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# ROYCE Mining Telemetry

"All the Data, All the time"

# Pempek Telemetry Systems installed for more than 10 years on multiple sites globally!

The ROYCE system is installed and functioning on notable sites such as Kriel Colliery, Kestrel Coal Mine, Matla Coal and many others.

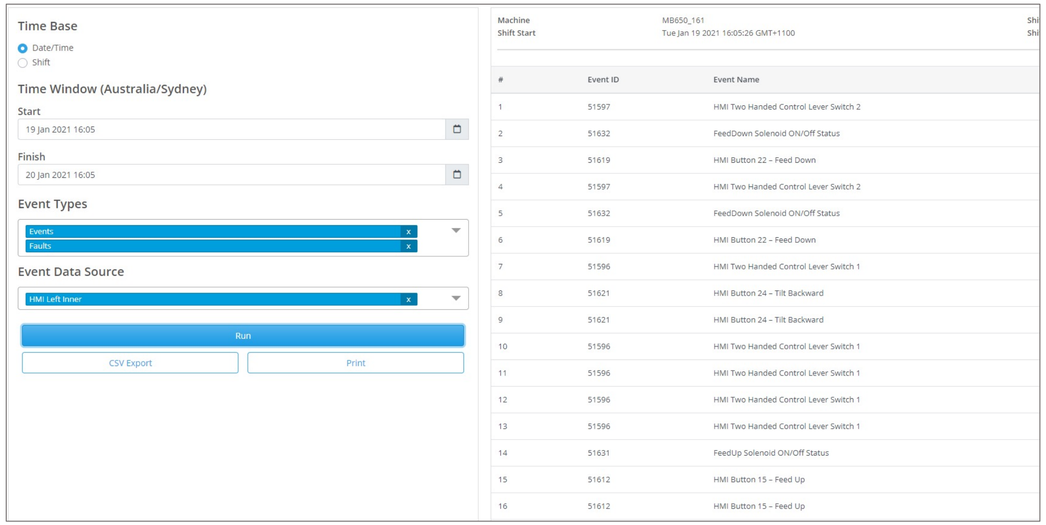
ROYCE is the current development of the proven Elliot reporting system, which has been a functioning and stable system for over ten years.  The ROYCE system integrates the consistency and functions of the legacy Elliot system, while bringing forward the addition of new exciting technologies and developments to the fingertips of the user.

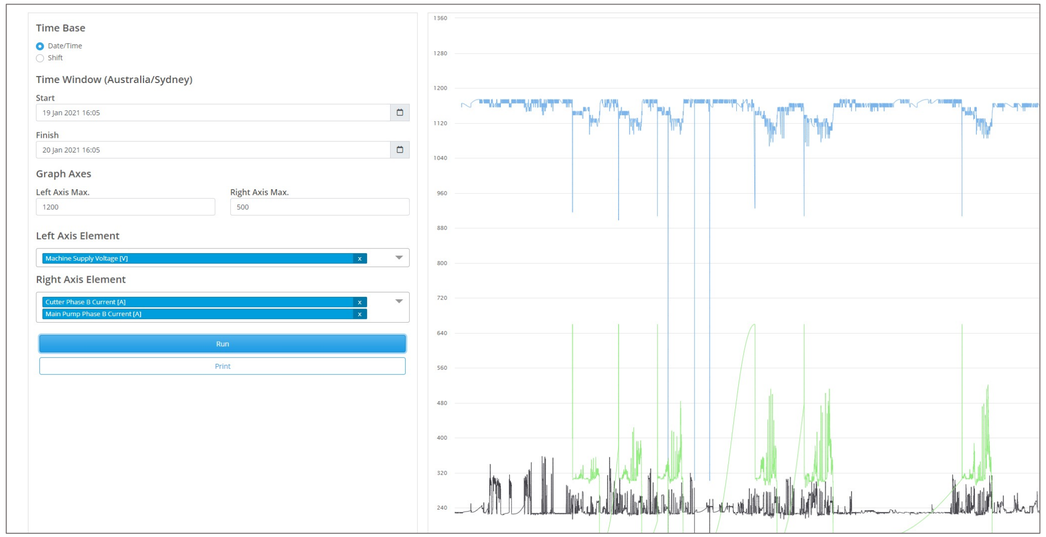
KESTREL COAL RESOURCES

exxaro POWERING POSSIBILITY

# ROYCE Feature Summary

- Live Dashboard
- Historical Database
- Multitude of reports
- User Configured report generator & data trending
- Mine specific KPI’s and feedback
- Fault reporting and troubleshooting functionality
- Data Export functionality
- Automated email service
- User permission control
- Device and Machine connectivity diagnostics
- Site Status feedback
- Data Buffering and Recovery from machine
- Section Overview display.



