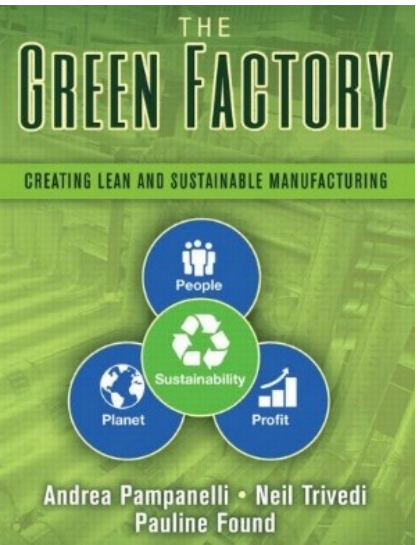
THE PERFECT PROCESS

ecobat RESOURCES

Lean and Green Deployment

Chris Birds
Ecobat Resources

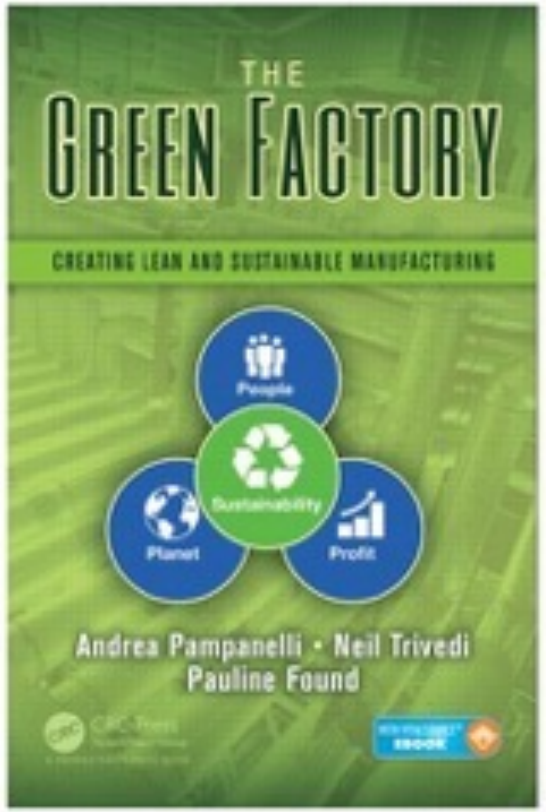
Neil Trivedi
The Perfect Process Company



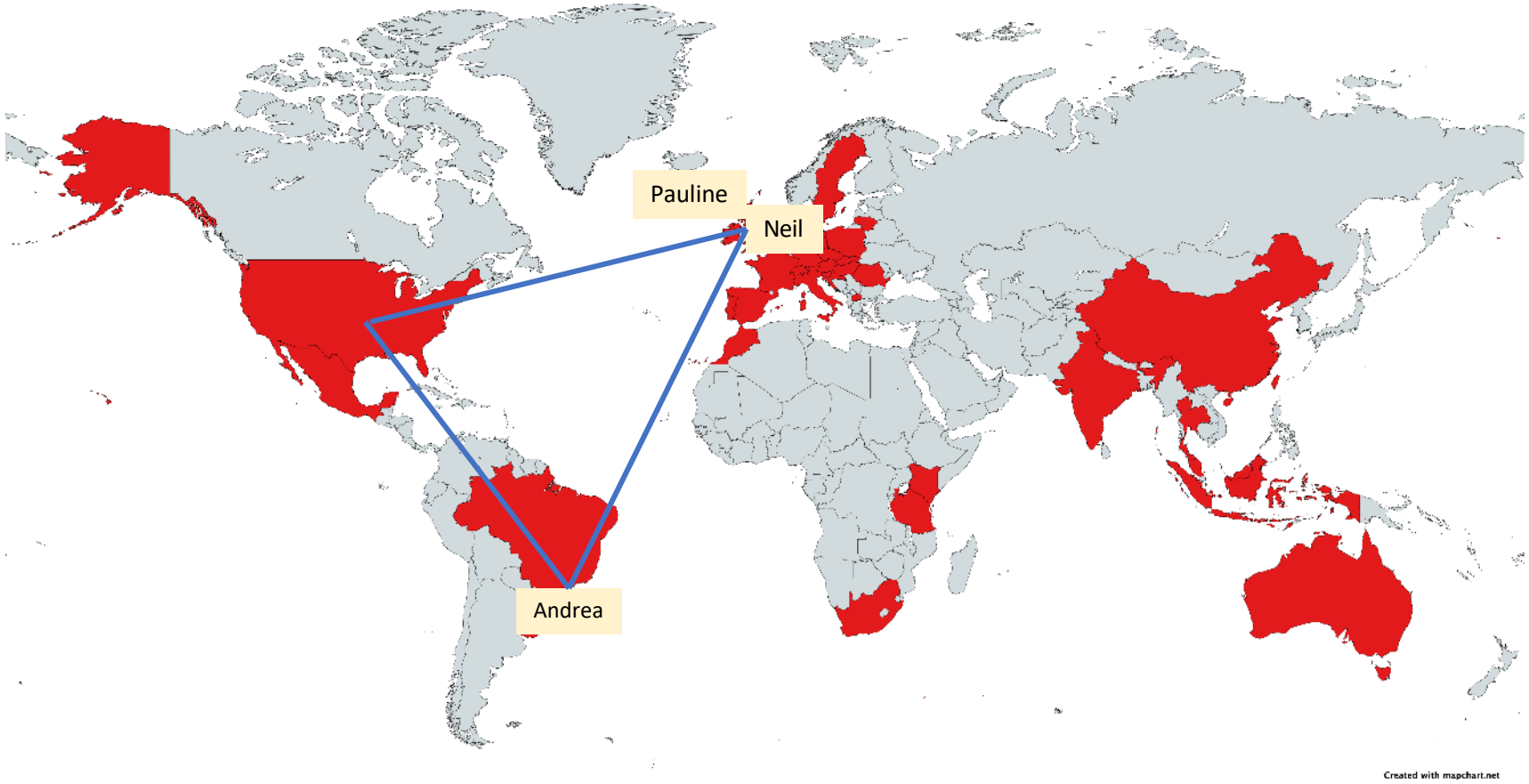
The Perfect Process Company

- Focussing on 3 areas of improvement using lean techniques:
  - Manufacturing improvement
  - Business process improvement
  - Green manufacturing
- Over 20 years experience in automotive, aerospace and food manufacturing improvement at a global level
- 10 Years consulting experience with a network of experienced associates
- Certified LCS (Lean Competency Systems Level 3B) Trainer
- Author “The Green Factory” 2016 and “The Strategic Lean Office” 2022
- Speaker at over 20 academic and business conferences

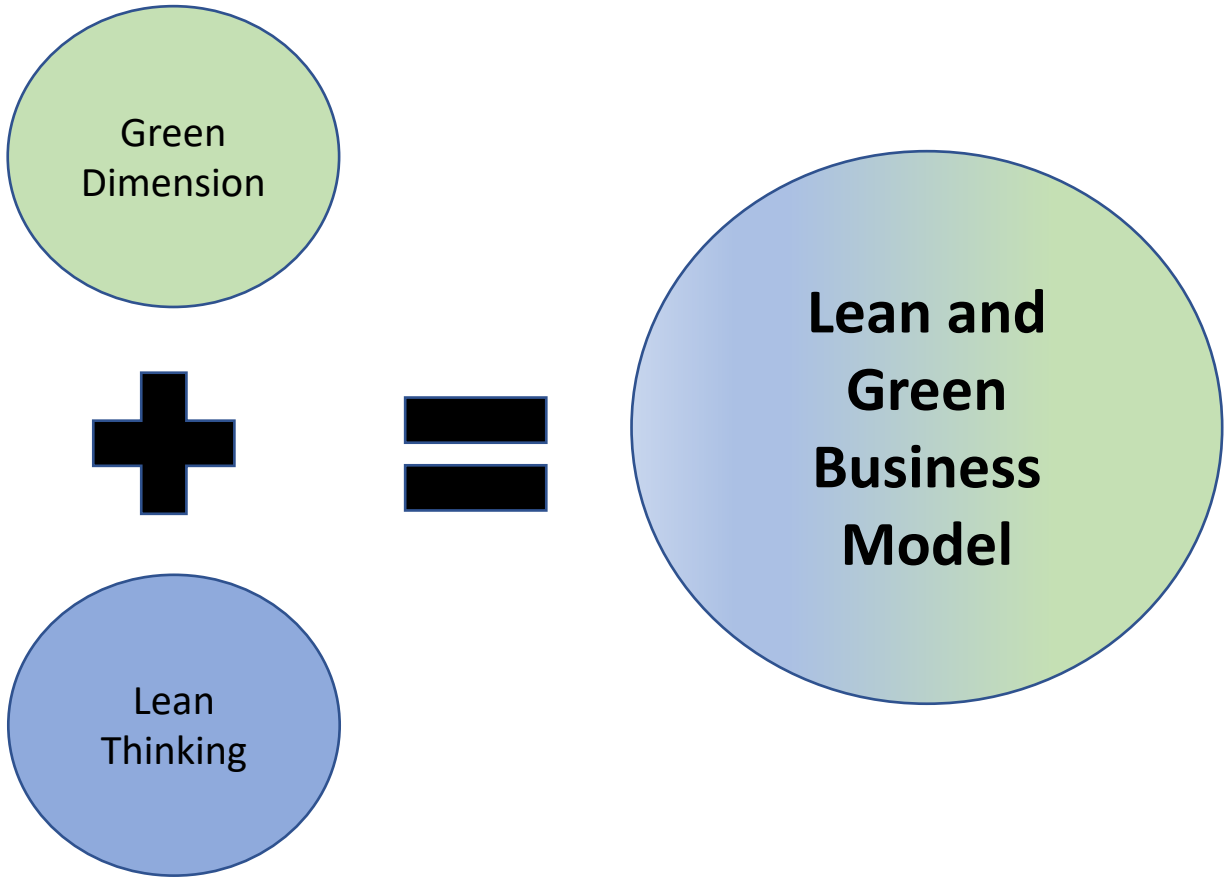
2 Books on Lean share the knowledge developed over 20 years

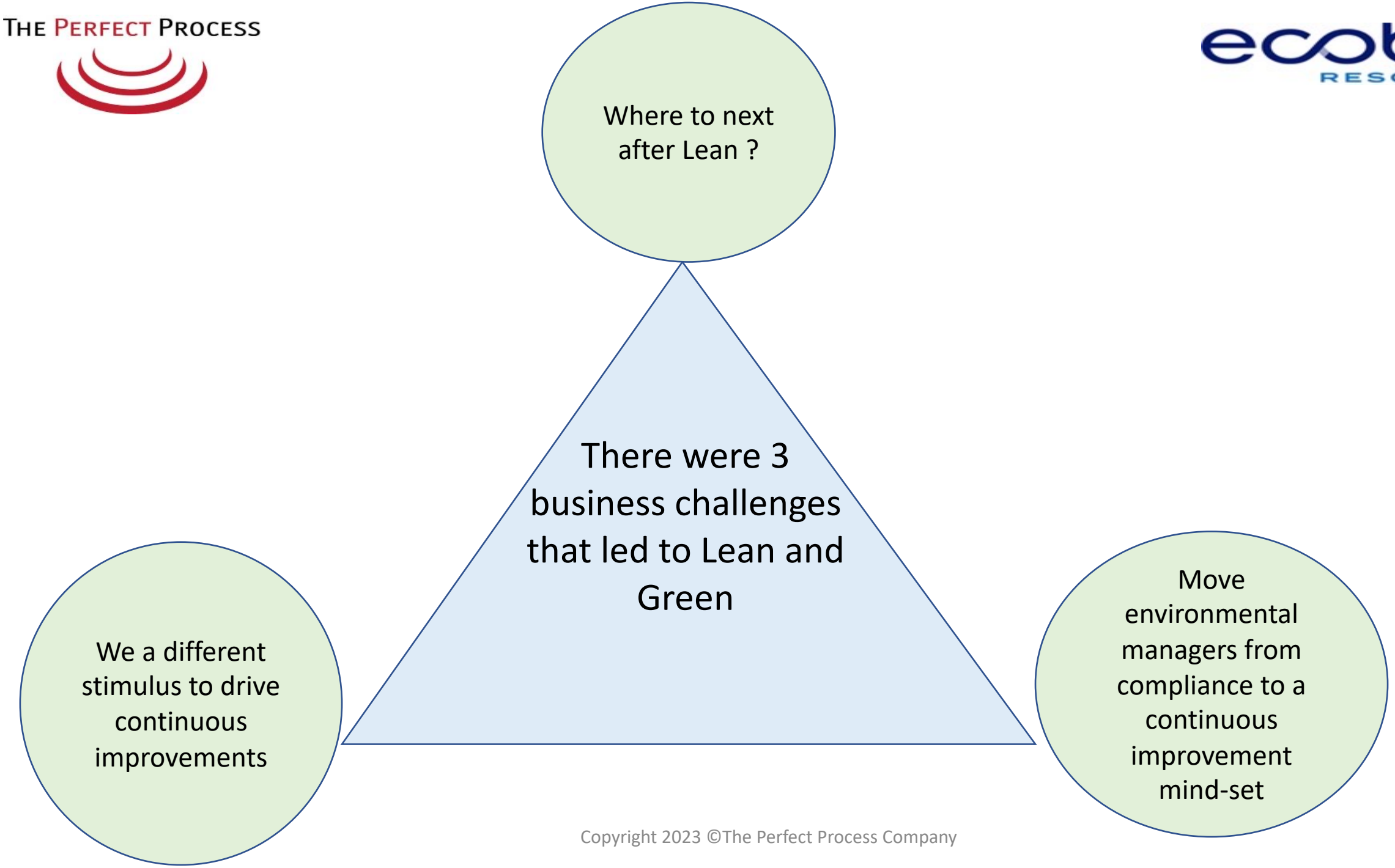


The journey to Lean and Green starts a long time ago, far far away in Porto Alegre Brazil in 2008



