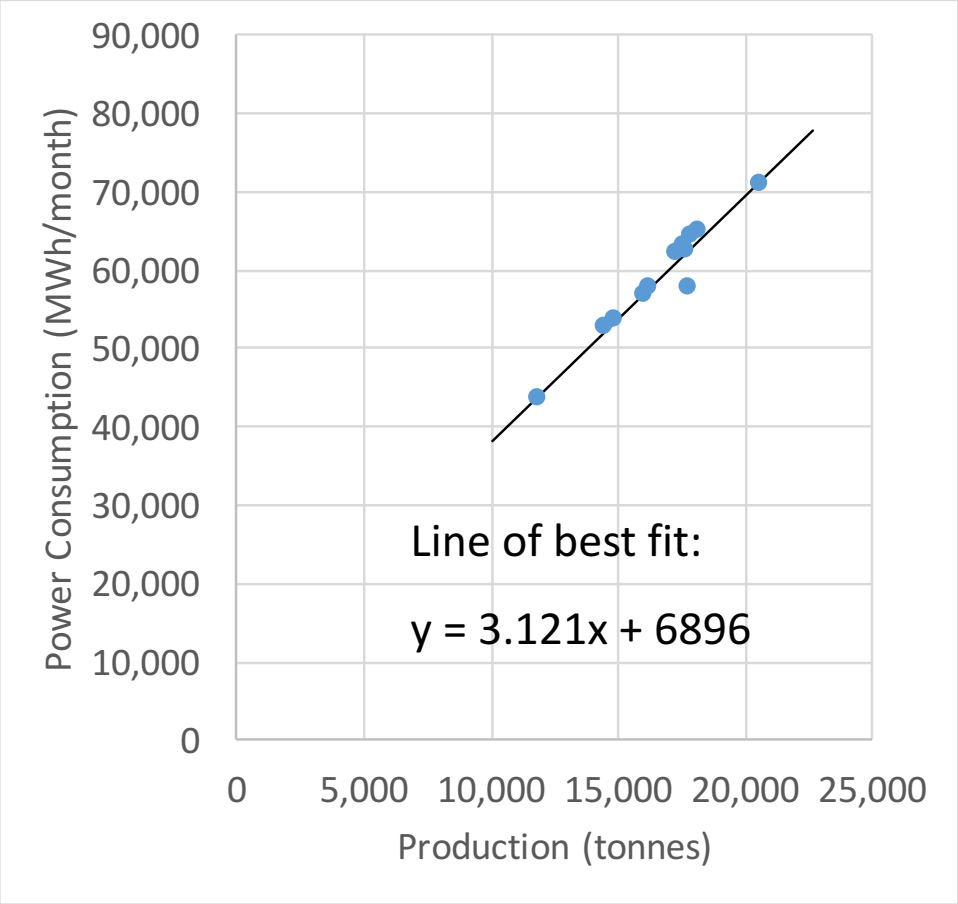
Energy Management - Most Basic Level

	Jan	Feb	Mar	Apr	May	Jun	Jul	
Power consumption (MWh)	62,922	64,937	62,482	64,209	70,920			
Production (tonnes)	17,632	18,206	17,744	17,884	20,634			
Energy intensity (MWh/tonne)	3.57	3.57	3.52	3.59	3.44			



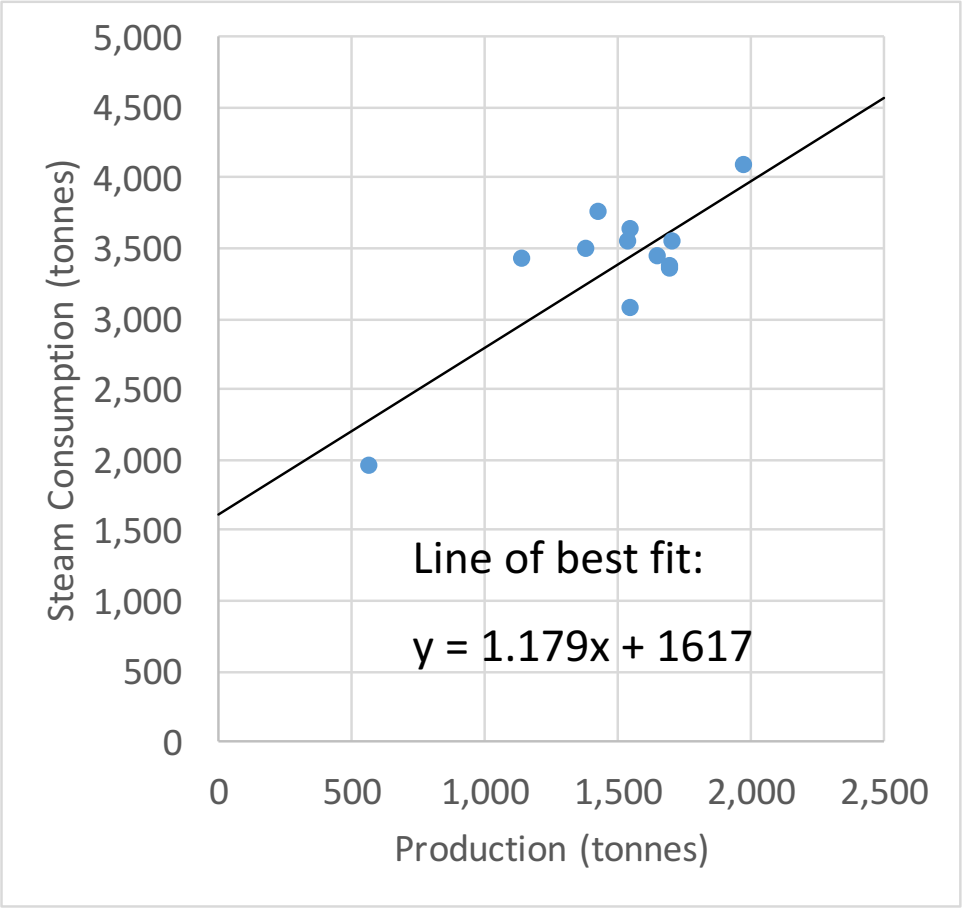
Tools and Best Practices

Energy Management - Most Basic Level



Tools and Best Practices

Energy Management - Most Basic Level



Tools and Best Practices

Energy Management - Comprehensive

Goal: Get the right information to the right people at the right time to manage energy performance

Tools and Best Practices

Energy Management - Comprehensive

Goal: Get the right information to the right people at the right time to manage energy performance

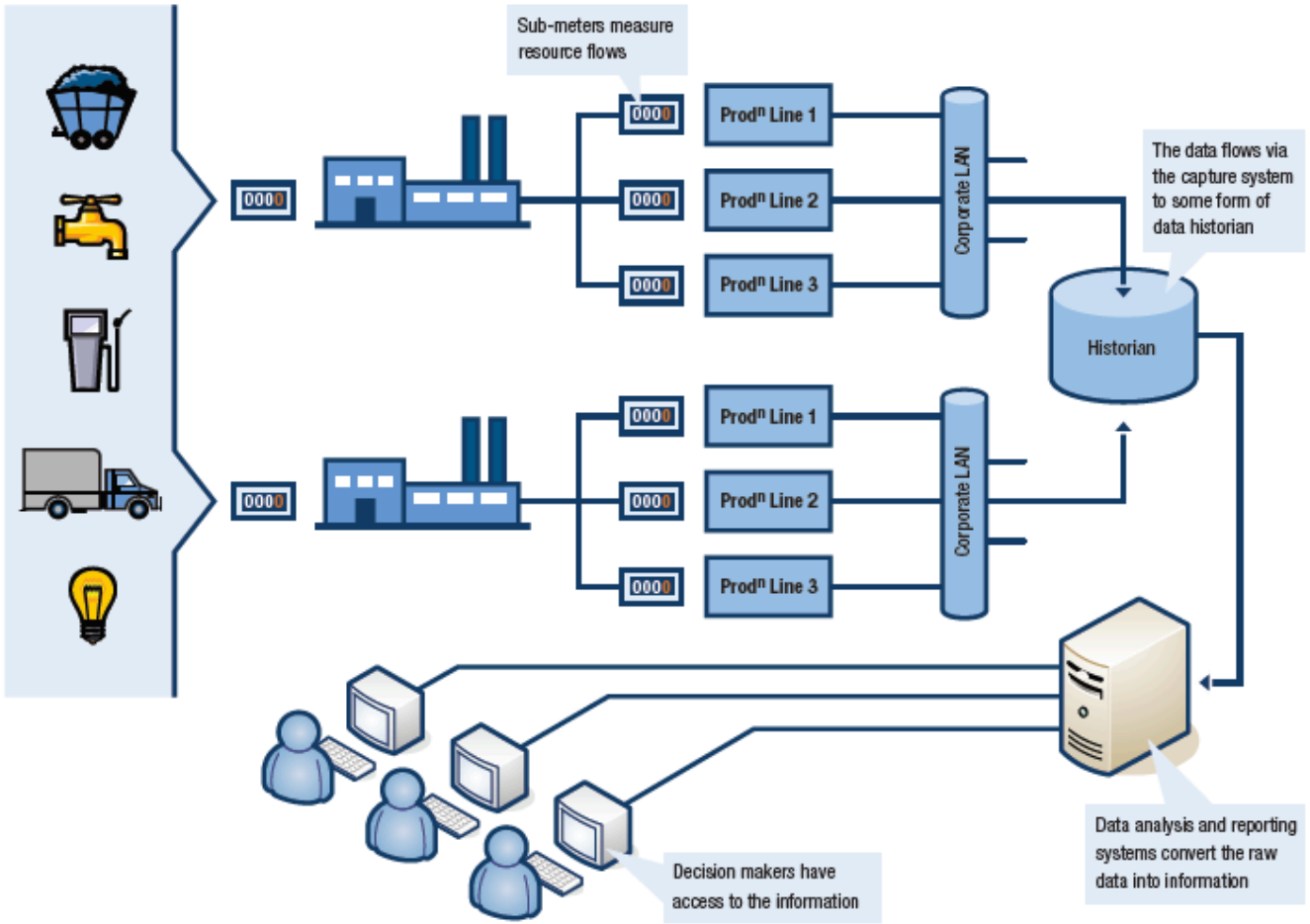
Key Concept:

- **Energy Management Information System (EMIS)**

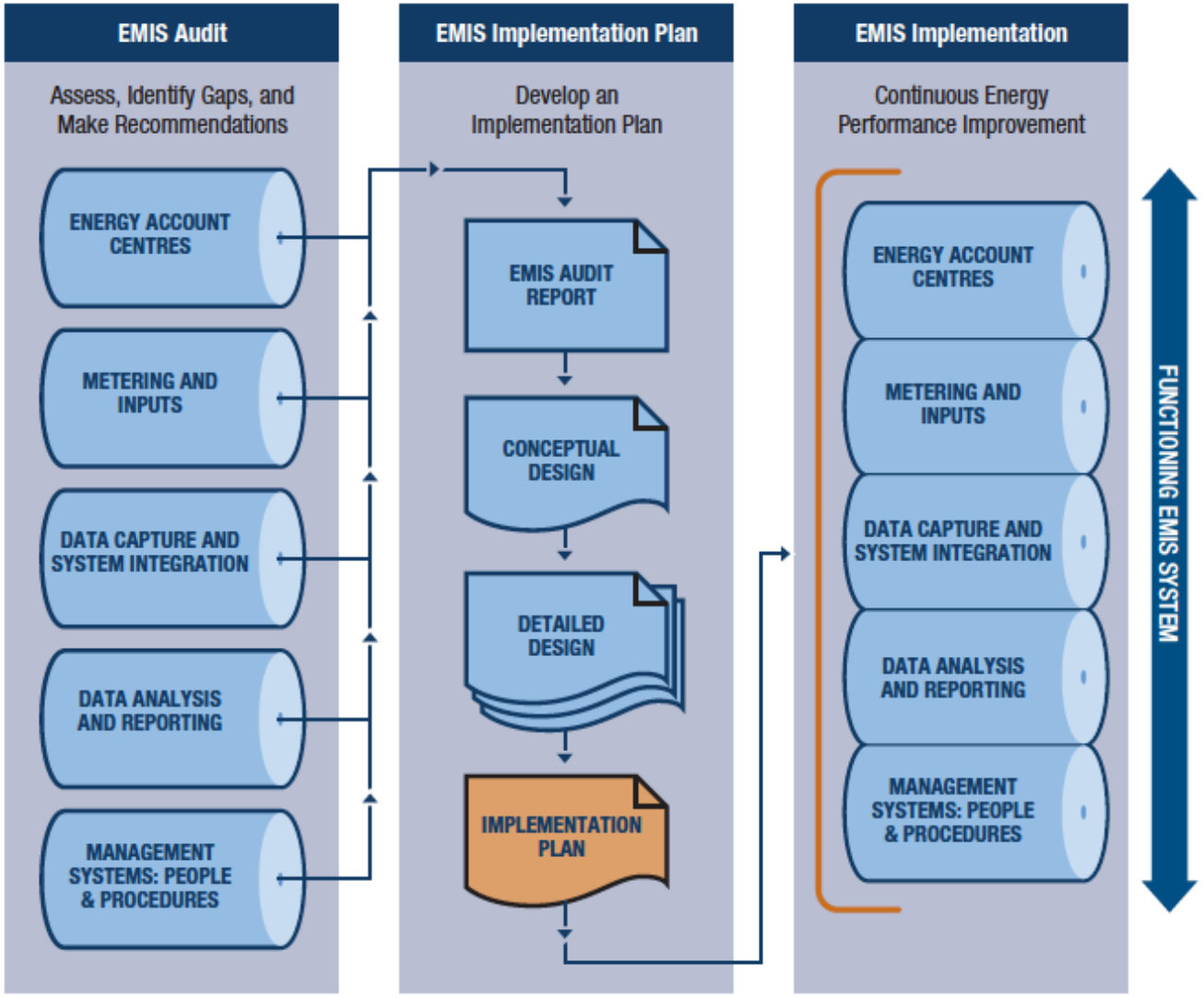
An EMIS provides relevant information that makes energy performance visible so that key individuals and departments can take timely, effective action to control and reduce energy costs.