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# Live, reliable, future proofed, user driven reporting, available anywhere.

Mining Telemetry

- **Collects live data** from a range of machines (CM, BM, SC, Bolters, Conveyrs)
- **Presents the data live across a range of devices in a range of formats**
- Protects from network dropouts, no loss of data!
- A VAST RANGE of standard and user driven report generators
- Visually clear and intuitive, with simple navigation and control mechanics
- Web browser interface to support PC, Laptop, Tablet, Smartphone
- Permission levels to present appropriate range of data with query tools
- Future proofed to support future changes in hardware & operating systems.
- **IS optimised for existing Pempek Ecosystem & Nautitech modems.**



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# Live Telemetry

8




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# Live Telemetry




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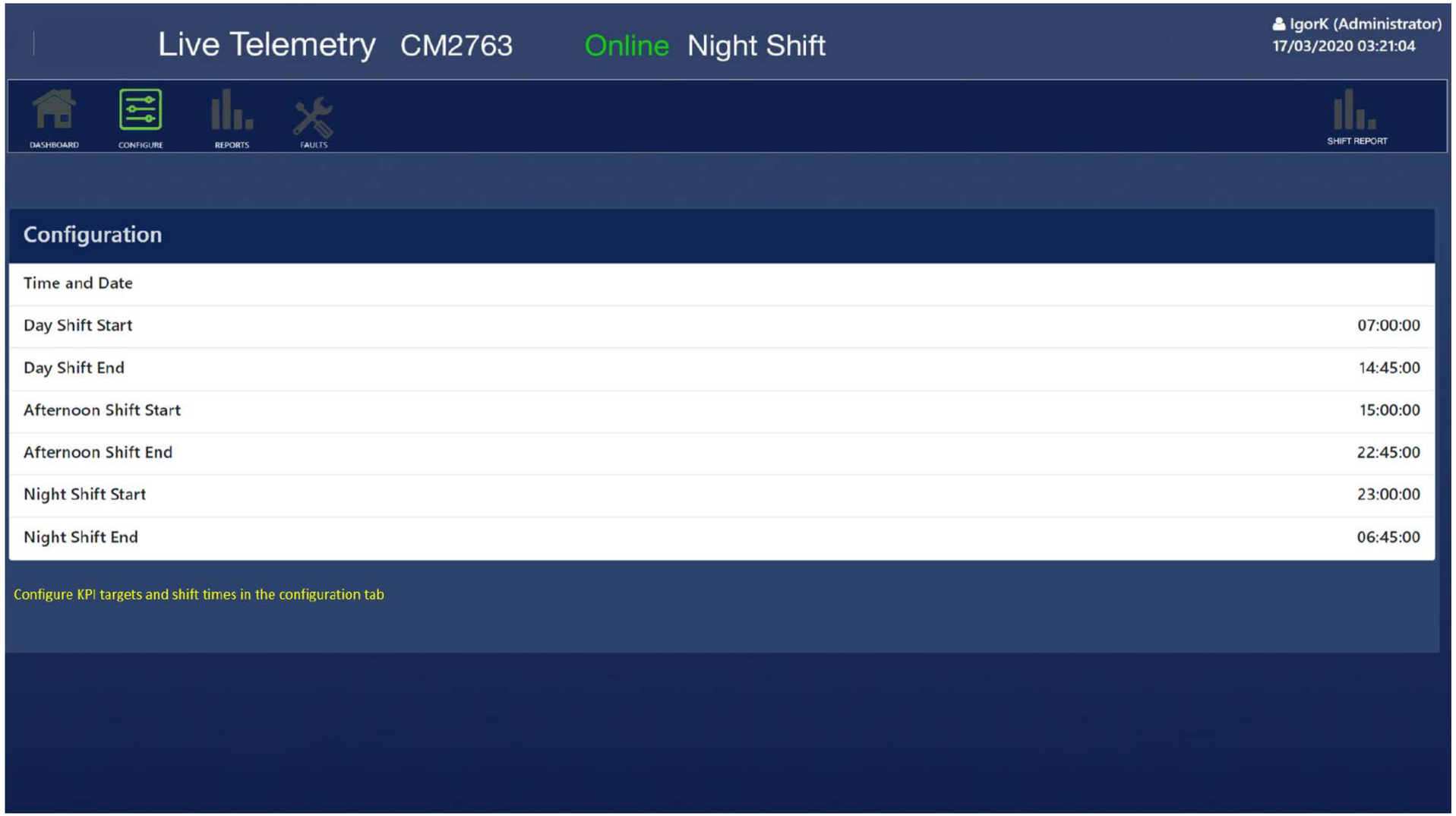
# Live Telemetry