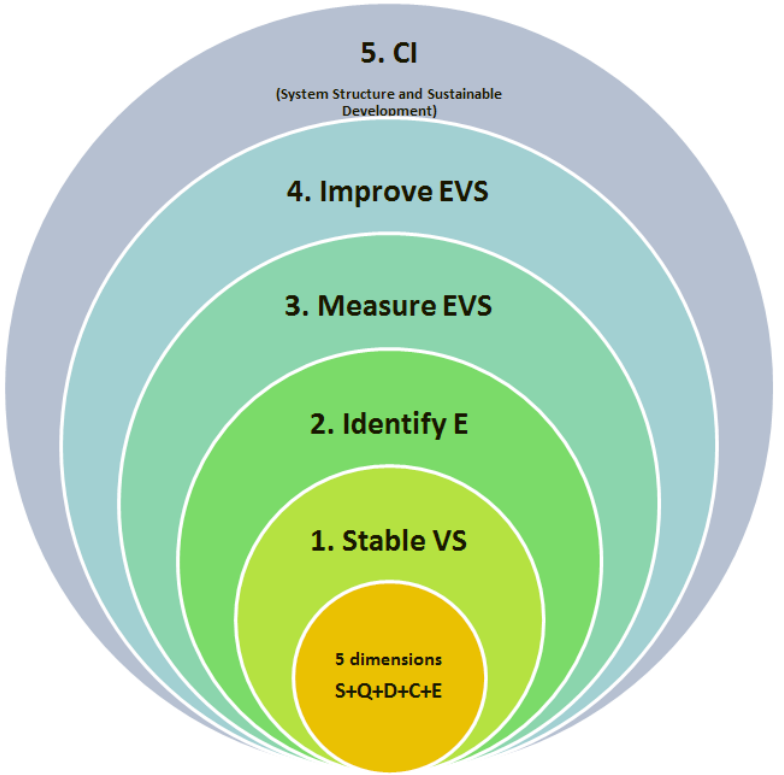
Lean and Green combines 2 business concepts into a single practical model





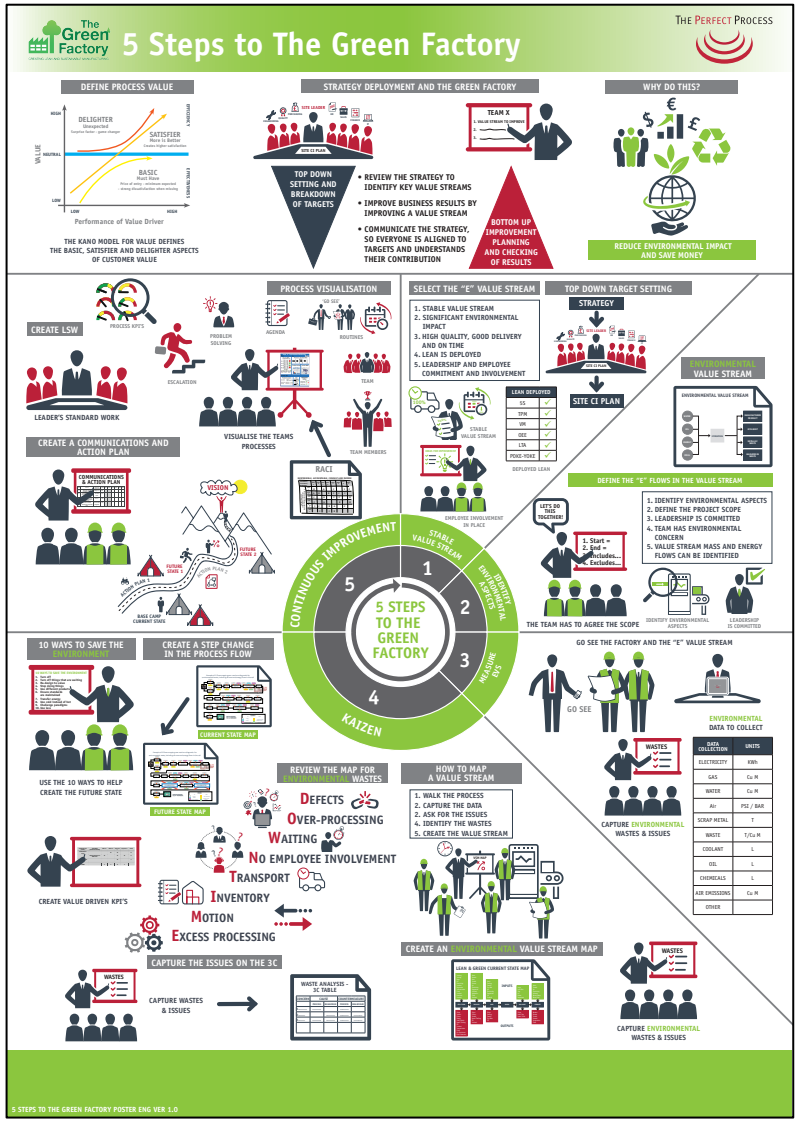
The Lean and Green Business model can be described by 5 principles

1. Identify a stable value stream (VS)
2. Identify the environmental impact (E)
3. Measure the environmental value streams (EVS)
4. Improve the environmental value streams (EVS)
5. Continuous Improvement (CI)



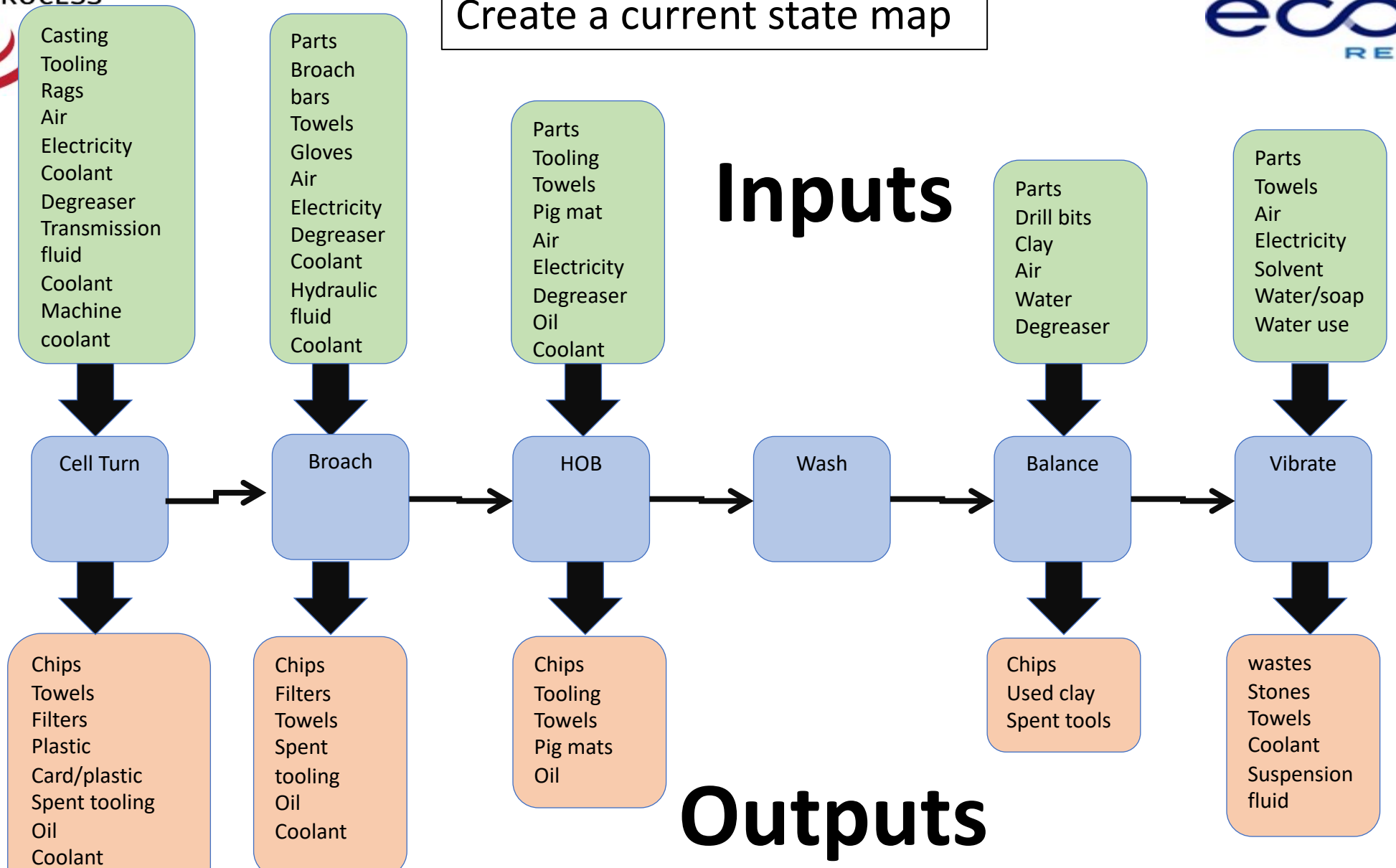
The principles of the L&GBM
Source: Pampanelli (2013).