Tools and Best Practices

Energy Management - Comprehensive

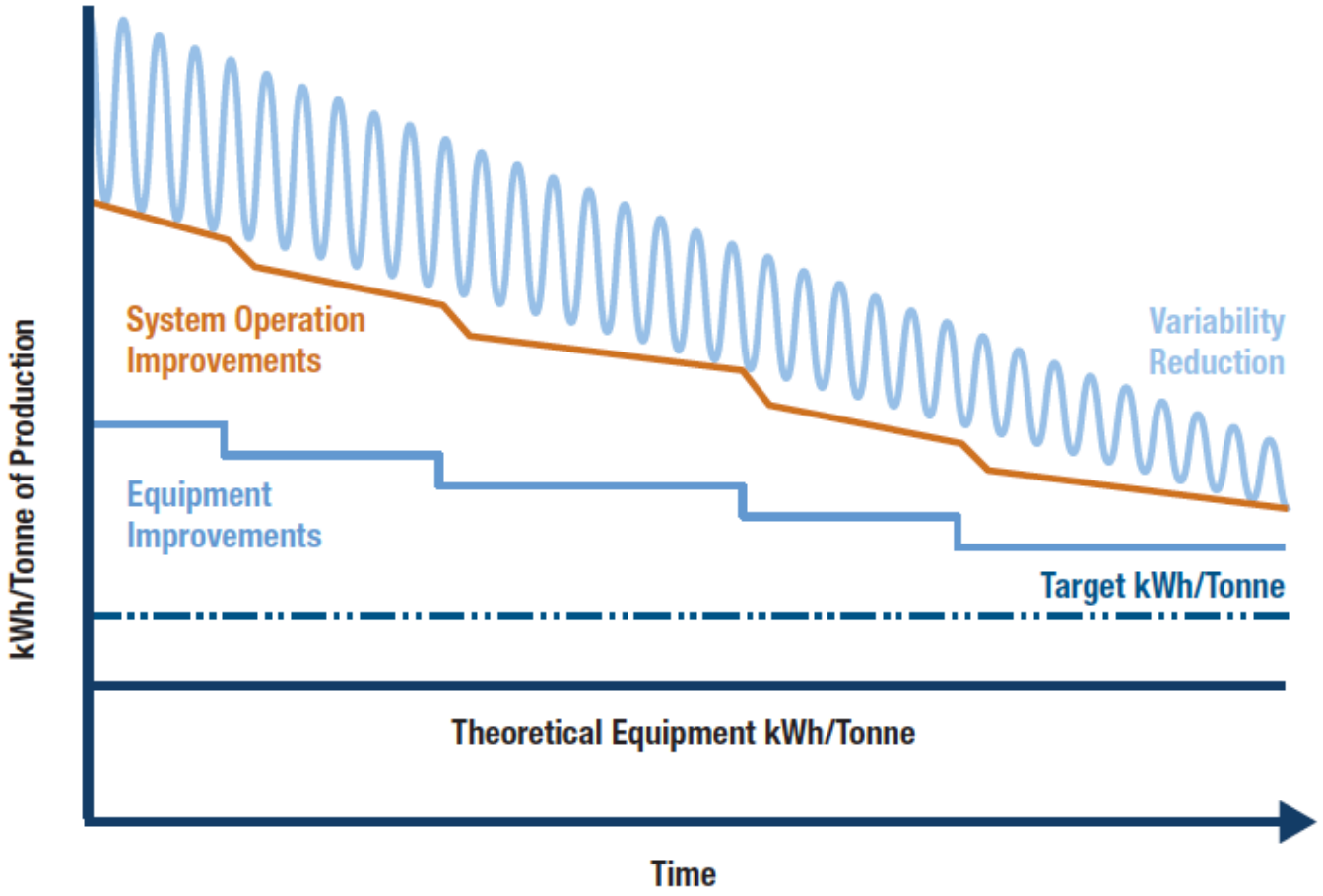


How To Identify Your Needs



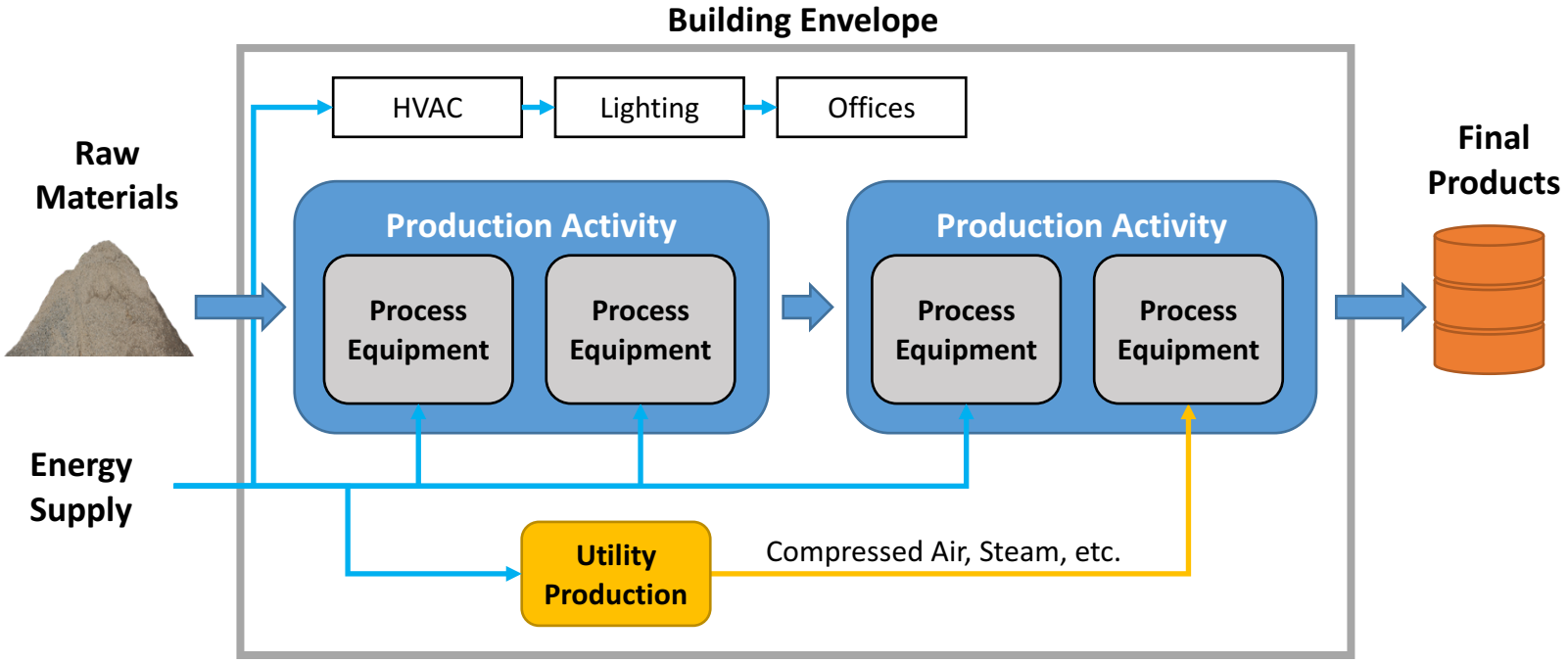
Tools and Best Practices

Energy Management - Comprehensive



How To Identify Your Needs

Energy Use In Your Operation



Tools and Best Practices

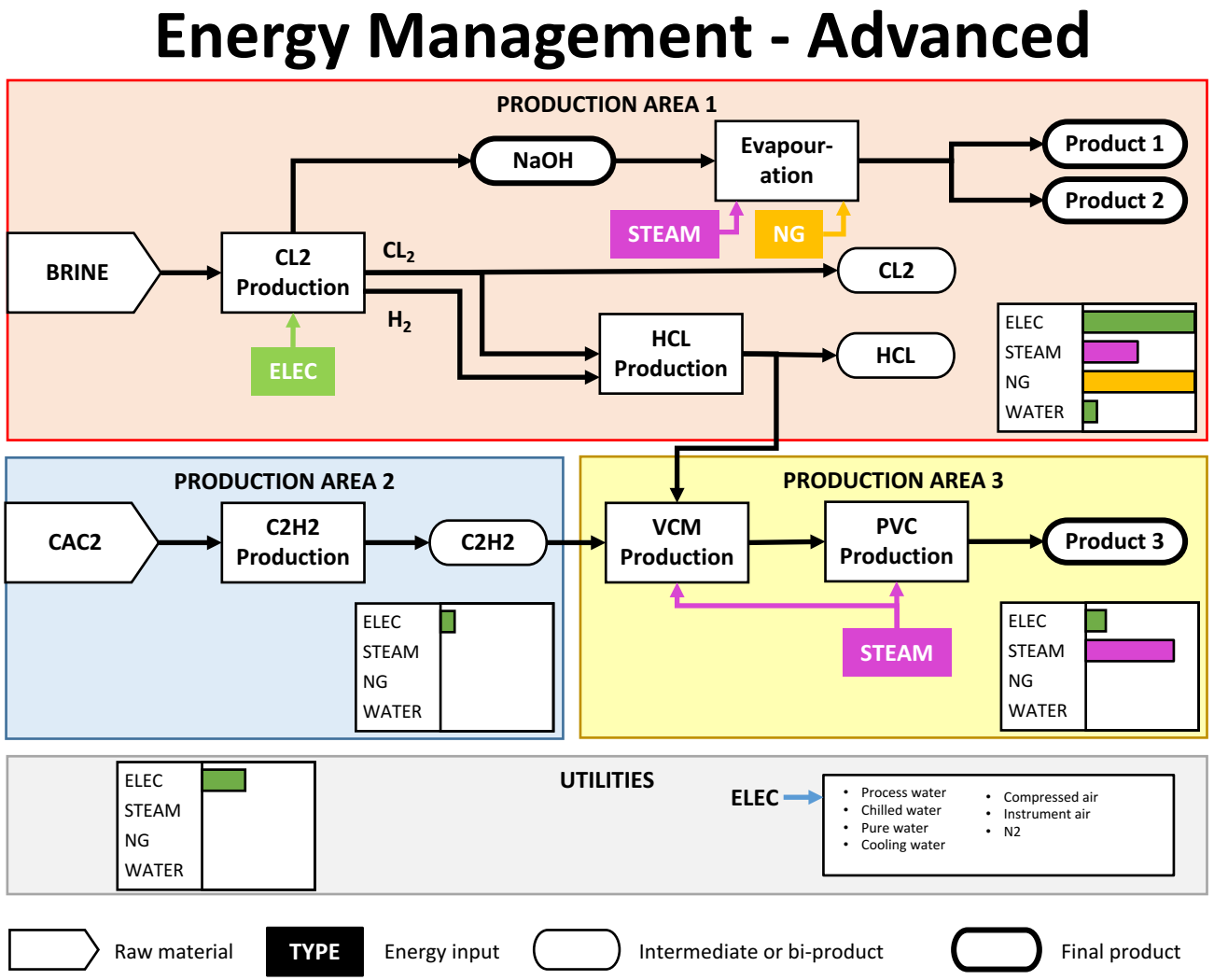
Energy Management - Advanced

Goal: Integrate energy efficiency into operations performance management systems and practices