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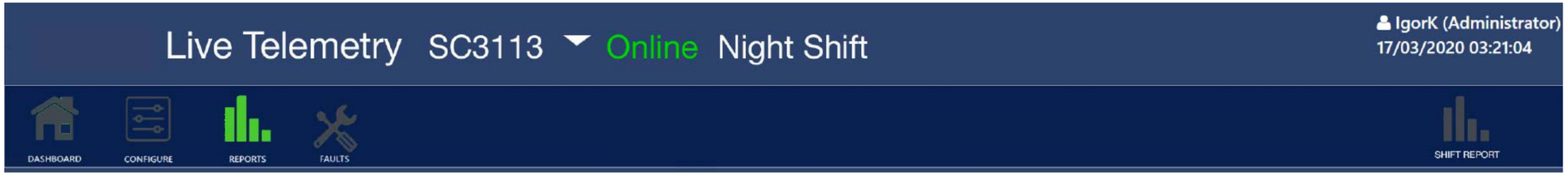
# Live Telemetry




## Provides a vast range of in-depth configurable reports

ROYCE Provide a vast range of configurable reports.

The generation of high-quality production reports make it easy to estimate a shift outputs, makeshift comparisons and improve business process. Set your commission goals and validate their completion using these reports.

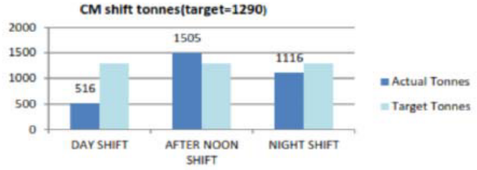
- Provides intuitive platform which users can configure including:
- Troubleshoot issues with a machine fault report
- Generate custom graphs based on selected data
- Generate historic production graphs based on the period of your choosing,
- Query all events that occurred in a machine over a specific period,
- And a number of other useful applications.

Mine:
Section: 18

Machine ID: 25
Machine no: CM004

| | Ave Estimate meters per shift | Ave Estimate tonnes per shift | Ave Cutting time per shift | Ave Cutting tempo per shift | Ave Production tempo per shift | Ave late 1st Coal | Ave early last Coal | Ave late machine powered | Ave early machine shutdown |
|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | 25.92 | 1116 | 136 | 8.2tpm | 4.26tpm | 00:04:50 | 0:00:36 | 00:06:29 | 0:00:00 |
| TARGET | 30 | 1290 | 144 | 9.00 | 6.00 | 00:00:00 | 0:00:00 | 00:00:00 | 0:00:00 |

| | Ave SC Loads per shift | Ave SC away time per shift | Ave SC load time per shift | Ave system Availability per shift | Ave system Utilisation per shift | Total daily tonnes |
|---|---|---|---|---|---|---|
| ACTUAL | 72 | 88sec | 129sec | ? | ? | 3137 |
| TARGET | 83 | 90sec | 80sec | ? | ? | 3870 |




| | Fault | Duration | Count |
|---|---|---|---|
| 1 | Traction Cont supply below limit | 100milliseconds | 2 |
| 2 | Machine powered up | 15seconds | 1 |
| 3 | Left Drive: Mains supply under voltage | 12seconds, 100milliseconds | 6 |
| 4 | Left Drive: Lost phase lock on mains supply | 2seconds, 200milliseconds | 5 |
| 5 | Right Drive: Mains supply under voltage | 100milliseconds | 2 |
| 6 | Right Drive: Lost phase lock on mains supply | 250milliseconds | 5 |
| | Total | 29seconds, 750milliseconds | 21 |