Implementing Lean and Green

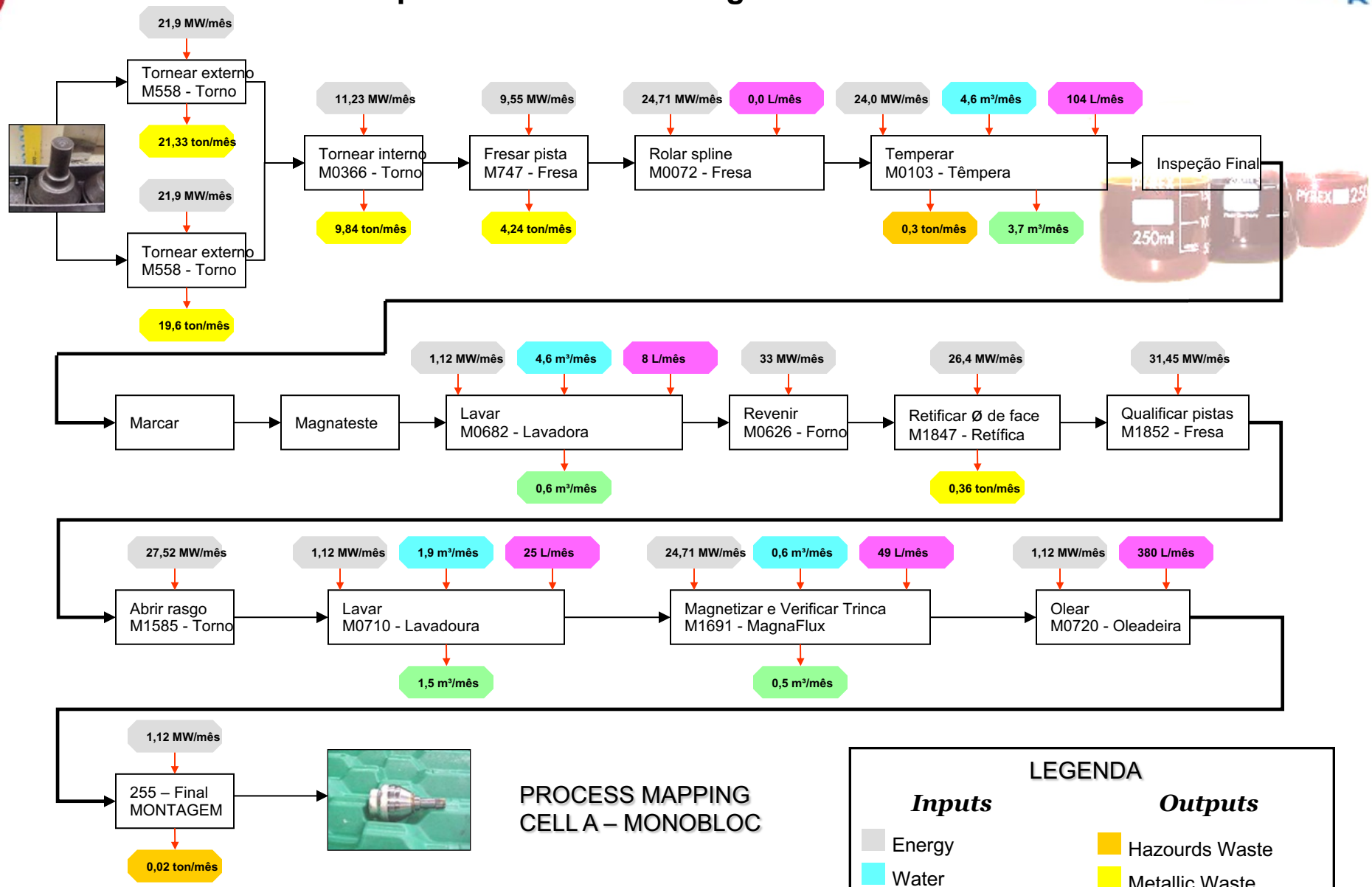


The steps to implement The Green Factory are summarised on this poster

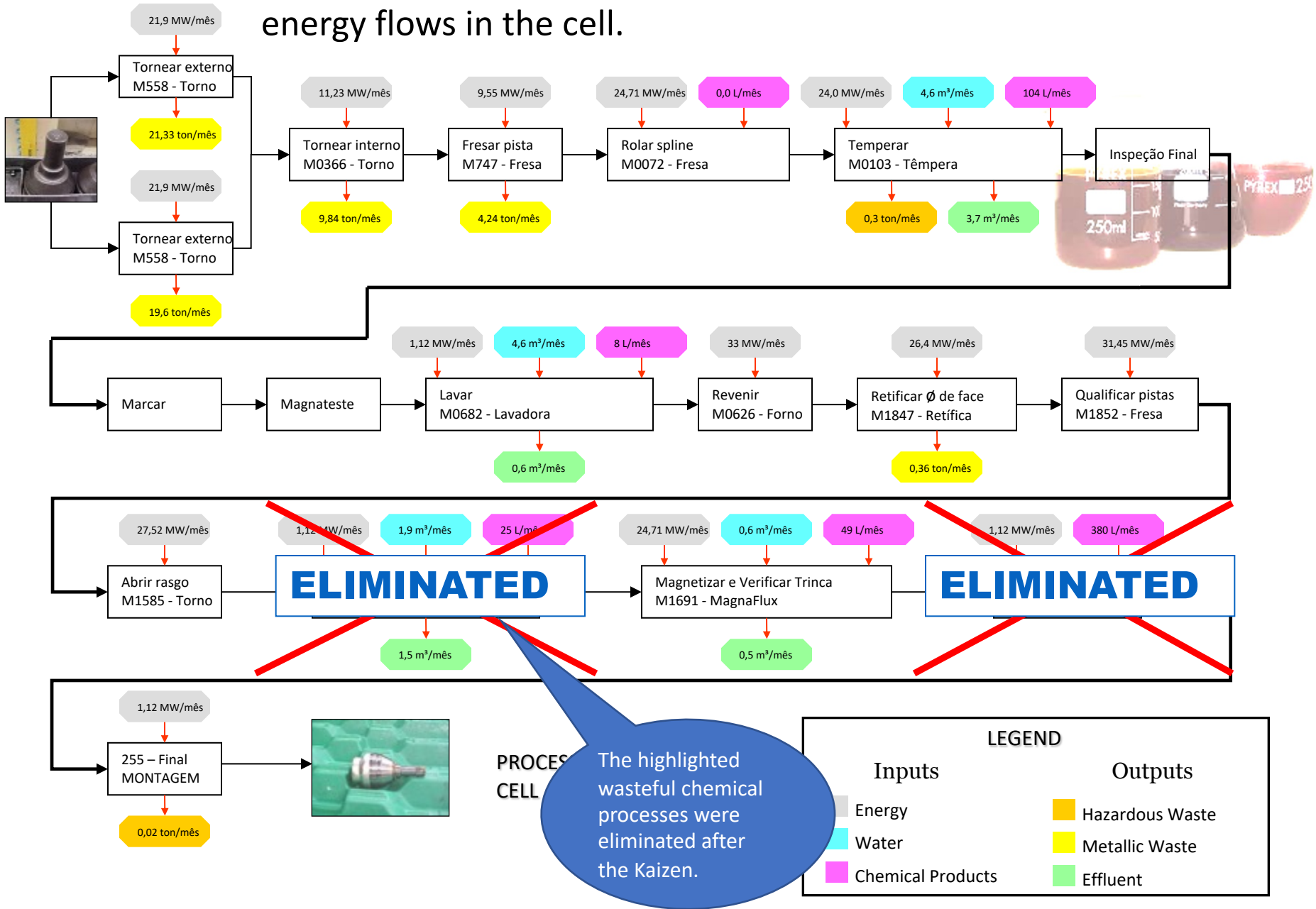
Create a current state map



Example of a Cell Block Diagram



E-Flow mapping used as a diagnostic for environmental waste, including all mass and energy flows in the cell.



THE PERFECT PROCESS

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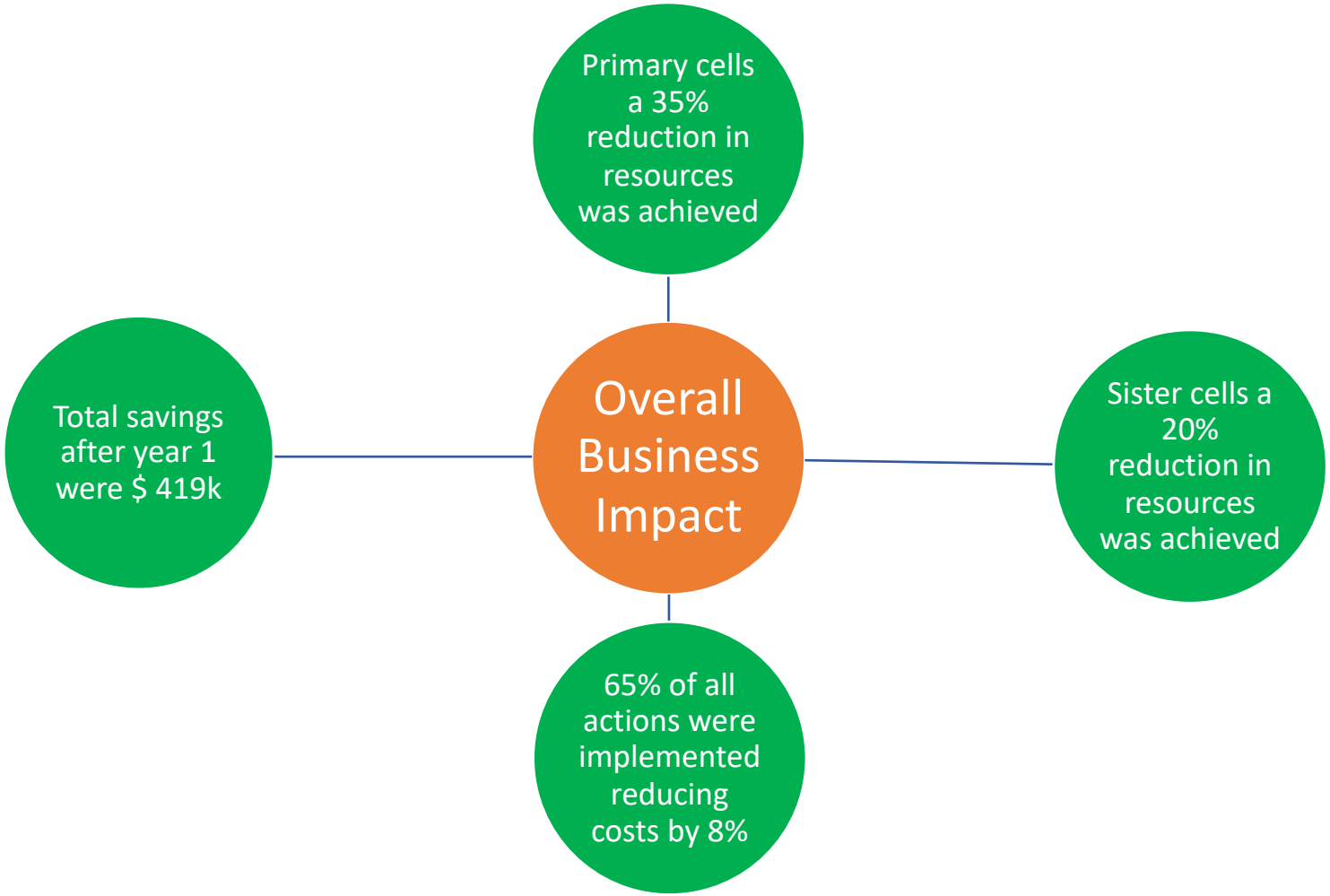
The Results

The Pilots confirmed the 7 pre-requisites

Overall business impact



Pilot testing at cell level show significant savings

	CELL 1	CELL 2
Kaizen Date	nov/08	jun/10
Nature of operations	Steel machining	Assembly of manufactured parts
Level of Lean	Deployment Level +	Deployment Level +
Process stability	<90% +	<90% +
Employee Involvement Tools	In place +	In place +
Leadership support	High +	High +
Environmental awareness	In place +	In place +
Data collection	In place +	In place +
Use of resources	High +	Medium -
Total cost of mass and energy flows (R$ / Year)	$ 1005 K	$ 483 K
Major impact CELL environmental cost	Metallic Waste: 68%	Grease 75%
% Cost savings by reducing cell`s mass and energy flows	13%	3%
Cost savings (R$ / Year)	R$ 264.000,00	R$ 30.000,00

Financial results were much more significant in the machining cell

	Cell 1	Cell 2
% Action plan implemented	94%	81%
Examples of improvement opportunity ideas that were identified during the Kaizen events and that were implemented	**For reducing energy usage:** Motion sensitive and low energy lights installed in low usage areas; **For reducing metallic waste generation:** Forgings were redesigned for reducing machining and hence metallic waste; **For reducing contaminated waste generation:** Plastic wrap containing oil contamination was eliminated from the containers - substantial savings in disposal costs.	**For reducing energy usage:** All assembly cell lighting system of was replaced by to 54watts system that consumes less energy; **For reducing grease waste generation:** (1) A new system was introduced to re-use the waste grease that was left in the used drums; (2) a new weighing standard was introduced in order to reduce the process waste grease.
% Cost savings by reducing cell`s mass and energy flows	13% After implementing the action plans (1 year)	3% After implementing the action plans (1 year)
Cost savings USD $	$ 132 000 Results after implementing the action plans	$ 15 000 Results after implementing the action plans

The results were a validation of the Lean and Green business model

Overall, after the first year of implementation, approximately 60% of the action plans for the seven kaizens developed were implemented, saving around USD $ 419 646, representing a 5.5% reduction of environmental cost for the cells' mass and energy flows.

3 Big lessons from the adventure to Green:

1. Introduces a new dimension into traditional lean thinking, the environmental concerns, motivating a conceptual transition
2. Focuses on non-traditional sources of hard savings for continuous improvement
3. Identifies and measures environmental aspects and impacts as well as inputs and outputs, based on manufacturing value streams and the real flow of value

Ecobat Resources – Lean and Green Implementation

Chris Birds

Operations Support Manager

Introduction – Who am I?

Chris Birds

- Ecobat Resources UK Operational Support Manager
- 21 years employed by the company
- Started my journey at Ecobat as a Production Chemist
- Worked as a Production Team Leader
- Moved to Production planning in 2018
- Completed my LSS Green belt in 2019
- Now promoted to Operational Support Manager covering aspects of planning, operations and Lean
- Working towards integrating the UK operations section of the global SAP system

Who is Ecobat?

Our Business

Our Business

Transforming the **materials** of energy storage.

Ecobat Resources uses our capability and technology to recycle materials without compromising performance while continuing to reduce overall impact.