Key Concepts:

- Energy end-use breakdown by process area
- Energy performance analysis
- Short interval controls (SICs)
- 3-2-1 reporting
- Management, control and reporting system
- Continuous improvement process

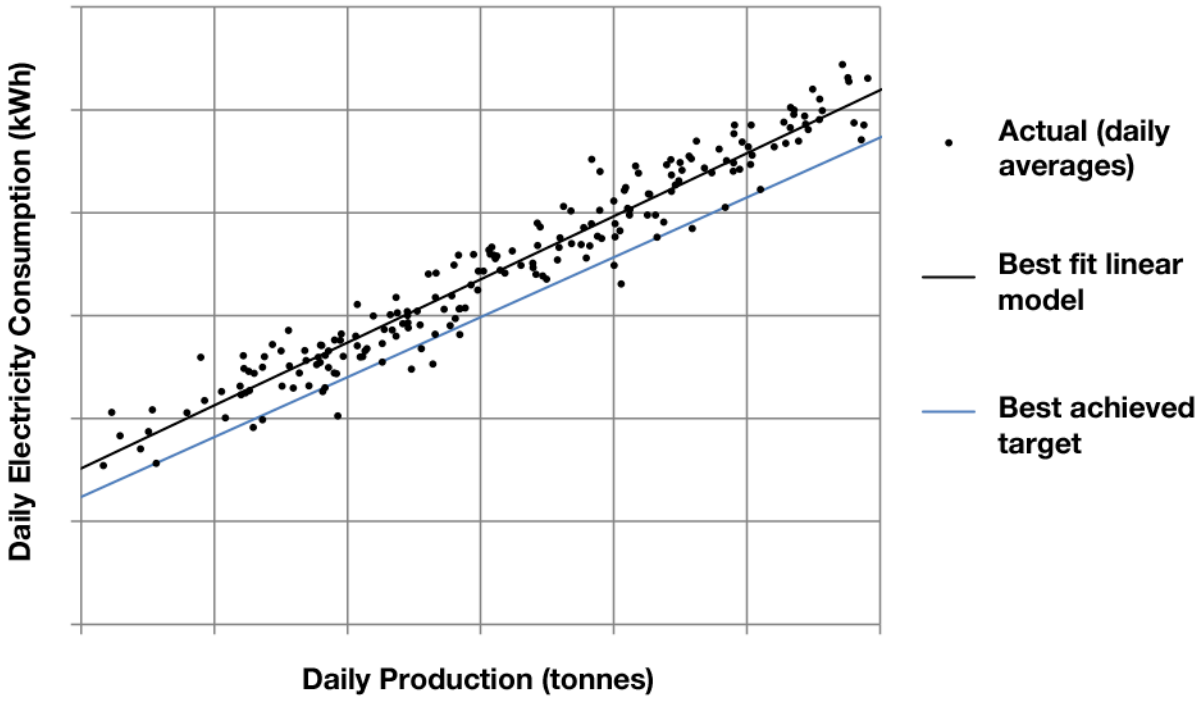
Tools and Best Practices



Tools and Best Practices

Energy Management - Advanced

Energy Performance Analysis



Tools and Best Practices

Energy Management - Advanced

Short Interval Control

Time	Production Target (tonnes)	Production Actual (tonnes)	Electricity Target (kWh)	Electricity Actual (kWh)	Cumualtive Energy Waste (kWh)	Energy Waste (kWh) Loss	Energy Waste (kWh) Comments
7:00	5.00	4.53	2,569	2,661	92	92	
7:50	5.00	5.01	2,753	2,777	116	24	
8:40	5.00	4.88	2,705	2,850	260	144	
9:30	5.00	0.50	1,026	1,020	254	-7	
10:20	5.00	4.87	2,698	2,772	327	73	
11:10							
12:00							
12:50							
13:40							
	45	19.79	11,752	12,079		327	

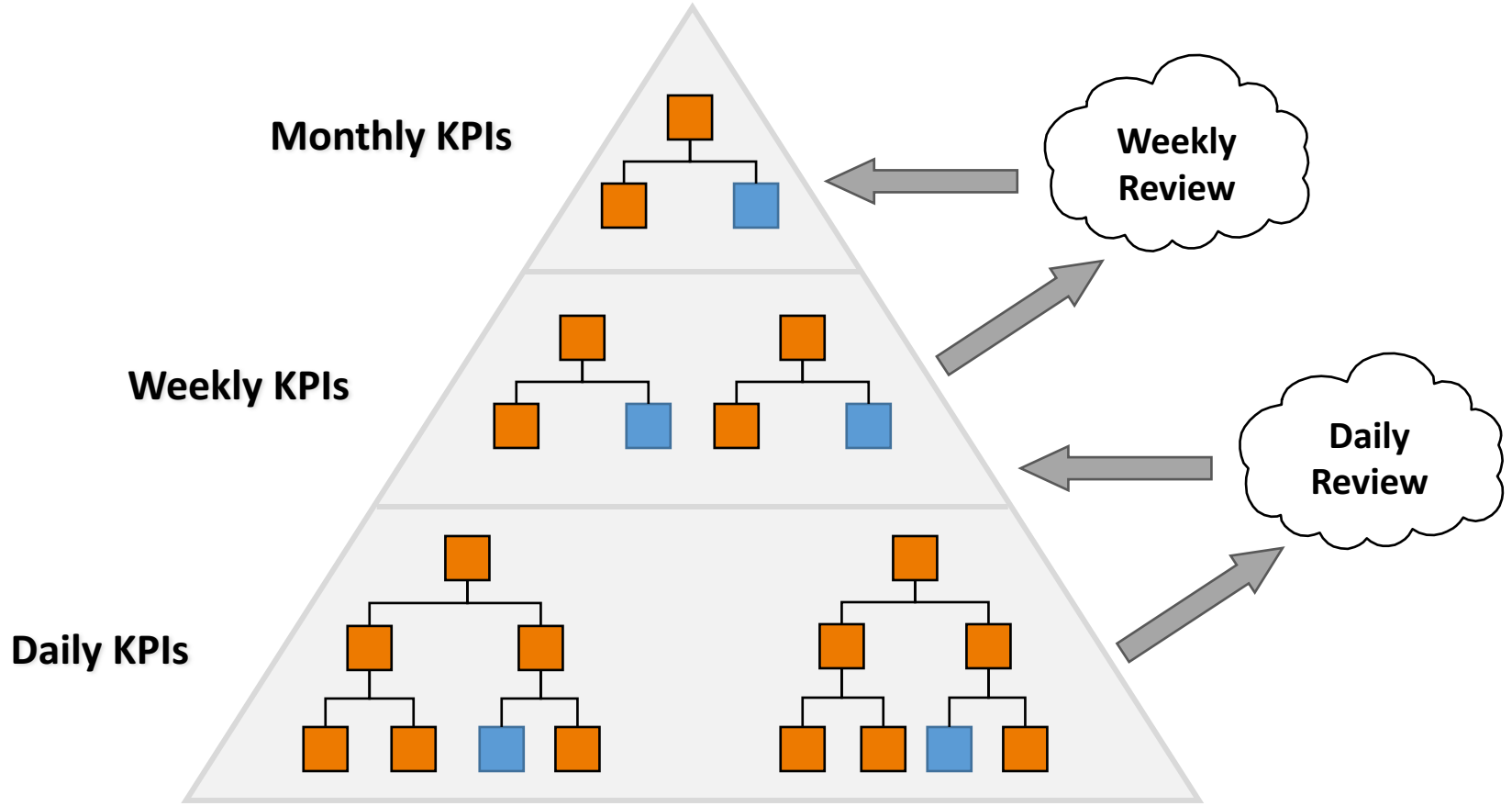
1. Operator compares performance in each short interval to the calculated target.