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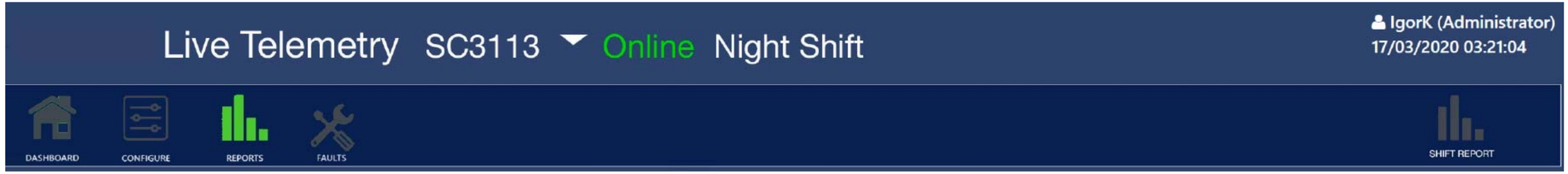
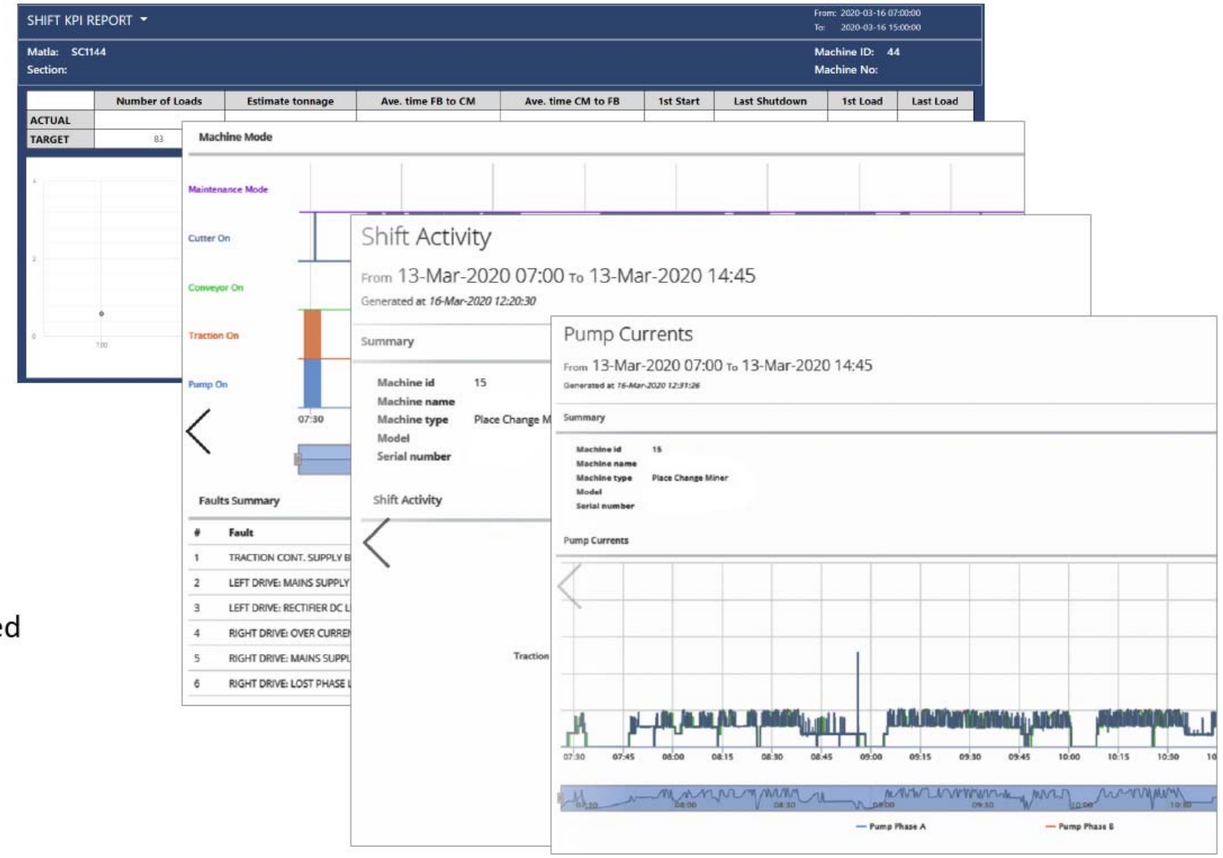
# Live Telemetry




## A VAST range of preconfigured reports

- Activity - Shows machine activity
- Production - Shows estimated coal output and info
- Event - Highlights notable machine events
- Fault - Details on last 20 active faults
- Cycle Time - Graphical break down of cutting cycle
- User Configured - User selects elements to be graphed
- Custom - Custom report request to be added to app