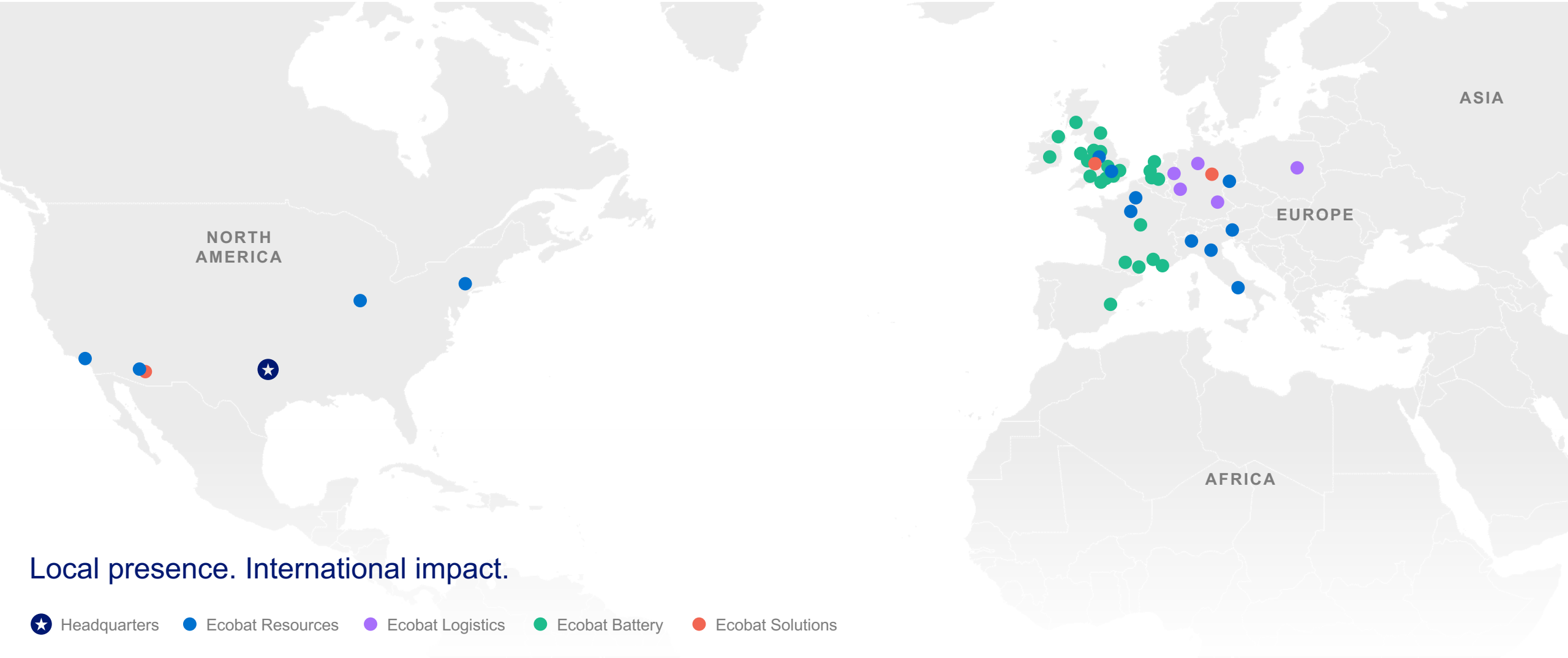
LEAD AND LEAD ALLOYS

POLYPROPYLENE COMPOUNDS

A Sustainable History of Lead Battery Recycling – in Numbers

1938	ECOBAT FOUNDED
14th	EARLIEST SMELTER COMMISSIONED
12	SMELTERS ACROSS
2	CONTINENTS
2,700	EMPLOYEES
65,000	BATTERY COLLECTION POINTS
120,000,000	BATTERIES RECYCLED ANNUALLY
840,000	TONS OF LEAD RECOVERED
99%	MATERIAL RECOVERY RATE FROM USED BATTERIES

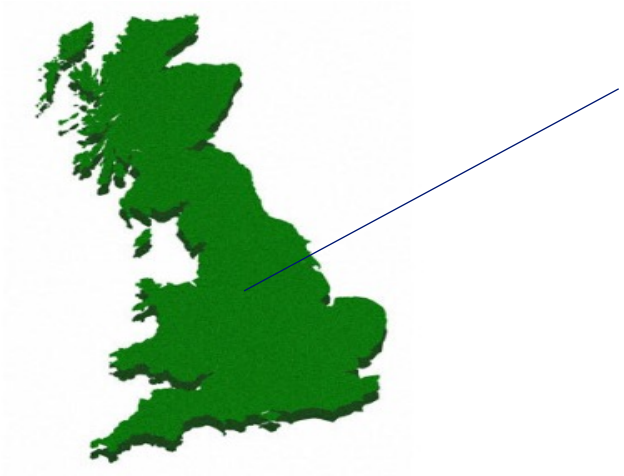
Our Locations



Local presence. International impact.

Headquarters | Ecobat Resources | Ecobat Logistics | Ecobat Battery | Ecobat Solutions

Ecobat Resources – UK Overview



Location ;-
Darley Dale Smelter
Matlock
Derbyshire
England

Smelting since 1820 - 203 years

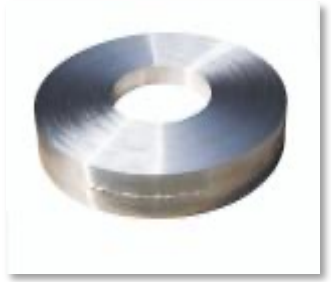
Key Information

- 250 acres
- 246 Employees
- 24/7 Operations
- 6 Products Produced
- (Ingots, Blocks, Strip, Shot, PP & Gypsum)

Ecobat Resources UK - HJE

Ingots 75,000 mT (Capacity for 90,000mT)

Poly 4,500 mT



Strip 5,000 mT

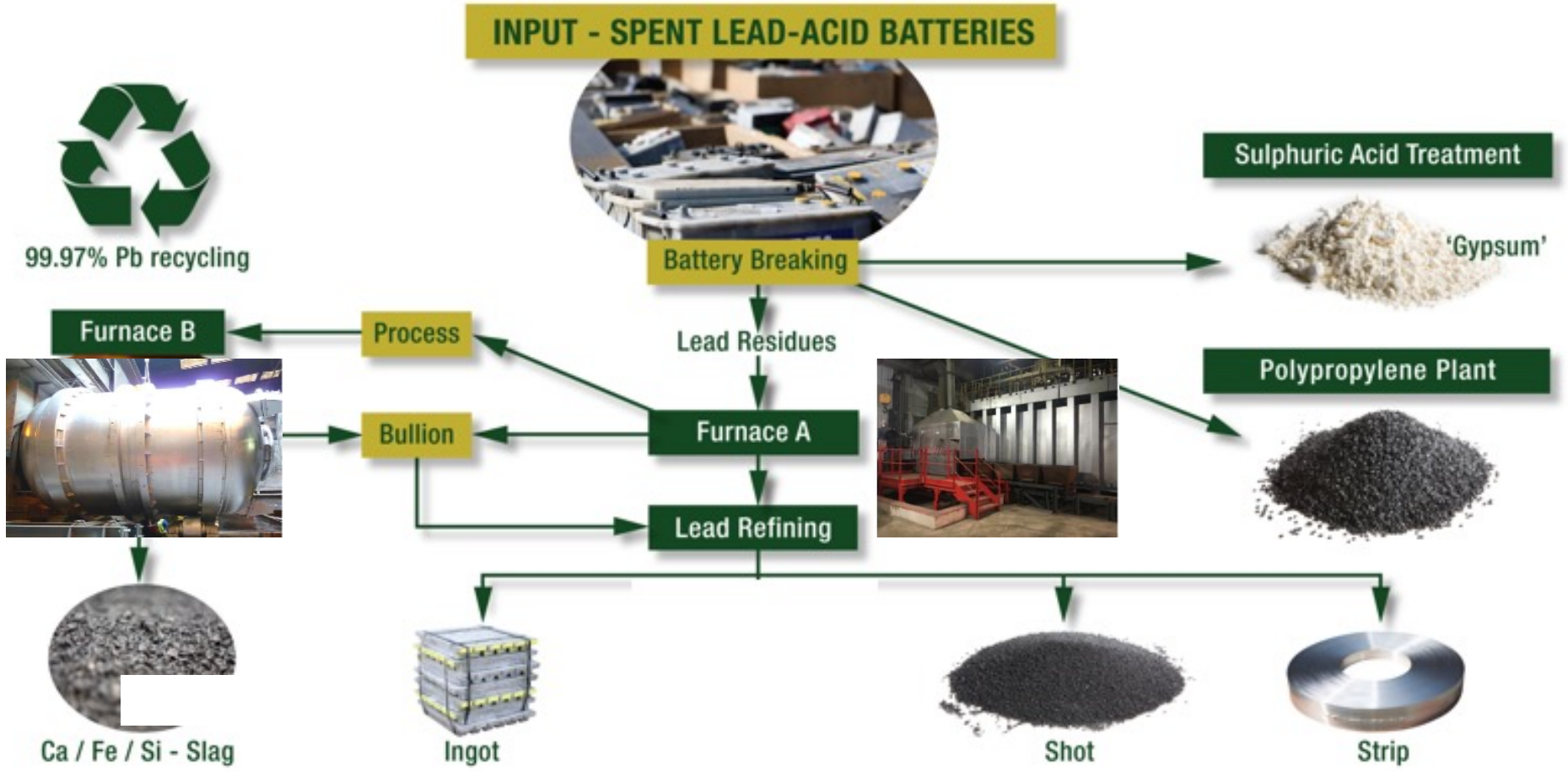
Gypsum 20,000 mT

Shot 1,000 mT

Ecobat Resources UK - HJE

- Reverb furnaces have been used in secondary lead production for many years
- FGD technology is well known on power stations
- We combine the most efficient processes from both technologies in a novel way
- The continuous smelting process is energy efficient, has low reagent consumption and achieves low emissions
- Sulphur generated in the off gas stream, treated with lime in a fluidised bed making gypsum product
- High temperature filtration of the off gas prior to the scrubbing step results in a high purity gypsum product for resale

Ecobat Resources UK – HJE



Ecobat Resources UK – HJE

Accreditations

- ISO 9001 - Quality Management Systems
- ISO 45001 - Occupational Health & Safety
- ISO 50001 - Energy Management Systems
- ISO 14001 - Environmental Management
- Investors in People Award (Gold Status)

Ecobat Resources & Lean & Green

Why did embark on this journey?

- Lean Manufacturing had been implemented for many years in the US
- Only HJE had started a Lean Journey in Europe
- Improve it Environmental performance and impact
- Perfect Process had the expertise (Lean and Green) to deliver the programme
- Previous success in helping Ecobat UK (BLM)
- A European team/roadmap was created to begin the Lean and Green journey

Ecobat Resources UK – Lean and Green journey

- A Training programme was developed and broken up into 3 phases
- Each Phase required training & implementation – tools and techniques
  - Phase 1 – Visual Management & JI's
  - Phase 2 – Value Stream Mapping (VSM)
  - Phase 3 – Practical Problem Solving (PPS – Kaizen, A3 etc.)
  - LCS Accreditation
- Each division then implemented the training with support from Perfect Process Company with updates at each phase

Ecobat Resources UK – Phase 1

What tools after phase 1 did we use?

- Use of JI and VM is what we implemented

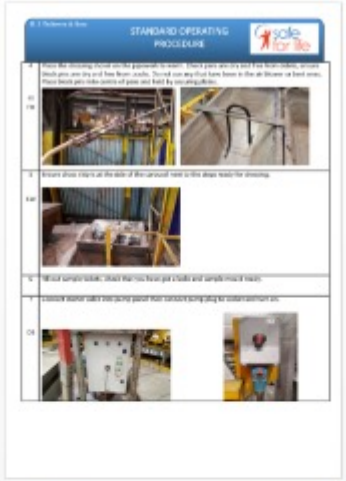
What did we do and why?

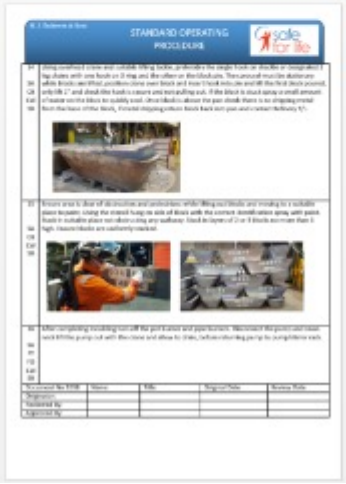
- High risk task
- Std Training Tool
- Viewed at any time without the task being completed
- Member of SLT actually carrying out the task
- Went to Gemba – carried out task and amended JI accordingly
- Many revisions – not as easy or quick (Must be right)
- You wont get it right first time from an office – you must go the GEMBA

Ecobat Resources UK – Phase 1

- Job Instruction (JI) Version





How long to I warm shovel up?
How do I warm shovel up?

Comments about block pin –
Where do I put it?

Dross skip, where do I put it,
where are they located?

Do I use ones with dividers in?