2. Energy waste is recorded and operator investigates cause

Tools and Best Practices

Energy Management - Advanced

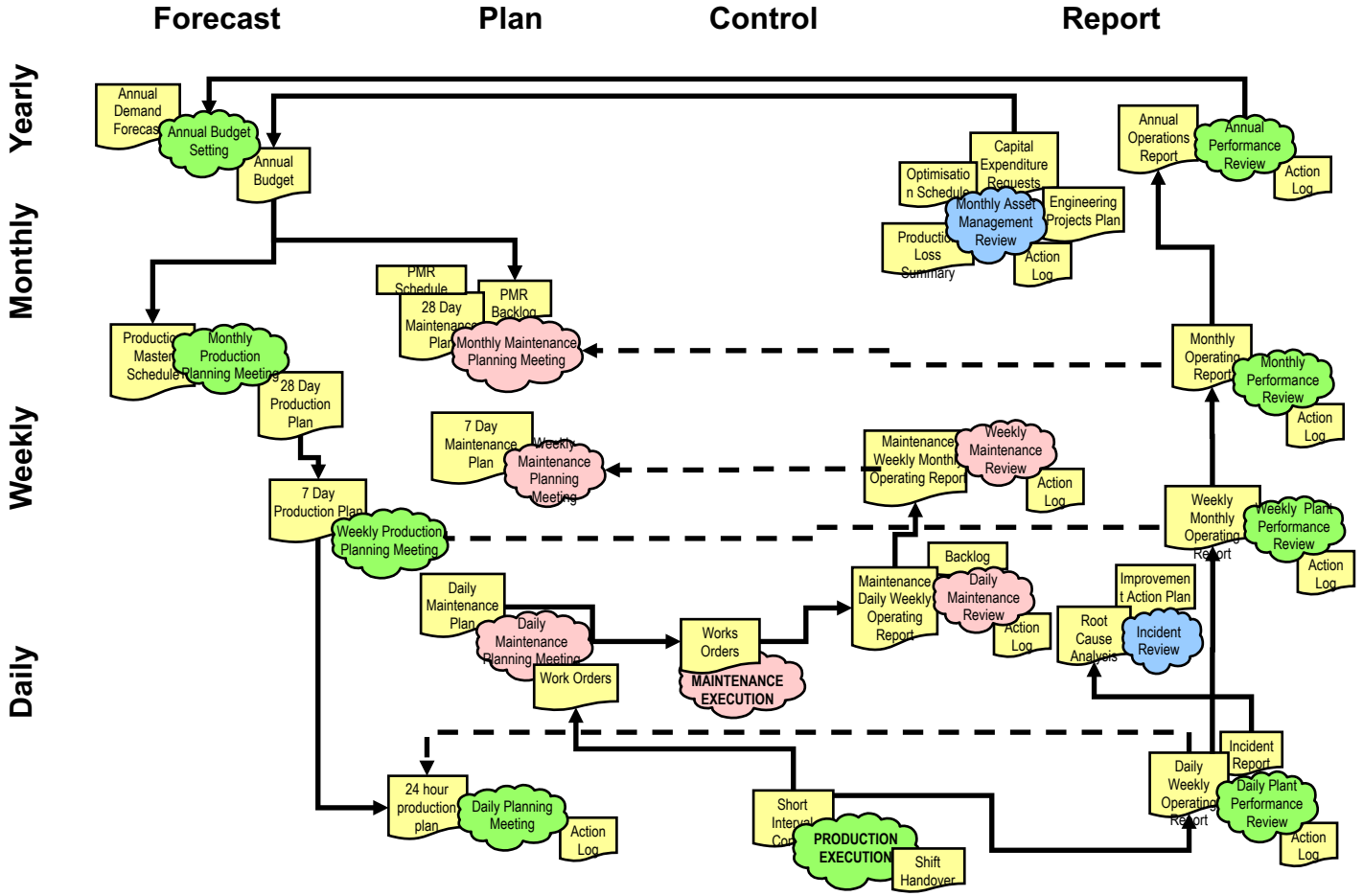
3-2-1 Reporting Structure



Tools and Best Practices

Energy Management - Advanced

Operations Management, Control, and Reporting System



Tools and Best Practices

Energy Management - Advanced

Weekly-Monthly Operating Report

solvents management report - 19XX

plant: ---------

area	indicator	uom		base 1998	target 1999	week ending 02/04	02/11	02/18	02/25	02/25	Rolling 5 weeks	month jan	feb	mar	apr	may
SHE	Hours since classified injury	No	actual	48000	142500	43500	45600	47700	49800	51900		42300	50605			
	days since breach of IPC	No	actual	161	415	85	92	99	106	113		81	109			
	personal monitoring above MEL	No	actual	10	0							0				
	outstanding health checks	No	actual	3	0							0				
plant operations	HPE output	tes	S&OP plan	35013	17560	276	743	826	698	344	2887	3351	6496	10714	10368	555
		tes	actual	59604		269	339	449	268	200	1525	6446	1086			
	Beta Tri output	tes	S&OP plan	35366	23010	393	1058	1176	988	118	3733	2035	1496	5503	7101	71
		tes	actual	32173		376	684	616	425	0	2101	435	1725			
	Beta Tri to Per Tri	tes	S&OP plan	25305	17056	840	840	840	840	210	3570	3720	3360			
		tes	actual	19112		491	469	354	354	185	1853	3266	1182			
	VDC output	tes	S&OP plan	6933	4330	203	203	203	203	87	899	400	400	378	491	33
		tes	actual	5234		0	43	250	0	0	293	338	291			
	HPE Utilisation	%	actual	57	13.3	11	13	18	12	8	12	57.8	10.8			
	Beta Tri Utilisation	%	actual	33	23.2	17	36	33	22	0	22	5.2	22.7			
	VDC Utilisation	%	actual	24	19.8	0	10	60	60	0	26	18.2	17.3			
	HPE Potential Utilisation	%	actual	79	?	100	100	98	100	100	100	98.4	99.4			
	Beta Tri Potential Utilisation	%	actual	50	?	20	50	81	100	100	70	5.2	85.7			
	VDC Potential Utilisation	%	actual	69	?	100	90	92	100	100	96	99.4	97.4			
materials	HPE stock	tes	actual		250	657	534	520	520	646		626	520			
	Beta Tri stock	tes	actual		6000	3066	3091	3408	3485	3317		3251	3391			
	VDC stock	tes	actual		700	600	535	638	564	490		655	527			
costs	Beta Tri Variable Cost/te ytd	£	actual	167	107							136				
	HPE Variable Cost/te ytd	£	actual	153	106							83				
	VDC Variable Cost/te ytd	£	actual	284	152							284				
	Total Fixed Costs for VDC4	£k	actual	4938								262.5				
		£k	plan	5366	4908							305.4	335.4	305.4	305.4	475
people	sickness absence	%	actual	3.0	2.0											
	outstanding commitment time	hrs	plan													