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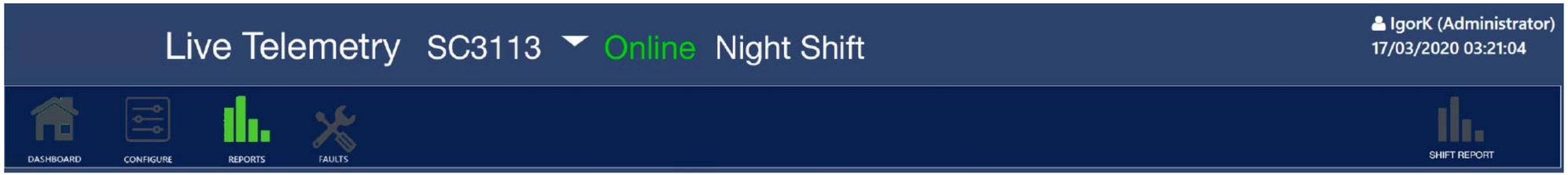
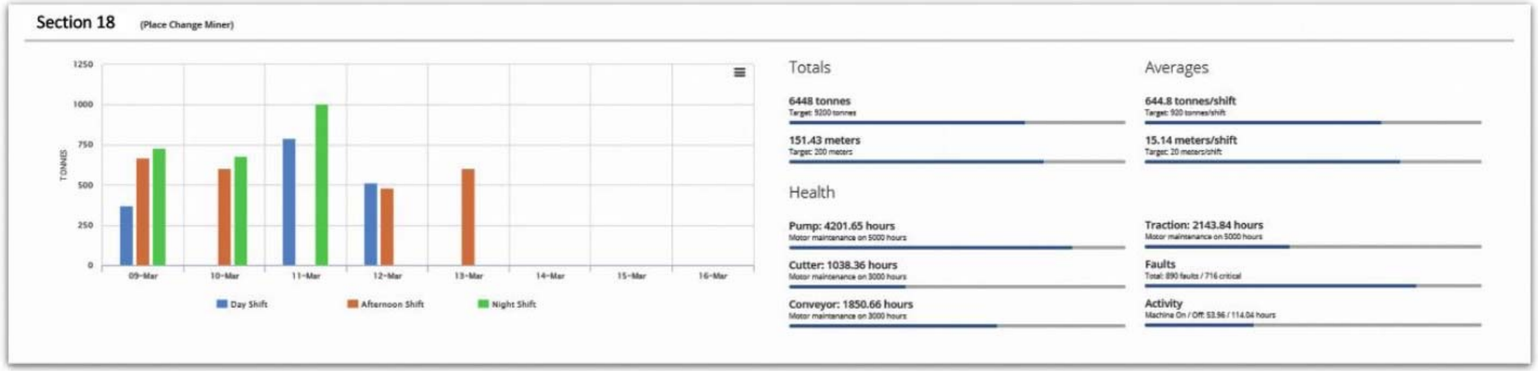
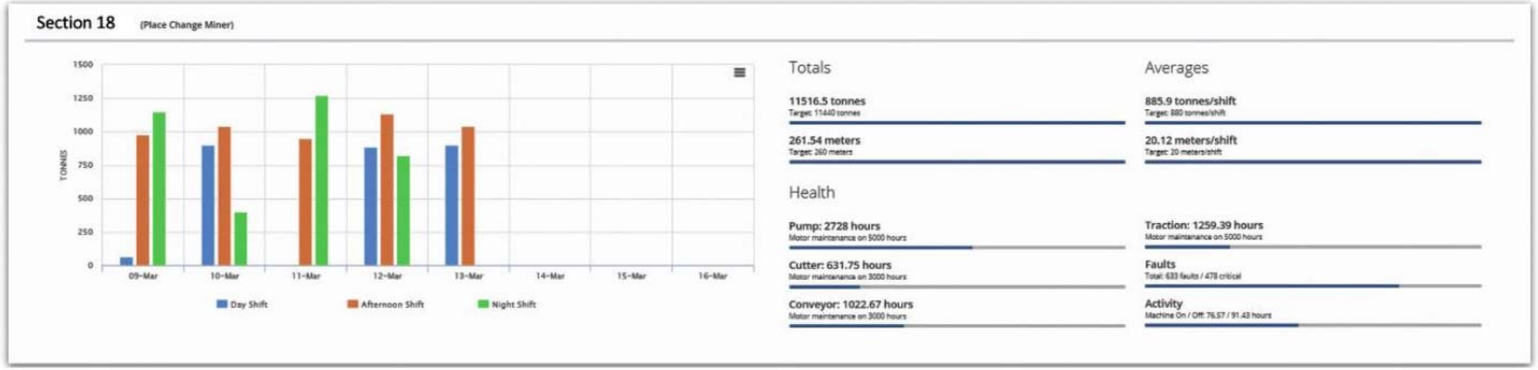
# Highly detailed graphical outputs