Ecobat Resources UK – Phase 1

Day of Month:	S/Sup Initial	Infeed rate (used only to see if shift should be void)	WGF Above 40K (Enter Y or N)	4 Tube Damper above 50% Open	PCC DP Setpoint (majority of shift value) Min -80Pa	Main Fan speed <88% (majority of shift)	PCC Gas temp (majority of shift)	Flue Gas Temp (majority of shift)	Sonic Sprays M3/h?	FF Pa Average for shift	High Opacity running above 8?	Sieve Tray setpoint (7-7.5kPa)	Sinter Rate 20-25% of Pb output?	Dryer Hopper Setpoint <=52%	Comments
10/08/2020 06:00															SUMMER SHUTDOWN
10/08/2020 18:00															
11/08/2020 06:00															
11/08/2020 18:00															
12/08/2020 06:00	KW	155	N	80%	-110	88%	480				N	7.5	18.0%	52%	1st Shift after restart
12/08/2020 18:00	AR	178	N	40%	-117	88%	551				N	7	23.0%	56%	
13/08/2020 06:00	KW	108	Y	45%	-110	90%	560				N	7	28.0%	59%	CPC downtime
13/08/2020 18:00	AR	182	Y	70%	-108	87%	450				N	7	30.0%	53%	
14/08/2020 06:00	GJ	66	Y	85%	-105	86%	425				N	7	29.0%	57%	Dryer Burner
14/08/2020 18:00	KW	160	Y	85%	-105	86%	425				N	7	29.0%	56%	Off for 3.5hrs - dryer burner
15/08/2020 06:00	GJ	152	Y	70%	-105	86%	470				N	7	44.0%	54%	Foaming
15/08/2020 18:00	KW	208	Y	85%	-108	88%	400				N	7	29.0%	52%	
16/08/2020 06:00	JH	180	Y	85%	-115	87%	400				N	7	28.0%	48%	
16/08/2020 18:00	GJ	90	Y	85%	-115	88%	380				N	7	14.0%	44%	Foaming and inspecting burners
17/08/2020 06:00	JH	180	Y	85%	-110	86%	480				N	7	15.0%	44%	
17/08/2020 18:00	GJ	186	Y	85%	-110	89%	390				N	7	40.0%	46%	Stopped for 2x breaks and 1 hr PCC Gearbox
18/08/2020 06:00	LS	189	Y	85%	-110	86%	570				N	7	30.0%	53%	1 hr foaming event - linked to lack of coke
18/08/2020 18:00	JH	105	Y	85%	-110	88%	530					7	19.0%	52%	Stopped for 2x breaks and 45mins labour
19/08/2020 06:00	LS	162	Y	85%	-105	86%	540						23.0%	53%	Stopped for repairs to Dryer tracking
19/08/2020 18:00	JH	206	Y	85%	-110	85%	540						40.0%	52%	Dryer burner failed and then foaming later on
20/08/2020 06:00	GJ	184	Y	85%	-120	86%	480						37.0%	51%	Foaming event first thing
20/08/2020 18:00	LS	192	Y	85%	-115	85%	480						31.0%	54%	Dryer Burner
21/08/2020 06:00	RP	200	Y	85%							N	7	24.0%	56%	Dryer Burner
21/08/2020 18:00	LS	191	Y	85%							Y	7	35.0%	56%	
22/08/2020 06:00	GJ	186	Y	85%							N	7.2	27.0%	55%	increase ST setpoint to 7.2
22/08/2020 18:00	KW	218	Y	85%							N	7.2	60.0%	52%	suspect lack of coke/large coke
23/08/2020 06:00	GJ	180									N	7.2	37.0%	54%	suspect lack of coke/large coke
23/08/2020 18:00	KW	131									N	7.2	60.0%	53%	suspect lack of coke/large coke
24/08/2020 06:00	JH	135									Y	7.2	40.0%	53%	Ran out of Pet Coke - suspect som CIB has also gone in
24/08/2020 18:00	GJ	204	Y	85%							N	7.2	37.0%	52%	
25/08/2020 06:00	JH	148	Y	85%							N	7.2	53.0%	51%	Started to add 3 buckets of CRT and Ca
25/08/2020 18:00	GJ	224	Y	85%							Y	7.2	30.0%	53%	
26/08/2020 06:00	LS	208	Y	85%							N	7.2	25.0%	56%	
26/08/2020 18:00	JH	214	Y	55%	-110	87%	460				N	7.2	33.0%	56%	changed to 2 buckets of each
27/08/2020 06:00	LS	230	Y	85%	-105	87%	450	225	1	1200	N	7.2	27.0%	56%	changed back to 3 buckets of each
27/08/2020 18:00	JH	180	N	85%	-105	86%	380	225	0.7	1130	N	7.2	35.0%	52%	low infeed due to hopper bridging
28/08/2020 06:00	SB	200	Y	85%	-115	87%	420	225	0.6	1140	N	7.2	26.0%	53%	
28/08/2020 18:00	LS	175	Y	85%	-115	87%	510	225	0.7	1150	N	7.2	25.0%	56%	CPC Down and PCC screw stopped
29/08/2020 06:00	SB	80	Y	85%	-110	87%	530	225	0.7	1100	N	7.2	30.0%	56%	Dryer stopped rotating, had to dig out
29/08/2020 18:00	LS	100	Y	85%	-110	87%	490	225	0.4	1180	N	7.2	23.0%	55%	Dryer still down for 6 hrs
30/08/2020 06:00	GJ	132	Y	50%	-105	87%	480	225	0.5	1200	N	7.2	31.0%	56%	30 mins sinter foaming - no Ca or CRT added
30/08/2020 18:00	AJ	165	Y	85%	-110	87%	480	225	0.8	1270	N	7.2	29.0%	57%	
31/08/2020 06:00	GJ	156	Y	85%	-105	87%	470	225	0.8	1300	N	7.2	28.0%	53%	
31/08/2020 18:00	AJ	174	Y	85%	-105	86%	590	225	1	1290	N	7.2	23.0%	59%	

Lower daily input due to various breakdowns

High Sinter rates seen during month. Found the RC to be the lack of ABS batteries being processed hence less Silica

Ecobat Resources UK – Phase 1

SINTER from REVERB FURNACE (%)											
Date	Pb	Sb	Sn	FeO	SiO2	CaO	S		Si/Fe+ Ca	Fe/Ca	Total assay
22/08/2020 13:00	52.68	1.83	1.26	1.32	2.53	8.61	1.57		0.3	0.15	69.80
23/08/2020 01:00	54.18	1.87	0.92	2.70	1.90	3.81	0.87		0.3	0.71	66.25
23/08/2020 07:00	55.57	2.31	1.55	3.05	3.18	3.72	0.85		0.5	0.82	70.23
23/08/2020 09:00	49.49	2.18	2.17	8.08	4.24	5.77	1.38		0.3	1.40	73.31
23/08/2020 11:00	49.66	2.18	2.15	8.05	4.33	5.79	1.38		0.3	1.39	73.54
23/08/2020 13:00	57.18	2.11	1.39	2.47	4.49	3.60	0.63		0.7	0.69	71.87
24/08/2020 01:00	51.08	2.25	2.40	4.41	2.91	5.39	0.89		0.3	0.82	69.33
24/08/2020 07:00	54.78	1.71	1.43	3.62	2.04	4.76	1.05		0.2		
24/08/2020 09:00	46.88	2.33	3.60	5.50	2.85	6.49	1.13		0.2		
24/08/2020 13:00	45.47	2.87	3.91	9.18	4.26	5.73	0.93		0.3	1.60	72.35
24/08/2020 15:00	46.31	3.09	2.72	6.25	4.16	4.98	1.11		0.4	1.26	68.62
25/08/2020 05:00	56.17	1.82	0.88	2.11	2.18	3.95	1.00		0.4	0.53	68.11
25/08/2020 07:00	54.08	1.89	1.23	1.83	1.64	3.62	0.79		0.3	0.51	65.08
25/08/2020 11:00	46.44	2.13	1.01	3.07	3.15	3.65	0.87		0.5	0.84	60.32
25/08/2020 13:00	51.2	1.48	1.19	9.01	4.30	6.27	1.41		0.3	1.44	74.86
25/08/2020 15:00	48.38	1.84	2.22	5.25	3.86	9.89	1.76		0.3	0.53	73.20
25/08/2020 19:00	51.22	2.31	1.73	2.25	4.23	9.08	2.24		0.4	0.25	73.06
25/08/2020 21:00	47.4	3.06	2.54	2.36	5.03	8.31	2.24		0.5	0.28	70.94

The amber here shows incorrect Si/Fe + Ca ratio

- Training of S/Sup to understand Sinter Assay and how this indicates Reverb performance. Starting in October, due to planned Isolation in July when originally planned.

Ecobat Resources UK – Phase 1

Summary of Phase 1:

What have we learnt?

- Repeat, Try, repeat, try…….. Not everyone is the same and has varied levels of knowledge and ability
- Current system is not best for training
- A Gemba walk is the best way to test the JI
- Don't just do it on your own….. Use different people to ensure different views and practices are seen

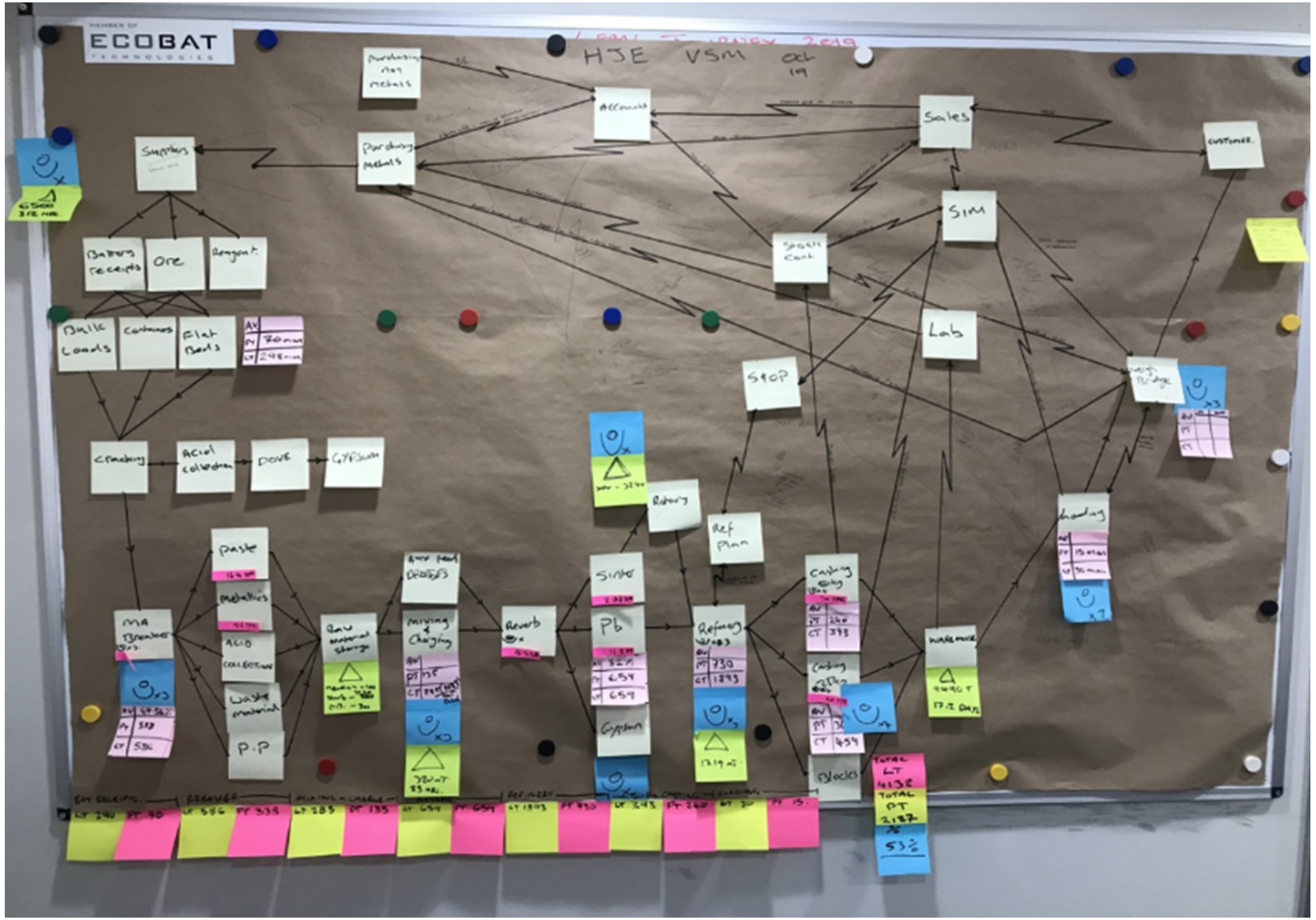
What challenges did we have?