Tools and Best Practices

Energy Management - Advanced

Continuous Improvement Process

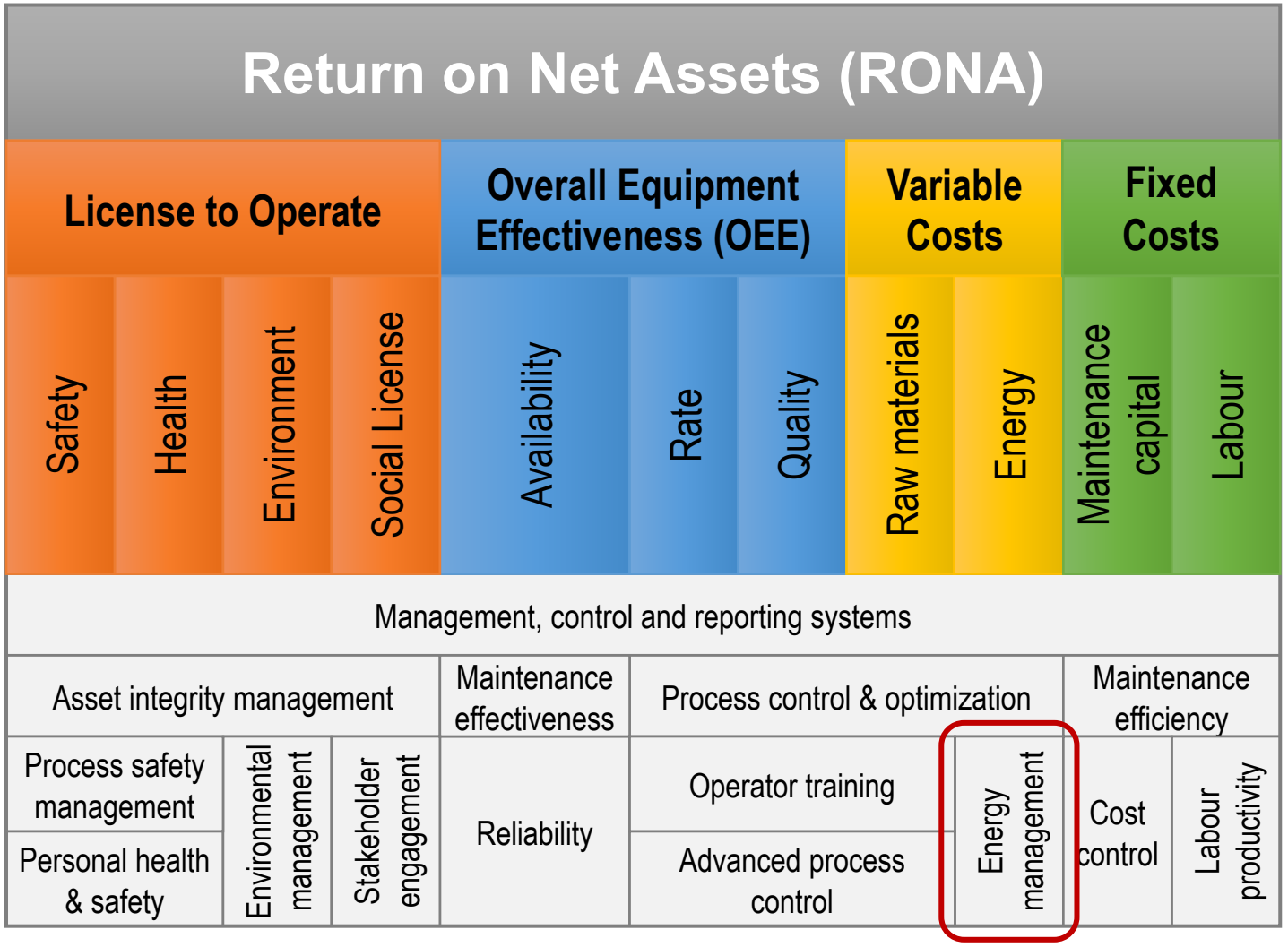
Tools and Best Practices

Summary Of Energy Management Tools and Best Practices

Theme	Most Basic	Comprehensive	Advanced
Energy Account Centres	-	Yes	Yes
Metering	Utility meter	Sub-metering	Sub-metering
Data Capture & System Integration	By hand	Plant historian	Plant historian
Analysis & Reporting	Simple KPI (e.g. kWh/tonne)	Energy performance baselines	Energy performance analysis
Roles & Responsibilities	One person	Accountabilities by EAC + Energy Team	Operational accountabilities
Management Systems and Practices	• Monthly review • Ad-hoc investigation	• Daily, weekly, monthly review vs targets • CUSUM	Integrated operations performance management system
Continuous Improvement	-	• Project list	• Opportunity identification • Project development • Targets and results plans

How Important Is Energy Efficiency?

How Important Is Energy Efficiency?



Barriers To Energy Efficiency

Internal Barriers

- Energy is less visible
- Cost of metering, data collection
- Lack of information, knowledge, expertise
- Uncertainty about the savings and benefits
- Management bandwidth
- Opportunity cost of people's time.

External Factors

- Energy prices

Assessing The Potential Benefits

Questions To Ask

(i) Size Of The Opportunity

- How much is your annual energy spend?
- How complex is the production process?
- Degree of process variability
- Organisational awareness
- Current knowledge and expertise
- Historic efforts

Assessing The Potential Benefits

Energy Intensity and Cost Estimates for Canadian Industry Sectors in 2005

Industry Sector	Average Energy Intensity		Average Energy Cost per Unit Output ($)[1]	
Coal mining	0.38	GJ/ton	3.4	$/ton
Mining (excluding coal)	0.68	GJ/ton	6.3	$/ton
Industrial Minerals	4.7	GJ/ton	28	$/ton
Iron and steel	11.1	GJ/ton	57	$/ton
Pulp & paper	21	GJ/ton	226	$/ton
Metal smelting	71	GJ/ton	882	$/ton
Crude oil production	4.7	GJ/m3	31	$/m3
Natural gas production	6.8	GJ/1000m3	37	$/1000m3
Petroleum refining	1.1	GJ/m3	88	$/m3
Chemicals	14	GJ/$GDP	0.10	$/$GDP
Other Manufacturing	6.0	GJ/$GDP	0.05	$/$GDP

Data source: Masters thesis, A Simulation Model For Canada-US Climate Policy Analysis, B Tubbs, 2008.
Notes:
1. Includes all fuels and purchased energy sources. Costs are based on average provincial industrial energy prices.
2. Costs were converted from 1995 Canadian dollars to 2015 dollars using the consumer price index for Canada.

Assessing The Potential Benefits

Questions To Ask

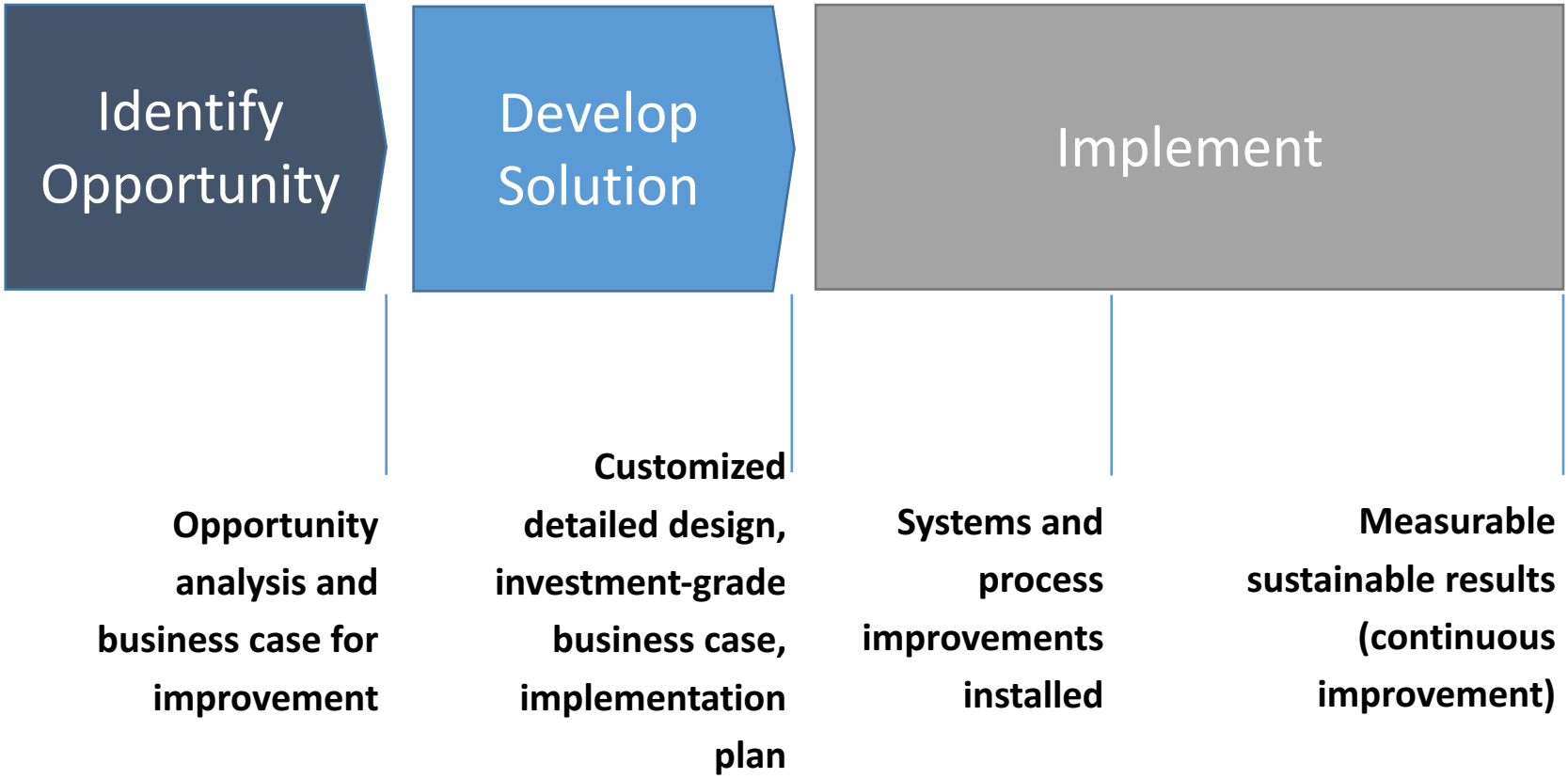
(ii) Importance To Business

- How important is reducing operating cost?
- What proportion of total operating cost is energy?
- Is sustainability an important goal?
- Are energy rates likely to increase?