# Compare prior periods



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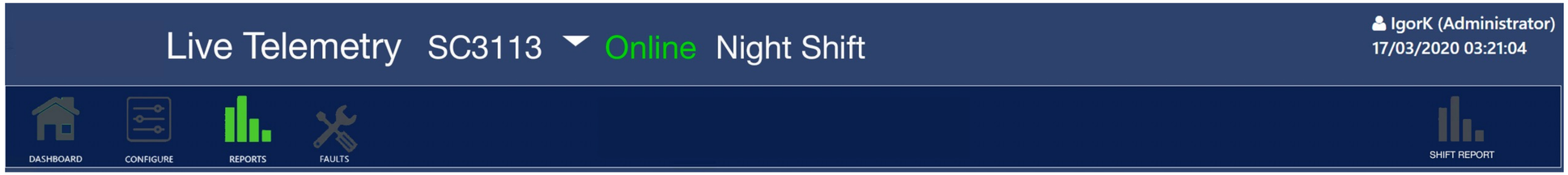
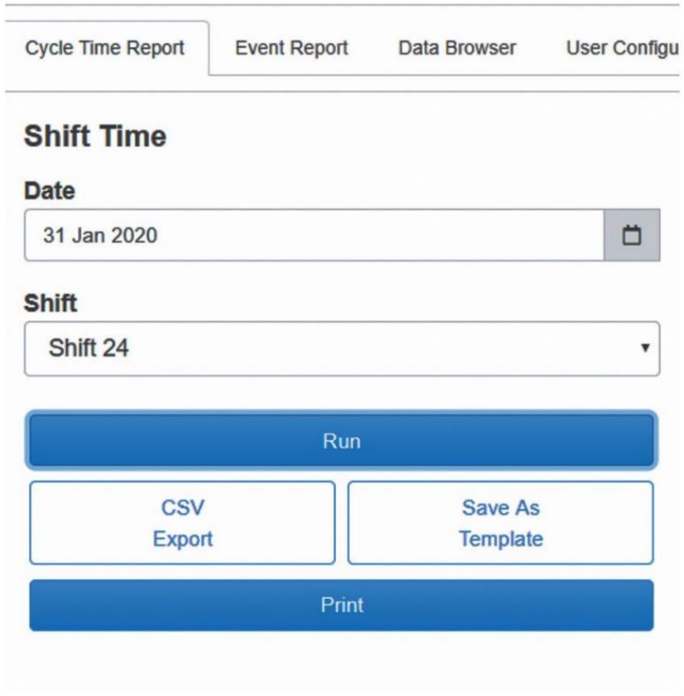
# User analytics process example




Use Cycle Time report to query desired period of operation


**Zoom functionality**

Zoom into area of concern on the graph within your queried period



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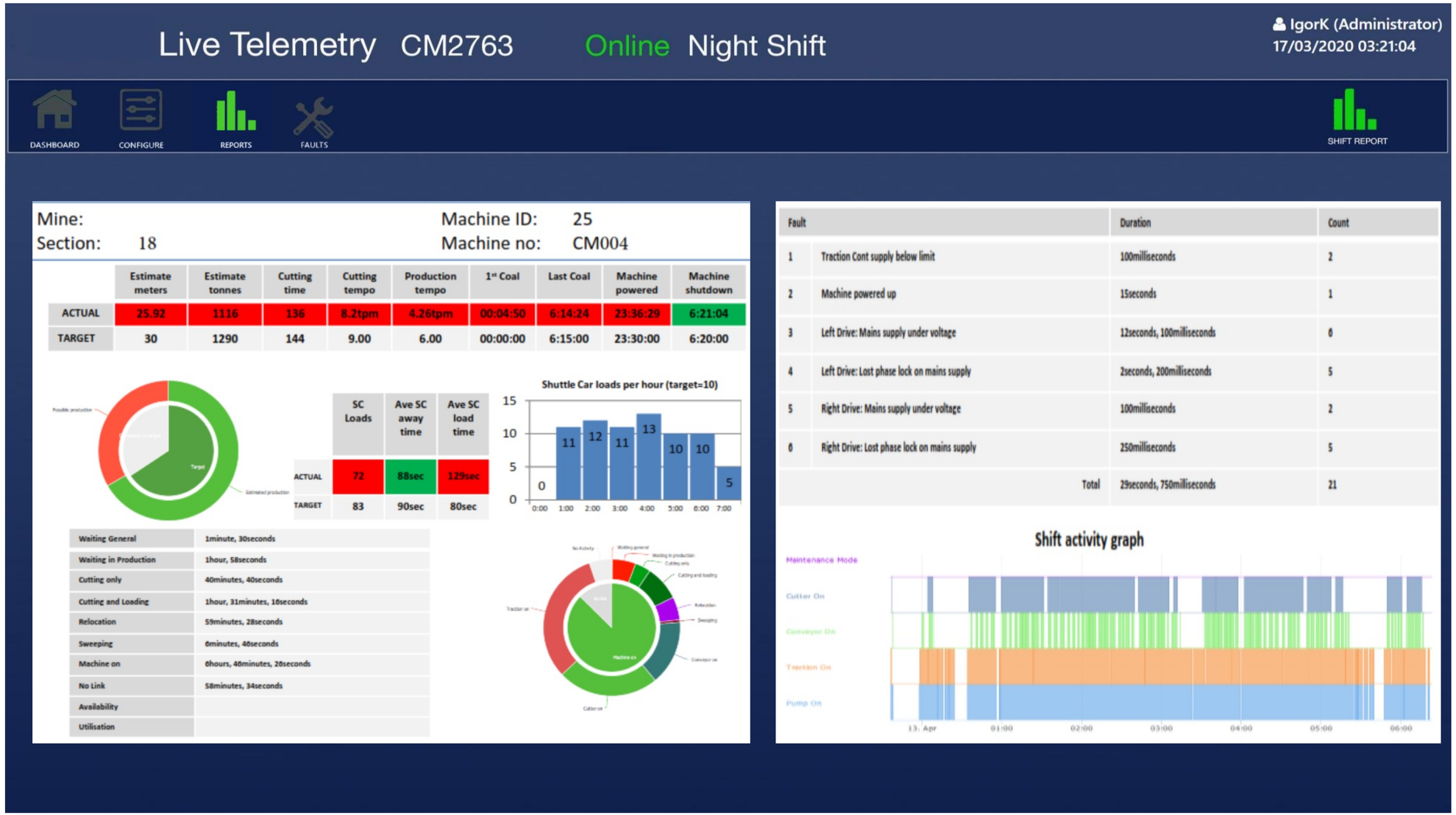
# A typical shift summary that can be reconfigured by the user with different reports for different user types