- Not a quick solution
- Planning in time to go and walk the Gemba and test the JI in line with production of 3mT blocks

Results

- We now have over 150 JI's at Ecobat Resources UK, for lots of task. Used in both Ops and Maint dept.

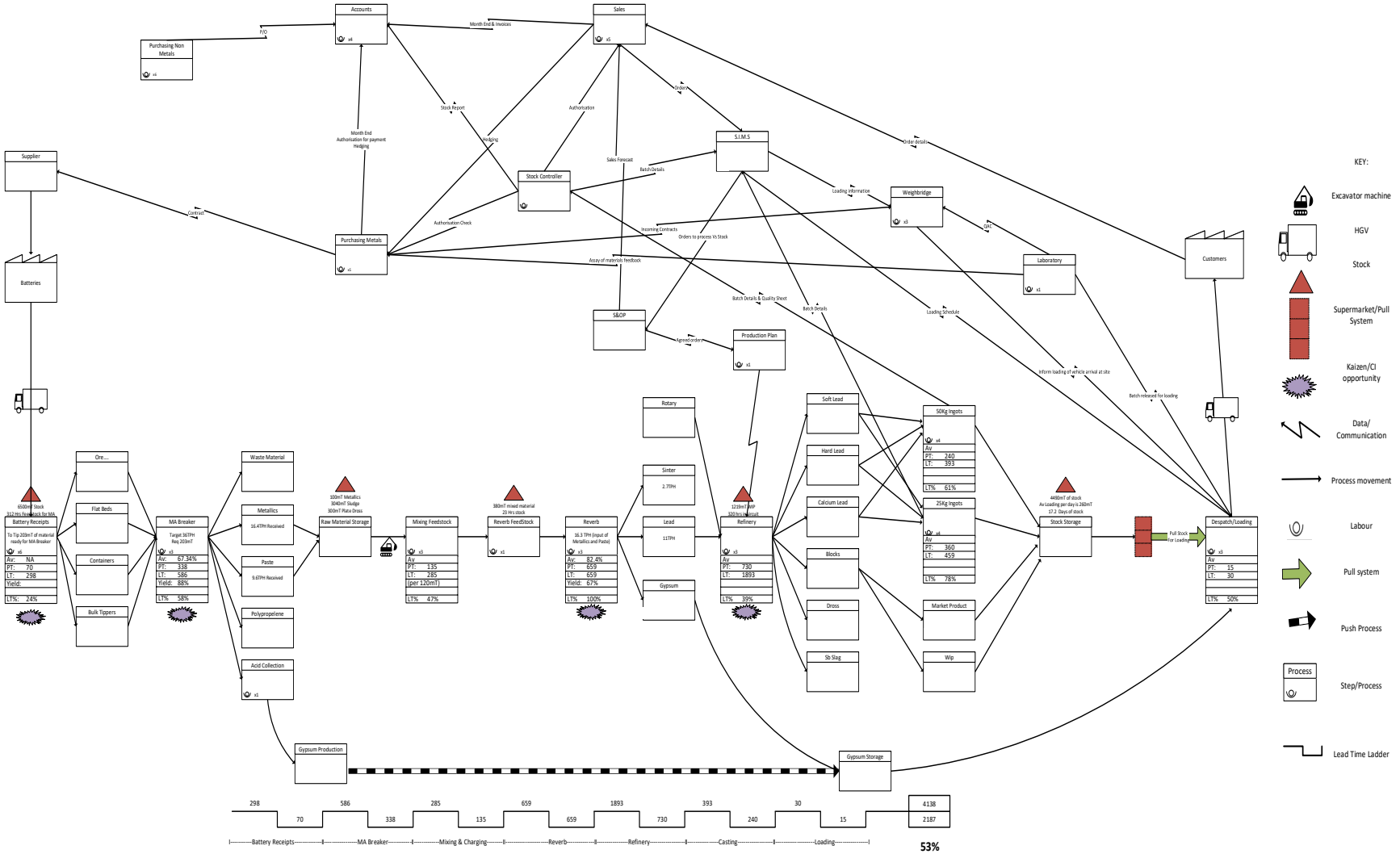
Ecobat Resources UK – Phase 2



- Overview and training given to the team on VSM
- Explained that a VSM is a way of measuring a plants performance
- VSM Team was created
- VSM Current State Map created over 3 days
- All processes and information/data lines were included

Ecobat Resources UK – Phase 2

H J Enthoven Value Stream Map – Soft Lead Ingots October 2019 Current State



Outcomes from VSM:

- Low LT% on MA Breaker
- Opportunity to improve Reverb
- Low LT% on Refinery & Casting

- Low LT% in other areas
- Minimal impact Overall LT%

- Confirmation/Validation

- Action Plan in place to address above

Ecobat Resources UK – Phase 2

HJ ENTHOVEN VALUE STREAM MAP DATA 2019

Lean & Green Improvements for 2020

Current State	Receipts	
	LT	PT
Tonnes Req	203	203
Per Load	29.8	7
No of Loads Req	10	10
Total time	298.00	70.00
LT%	23.49%	

Current State	MA Breaker	
	LT	PT
Tonnes Req	203	203
TPH	31	36
RT @ 100% Av @ current TPH	6.55	5.64
Availability %	67.34%	100.00%
Hrs to run at Av %	9.72	5.64
Hrs into Mins	583	338
Total time	583	338
LT%	57.99%	

Current State	Material Prep & Charging	
	LT	PT
	90	90
Transport	150	0
Charging	45	45
Total time	285	135
LT%	47.37%	

Current State	Reverb / Smelting	
	LT	PT
Tonnes Req	156	156
Infeed TPH	16	16
Yield %	67%	67%
TPH Output	11	11
RT @ 100% Av @ current TPH	14.15	14.15
** Availability %	82.40%	82.40%
Hrs to run at Av %	17.18	17.18
Hrs into Mins	1031	1031
LT%	100.00%	

Current State	Refinery	
	LT	PT
Tonnes Req	120	120
Refining Time	1893	730
LT%	38.56%	

Current State	50Kg Casting	
	LT	PT
Tonnes Req	120	120
Casting Time	240	240
Set Up	90	0
Av.	83.50%	100.00%
Delays	65	0
Total Time	395	240
LT%	60.73%	

Current State	Loading	
	LT	PT
Loading	15	15
Movement on Site	15	0
Total time	30	15
LT%	50.00%	

TOTAL	LT	PT
Receipts	298	70
MA Breaker	583	338
Material Prep & Charging	285	135
Reverb / Smelting	1031	1031
Refinery	1893	730
50Kg Casting	395	240
Loading	30	15
Total Time	4515	2559
LT%	56.67%	

L&G Projects 2020
Reduction in LT
Mini Projects on Bulk Tipping area

L&G Projects 2020
TPH Increase:
New Transfer Screws - Increased TPH from 31 to 35
Better Water flow - Increased TPH from 35 to 36
Availability Increase:
Floc System - Improve Front panel - 1%
Water flows (reduce blockages) - 3%
Delfilt Repairs - 3%
New Surge Tank - 5%
Breaks - will enable us to move back to 2 shift pattern

L&G Projects 2020
No Plan

L&G Projects 2020
Availability Increase:
New FGD Booster Fan Design - 1.5%
Operational Improvement - 0.5%
** Expect Year to end at 83% Availability

L&G Projects 2020
ll for drossing pots & better control of Reverb Temp
Trial lower P/O temps
Decrease Cooling time for De -Cu
Dross Hold time reduction

L&G Projects 2020
Reduction in Set up Time
Improve OEE

L&G Projects 2020
No Plan

2019 TO 2020 Improvement Plan

Future State	Receipts	
	LT	PT
Tonnes Req	203	203
Per Load	25	7
No of Loads Req	10	10
Total time	250.00	70.00
LT%	28.00%	

Future State	MA Breaker	
	LT	PT
Tonnes Req	203	203
TPH	36	36
RT @ 100% Av @ current TPH	5.64	5.64
Availability %	80.00%	100.00%
Hrs to run at Av %	7.05	5.64
Hrs into Mins	423	338
Total time	423	338
LT%	80.00%	

Future State	Material Prep & Charging	
	LT	PT
Mixing	90	90
Transport	150	0
Charging	45	45
Total time	285	135
LT%	47.37%	

Future State	Reverb / Smelting	
	LT	PT
Tonnes Req	156	156
Infeed TPH	16	16
Yield %	67%	67%
TPH Output	11	11
RT @ 100% Av @ current TPH	14.15	14.15
Availability %	85.00%	85.00%
Hrs to run at Av %	16.65	16.65
Hrs into Mins	999	999
LT%	100.00%	

Future State	Refinery	
	LT	PT
Tonnes Req	120	120
Refining Time	1533	730
LT%	47.62%	

Future State	50Kg Casting	
	LT	PT
Tonnes Req	120	120
Casting Time	240	240
Set Up	30	0
OEE %	85.00%	100.00%
OEE Lost Time	48	0
Total Time	318	240
LT%	75.56%	

Future State	Loading	
	LT	PT
Loading	15	15
Movement on Site	15	0
Total time	30	15
LT%	50.00%	

TOTAL	LT	PT
Receipts	250	70
MA Breaker	423	338
Material Prep & Charging	285	135
Reverb / Smelting	999	999
Refinery	1533	730
50Kg Casting	318	240
Loading	30	15
Total Time	3838	2527
LT%	65.86%	

Ecobat Resources UK – Phase 2

Summary of Phase 2:

What did we do and how?

- Gather a team of people to complete the VSM
- Get the data (not all to hand) and complete VSM and under LT% (Lead Time %)
- Identify opportunities for improvement (Kaizen burst etc.)
- Create a plan to implement opportunities and create FS VSM

Results?

- CS and FS VSM were originally created for 2020 in line with Business Plan

Challenges and Barriers?

- Information/data
- Standardising the data through the VSM
- Getting SMT to understand what is a VSM and its benefits to the business

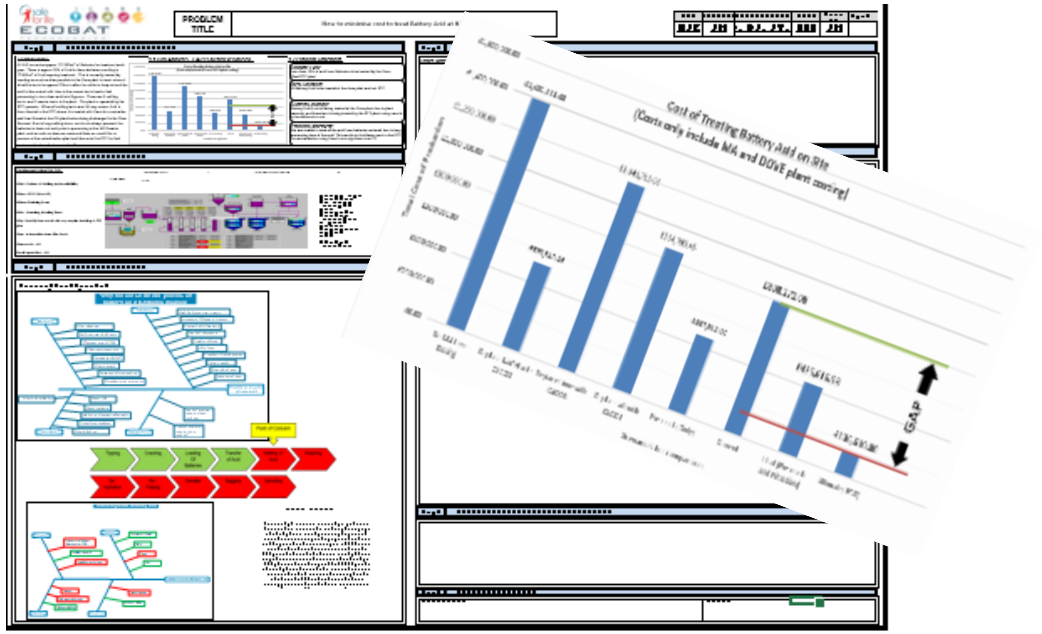
What have we learnt?