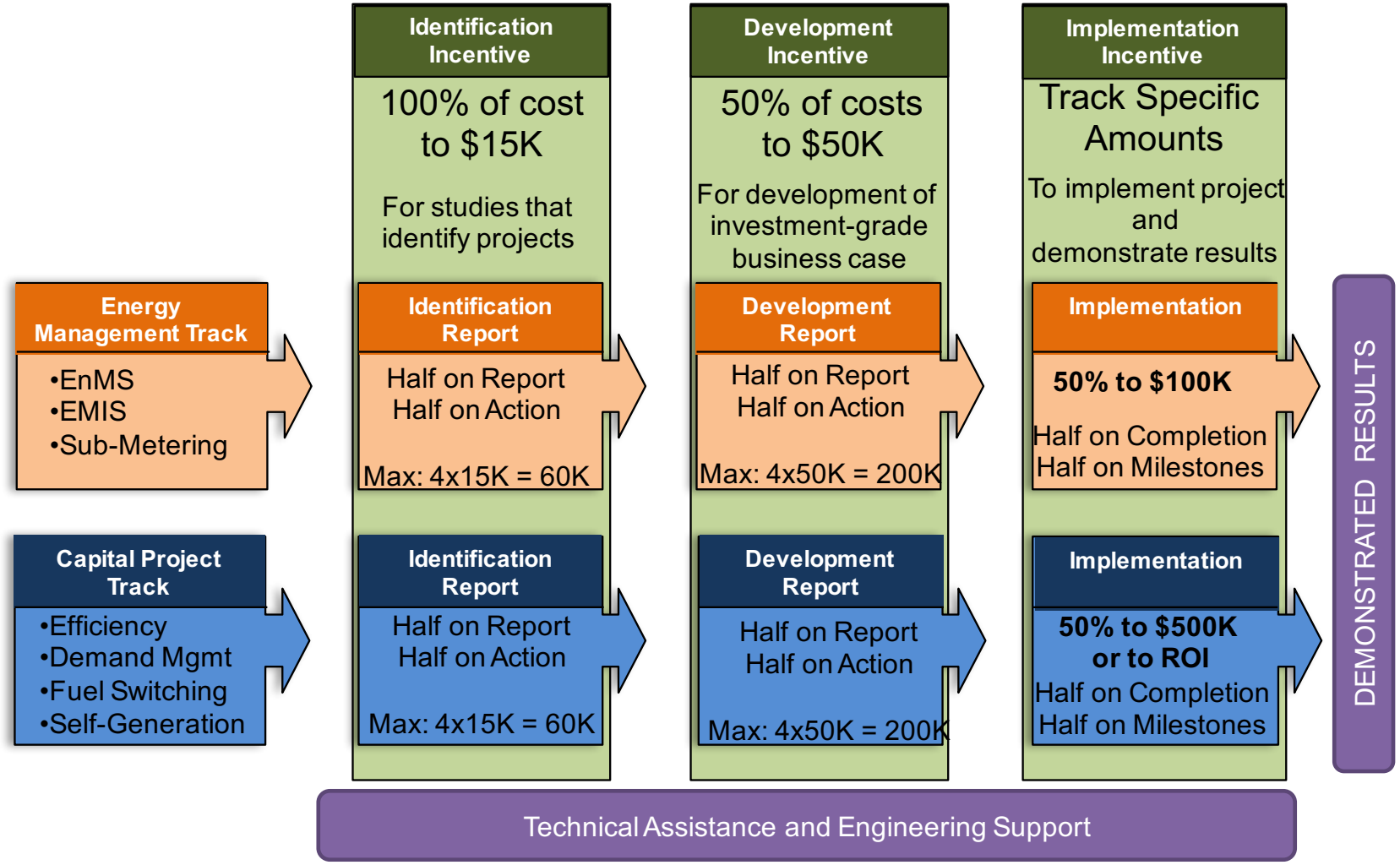
(iii) Organisational Readiness

- How are you doing on other priorities (reliability, safety, …)?
- Organisational capacity to manage competing priorities
- Management style
- Continuous improvement capability
- Senior management commitment.

How To Identify Your Needs



SaskPower IEOP Program



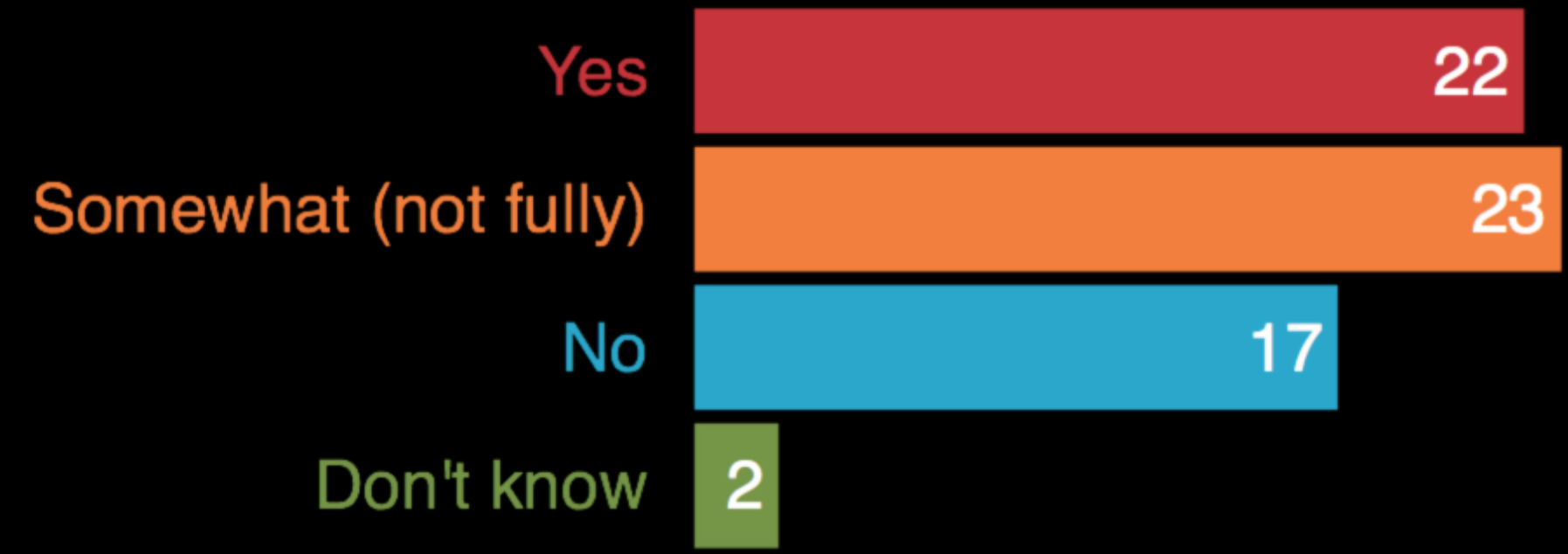
Thank You

Bill Tubbs
B. Tubbs & Associates Consulting Inc.
bill.tubbs@me.com
+1 (778) 378 6539

Audience Poll Results

Energy Management – Most Basic Level. Are you already doing these things at your site?