| | Estimate meters | Estimate tonnes | Cutting time | Cutting tempo | Production tempo | 1st Coal | Last Coal | Machine powered | Machine shutdown |
|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | 25.92 | 1116 | 136 | 8.2tpm | 4.26tpm | 00:04:50 | 6:14:24 | 23:36:29 | 6:21:04 |
| TARGET | 30 | 1290 | 144 | 9.00 | 6.00 | 00:00:00 | 6:15:00 | 23:30:00 | 6:20:00 |

| | SC Loads | Ave SC away time | Ave SC load time |
|---|---|---|---|
| ACTUAL | 72 | 88sec | 129sec |
| TARGET | 83 | 90sec | 80sec |

| | |
|---|---|
| Waiting General | 1minute, 30seconds |
| Waiting in Production | 1hour, 58seconds |
| Cutting only | 40minutes, 40seconds |
| Cutting and Loading | 1hour, 31minutes, 16seconds |
| Relocation | 59minutes, 28seconds |
| Sweeping | 6minutes, 46seconds |
| Machine on | 6hours, 40minutes, 26seconds |
| No Link | 58minutes, 34seconds |
| Availability | |
| Utilisation | |

| Fault | | Duration | Count |
|---|---|---|---|
| 1 | Traction Cont supply below limit | 100milliseconds | 2 |
| 2 | Machine powered up | 15seconds | 1 |
| 3 | Left Drive: Mains supply under voltage | 12seconds, 100milliseconds | 6 |
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| 6 | Right Drive: Lost phase lock on mains supply | 250milliseconds | 5 |
| | Total | 29seconds, 750milliseconds | 21 |



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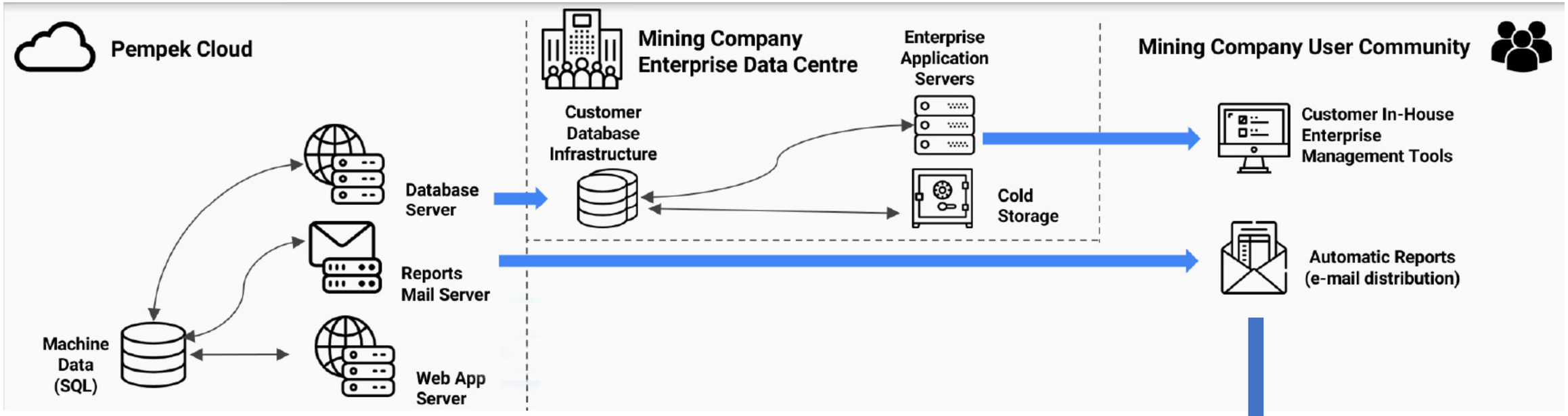
# Live data displayed on any device!