- There are many opportunities for improvement
- Area’s of focus would only give small gain

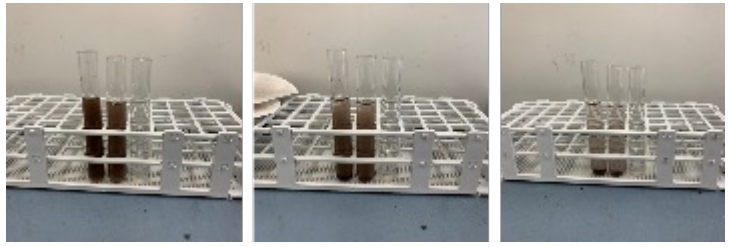
Ecobat Resources UK – Phase 3

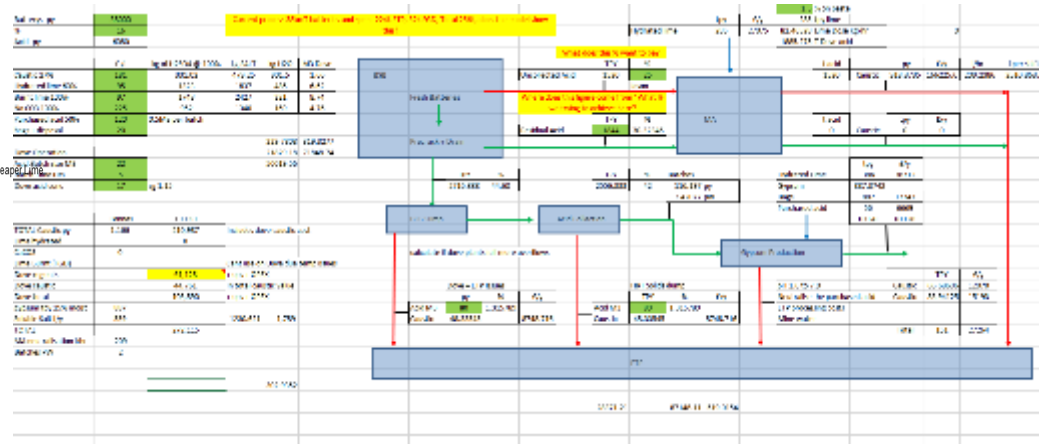
Identify projects:

- Caustic Treatment cost and environmental impact
- Inconsistent Rotary Tapping and VOC emissions
- A3 document produced
- Model scenario created in Excel
- Validate Data
- Identify opportunity
- Solution to opportunity
- CAPEX proposal submitted



	Caustic	Caustic	Dove Acid	Dove reagents	CaCO3	TOTAL	Gypsum	Salt	Batches	MA caustic	Residual	Uncollected	
	t/yr	£	M3/y	£		£	t/y	t/y	pw	l/hr	M3/y	M3/y	
No MA Lime Dosing	6771	1225604	7299	174538	0	1401351	2534	3245	7	1375	5531	4460	
Replace NaOH with CaCO3	762	137992	7299	174538	210819	523349	2534	1621	7	0	5531	4460	Benefit drops when pre cracking
Replace Lime with CaCO3	3457	625733	7299	174538	341444	1141715	2534	3214	7	614	5531	4460	
Replace all with CaCO3	762	137992	7299	174538	552263	864793	2534	3178	7	0	5531	0	
Pre crack (Only)	1025	185559	11809	282383	0	467942	4082	478	11	0	5531	0	
Current	3457	625733	7299	174538	0	800271	2534	1657	7	614	5531	4460	
Ideal (Pre crack and Filtration)	725	131277	12309	294340	0	425617	4273	347	12	0	5531	0	filter sludge back to BSB
Ultimate (FGD)	0	0	12309	136610	0	136610	3670	0	0	0	5531	0	gypsum moisture 10% not 2% cheaper Lime

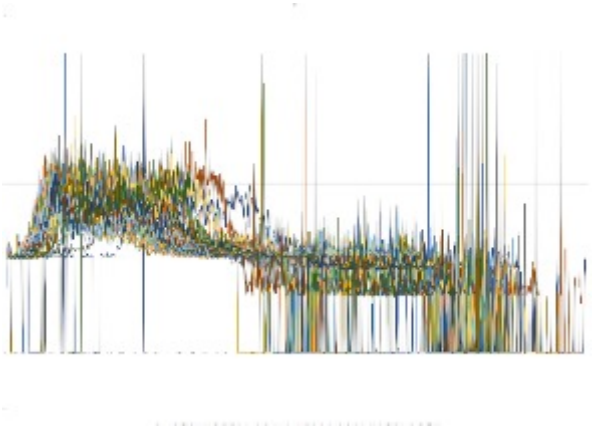




Ecobat Resources UK – Phase 3

- Reverb improvement focus for many years
- Best Practice exercise for Rotary Sinter smelting
- Idea for improvement was seen by site visit to BSB and Paderno (Italian site)
- Similar technique HJE uses on Reverb furnace
- Benefits – Improved Cycle times, Cost reduction, Std approach to smelting operation across all shifts
- Data collected and Trials to be planned – June/July
- Data below is analysis of % Drive load on Rotary furnace

Initial Raw data

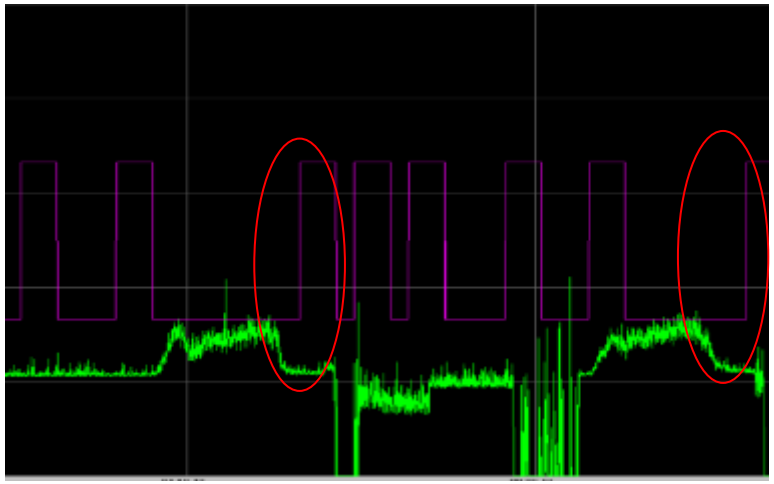


Simplified data

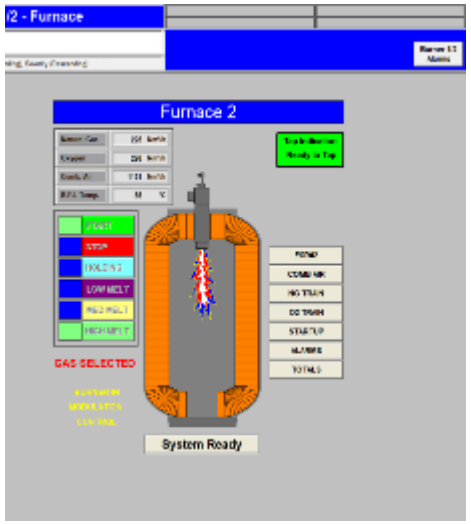
Summary Data

Ecobat Resources UK – Phase 3

- Review trends for analysis – Snap shot below but only sample data - Completed
- Set up trending for drive data and create SQL database so report can be generated - Completed
- Identify best trends – Data review – Under review
- Plan trials to replicate “best trend”
- Validate best practice
- Create visual management system – Part completed – see picture below
- Review tapping furnace (trial drill used at Paderno, use of screens potentially) –Mounting of Drill to be completed with Maint support and is required before further trials can progress.
- Review Burner firing rates and lambda settings and charging method to minimise Met Coke cost
- Create Job Instruction (New SOP)
- Validate Job instruction
- Issue Job Instruction



- Trend to the left shows when light come on (purple line goes up – Tapping light lit)
- You can see its 15 mins after curve levels out
- Some shifts still not working to this light due to it being unreliable atm
- Link the VOC trials to this also



Ecobat Resources UK – Phase 3

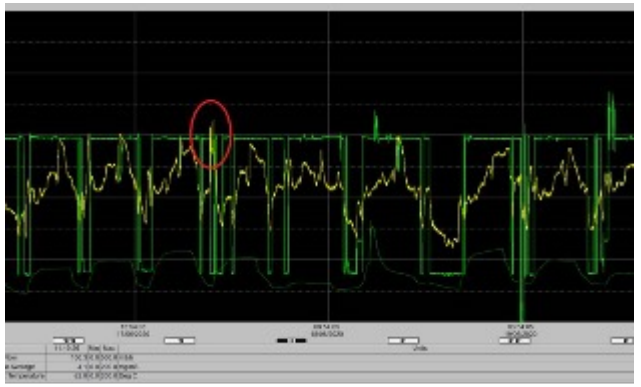
Why?

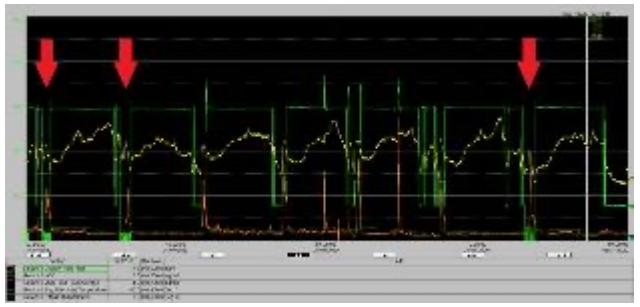
- Changes to environmental regulations in July 2020 reducing VOC Limit
- Solution - Thermal Oxidation burners
- CAPEX Cost to High – Not an option
- Increased Operation cost use of Met Coke, x4 Vs Pet Coke

Challenge: - Could we make this work with Pet Coke
Base Line monitored – Current Situation
Out of Consent with Permit (BREATH)

How?
Various trials done with different Scenarios create including break downs

Results?
Charging sequence changed
Burner (Oxygen rate) reduces when Charging
Inline Analyser used to trend information
4 Hrs av trend added to identify if Nonconforming emissions
Trialling on all recipes to confirm results
Excepted saving of £420k pa





Ecobat Resources UK – Phase 3

Summary of Phase 3:

What did we do and how?

- Identify 2 projects that covered the brief and improved the business
- Understand and write 1st part of A3
- Collect Data and map out onto A3 with use of Ishikawa diagrams, flow diagrams using multi-disciplined team
- Understand “Prize” (its not always £££)
- Carry out

Results?

- CAPEX submitted for Filtration of Battery Acid prior to Dove plant treatment. £125k saving
- VOC and Rotary Tapping - £300k+ (unconfirmed due to lining costs etc and WIP)

Challenges and Barriers?

- Sorting through lots of data and understanding process
- Set realistic target including agreeing CAPEX submission
- CAPEX approval – Still awaiting

What have we learnt?

Lots of work, but rewards can be big or small

Reward is not always money – Environmental & Safety improvements can be additional benefit

Ecobat Resources UK – Lean & Green Journey Continues

- Ecobat has continued it's Lean & Green journey, post training with great success.
- Rising Energy prices has accelerated a lot of projects in the pipeline
- Simple VM can also have a positive impact: - See below the launch of the Perfect Day in Jan 2023

Launch of the "Perfect Day"

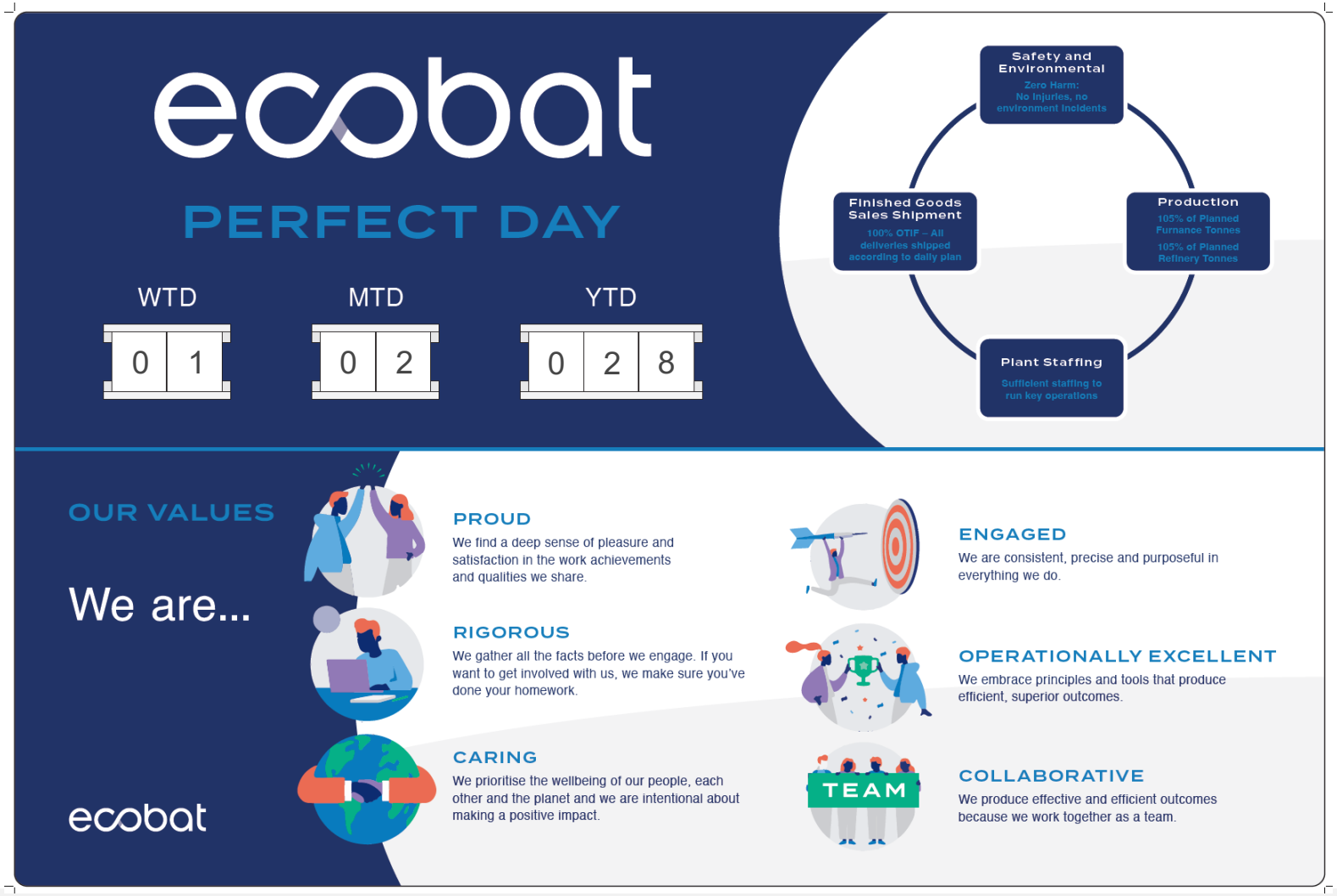
I am pleased to announce the launch of a simple metric called the "Perfect Day", which is the vision of our CEO - Marcus Randolph. This initiative has been trialled since the end of January and will be launching very soon.