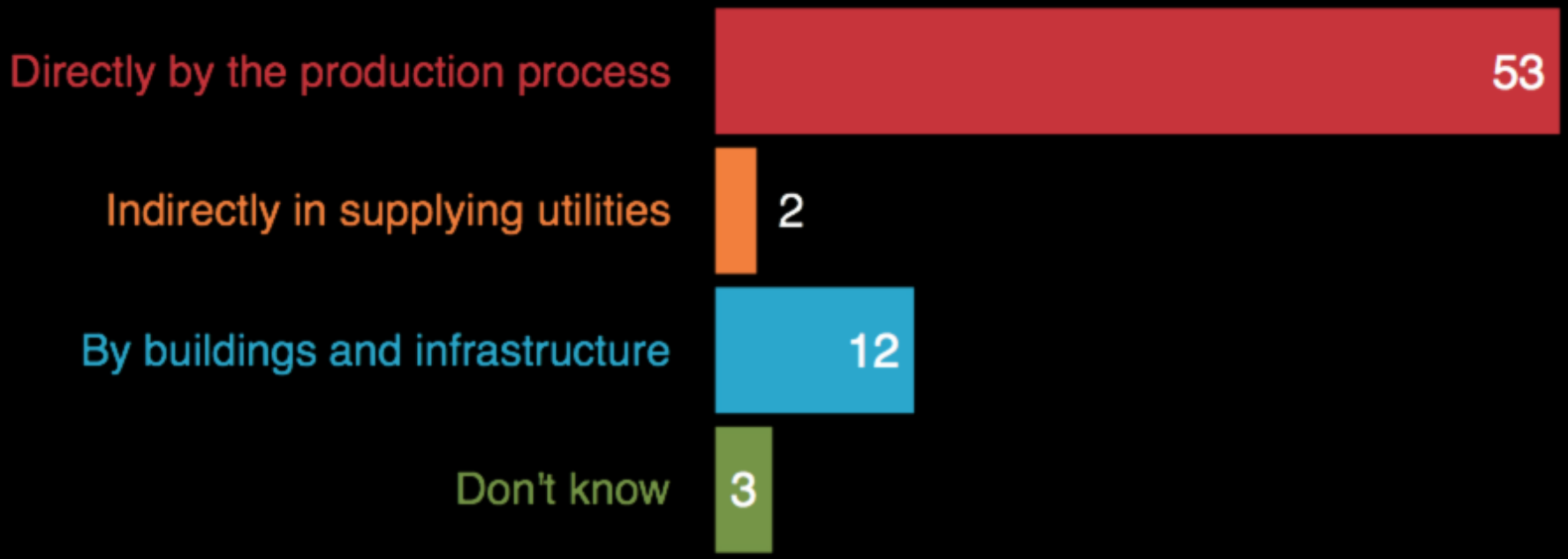
http://etc.ch/bsvG



64 votes - 64 participants

Where is most energy consumed in your operations?

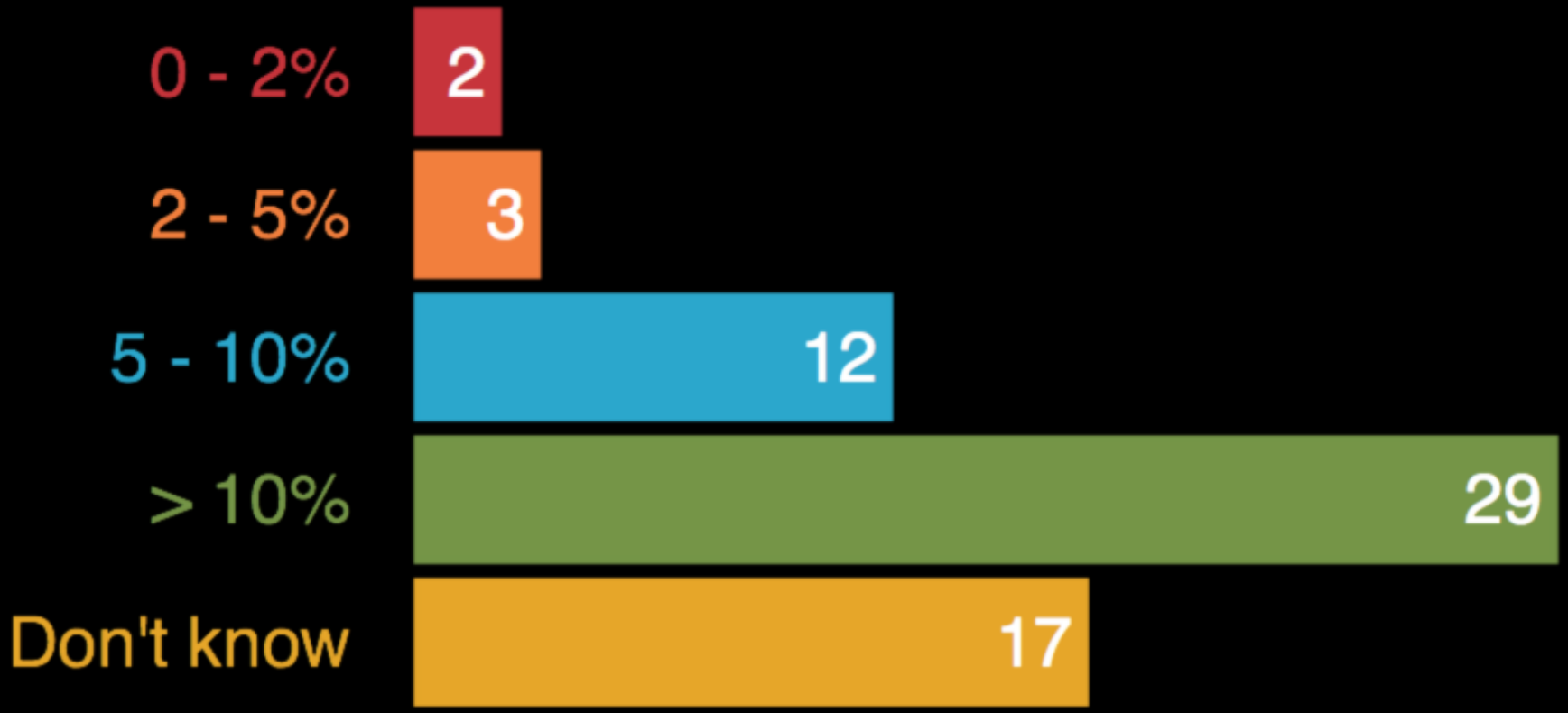
http://etc.ch/bsvG



70 votes - 70 participants

What is your site's energy cost as a proportion of total operating cost?

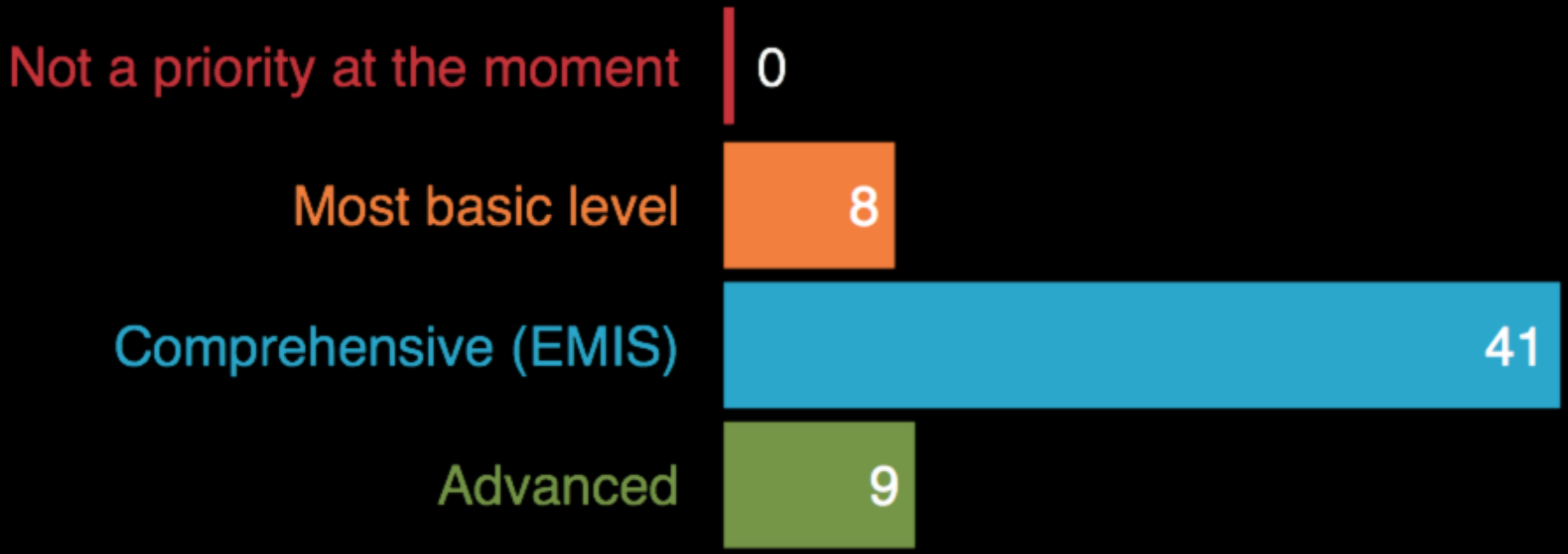
http://etc.ch/bsvG



63 votes - 63 participants

What type of energy management do you think is most appropriate to your operations?

http://etc.ch/bsvG



58 votes - 58 participants