It's has been generated with simplicity in mind to define what is a good day at Ecobat. The "Perfect Day" is being rolled out across the entire Ecobat Resource family with all metrics being measured at each facility the same. It does not replace any of our existing KPI's that we measure as a business, and use to track and improve our performance, but more to simply define a good day.

The "Perfect Day" is defined in 4 categories:

1. Safety and Environmental: 'Zero harm' to people and environment.
2. Production: Exceed furnace / refinery plan by 5%
3. Plant staffing: Sufficient staff to run key operations.
4. Finished goods sales shipment: 100% deliveries shipped on time, in full (OTIF

Ecobat Resources UK – Perfect Day VM Board



YTD Summary of reasons for not achieving:

- 3 x OTIF
- 6 x Staffing
- 19 x Production – split between Reverb and Casting

The Plan

Ecobat resources Lean and Green CI leader development programme –

The first step was training the EU Leadership team and Site leaders teams

- Risk of a “middle management gap” if leadership is not trained in lean and lean leadership
- EU team – be-spoke session designed for senior leaders in their role as Lean leaders
  - To align Lean with strategic objectives
  - To see where Lean can help the business
- Site leadership teams trained during the site support visits
  - Lean tools and techniques
  - Leadership skills (Gemba walks, Leaders standard work, VSM, coaching)

The right delegate selection is key to success

- These delegates are the seeds for the next generation of leaders
- Supported by their line manager and site director to attend

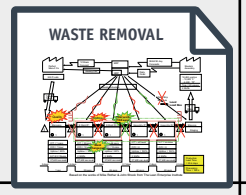
- An employee who has high potential for career growth in future leadership roles.
- Can read, write and speak English.
- Enthusiastic in learning and implementing Continuous Improvement.
- Works well within team environments and a committed team player.
- Has good communication skills with the ability to communicate with people (individuals or groups) at all levels of the business.
- A track record of achieving objectives through high involvement of others.
- A confident person who is not afraid to challenge the current ways of working.
- A 'completer/finisher', ensuring improvement actions are driven to closure.
- A person that can motivate and inspire others.
- Has a business awareness to assure that improvement action has a positive impact on operating results.

Competency validation through Lean Competency System - 2A

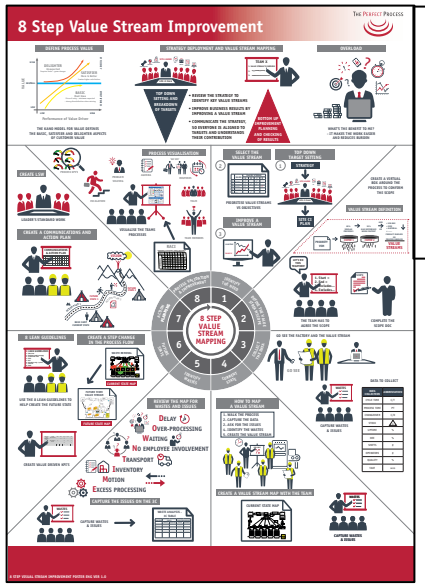
- LCS accreditation for the training
- External validation of the materials, content and trainer
- Aligned to Ecobat manufacturing process
- Requires successful practical implementation and pass of the test
- Externally recognized certificate awarded at the end following validation and test results

https://www.leancompetency.org

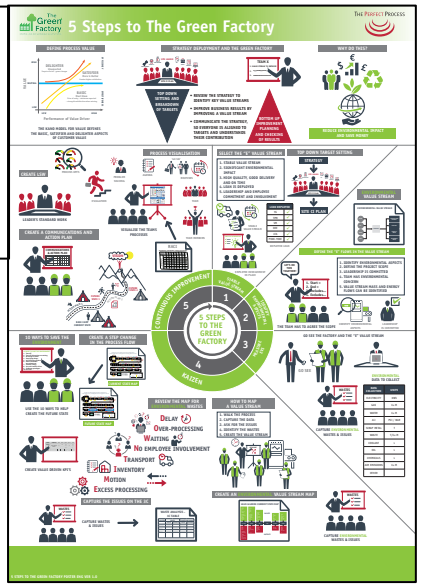
The content built up from level 1 team flow to level 2 VSM flow and added Green to provide the environmental extension

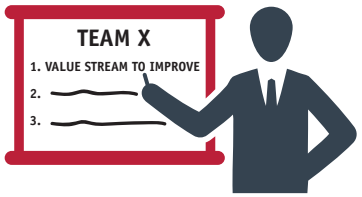
	Phase 1 Level 1 flow	Phase 2 Level 2 flow	Phase 3 Green flow
Planning	Delegate selection Site selection Site 5S selection Site team selection Job instruction selection	Site selection VSM selection Problem selection	Site selection Lean and green selection
Delegate Preparation	Pre-work Project identification	Implementation completion Project identification	Implementation completion Project identification
Content	Site tour Pre-work check Lean introduction Strategy and CI planning Visual management Daily meetings 5S, Standard work Facilitation skills 	Implementation validation Site tour Value stream mapping Practical Problem solving 	Implementation validation Site tour Lean and green Leadership standard work Lean leadership skills Strategy and CI planning Core skills 
Implement	CI plan, 5S, Daily meetings, visual management, standard work	Value stream mapping Problem solving	Lean and green Leadership skills, CI plan

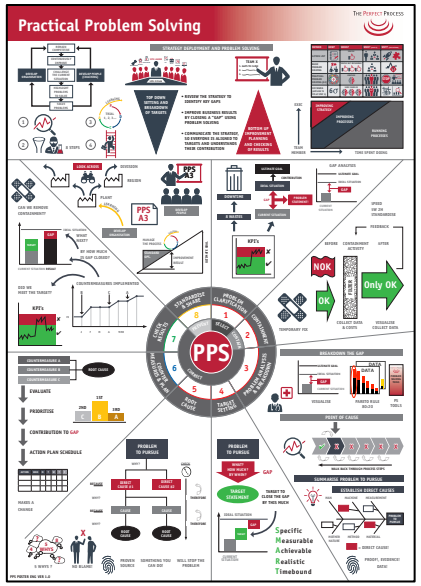
The programme used a mixture of coaching, teaching, practical case studies, go-see and home site implementation to develop capability

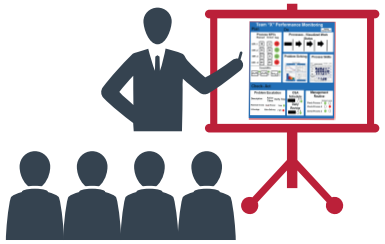


Several Different learning styles will be used throughout the programme









What happened?

Lean and Green CI leader programme

- Tough programme with travel, learning and implementation pressure
- We needed an extra week to consolidate the learning and fit everything in
- Great camaraderie and learning from each other as the learning style of travelling on site training was a first for Ecobat
- Learnt as much from each other as the training!

Practised the tools as part of the programme

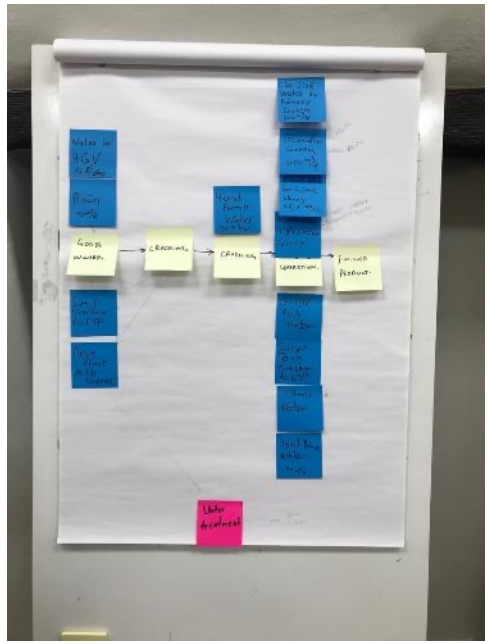
Leadership training aligned with the lean and green programme

- Delivering this in advance prepared the leaders for this change
- Allowed them to develop their role as local coaches
- Set the direction for the business

On site training provided “live” experience in a safe environment

Value Stream Mapping

5S workshop in the magazine



“E” Flow analysis

People

- 12 managers started
- 11 Finished the programme
- 10 Qualified to LCS level 2A
- 5 got promoted
- 3 left the business (promoted)

What did you learn?

The lessons from the training……

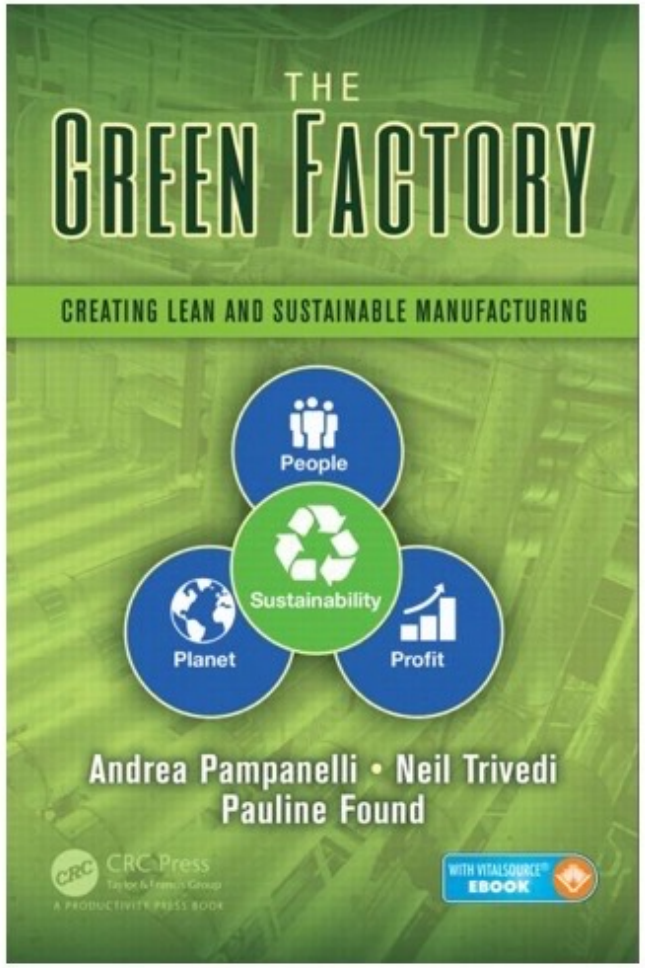
- LCS provided a strong lever for completing and finishing
- Leadership training and support ….
- Developed a lot of the team as well as learning Lean and Green

Summary – Neil T

- Use every lever in the book to get success:
  - Senior leadership buy-in
  - European and site leadership training
  - Escalation route direct to plant directors and MD – A3 reporting
  - LCS qualification – programme, validation of results and tests
  - Burning platforms of performance drove implementation
- Now is the time to expand Lean into Green
  - COP 26
  - Energy cost increase
- Or has the dial changed? Green to Lean
  - Use employee engagement to drive green improvement
  - Piggy back Lean onto the Green conscience and energy cost increase

What are you challenges in implementing Lean and Green?

The Green Factory – The Story of our journey



Available for sale today @£30 (Amazon price £40)

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W: Book page: http://www.theperfectprocess.co.uk/the-green-factory-creating-lean-and-sustainable-manufacturing/