## Mining Telemetry




**SEE YOUR LIVE DATE AND REPORTS ON ANY OF THESE DEVICES**





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# An abundance of additional features

Mining Telemetry

- CSV and JASON data export: for movement into excel tables or other desired use case
- User Account Control: designate who gets access to Application, and what level of control they have
- SMTP report email service: have reports automatically emailed out to a desired recipient list
- Can be accessed on phone or tablet!
- Azure development platform: providing a robust backbone for the system
- Draws data from installed Telemetry Database, which is capable of syncing with both OPC and ODBC

# Data browser

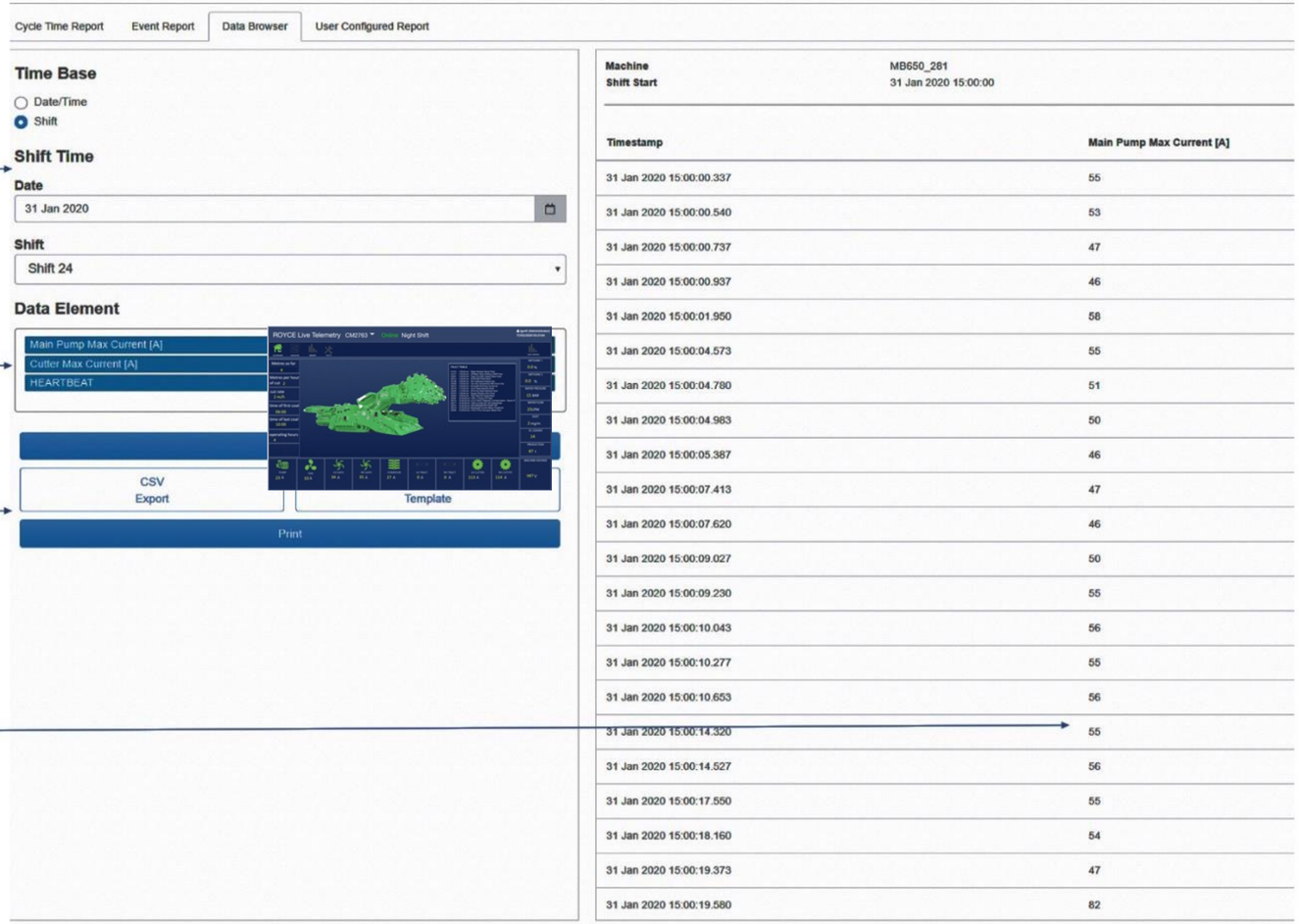
## Mining Telemetry

Select desired period

Select what data you wish to query

Customize your output

View raw data values




- Data Browser application, allows the user to query any machine data, at any period of time.
- Exceptionally useful tool when fault finding, troubleshooting and analysing operation process.



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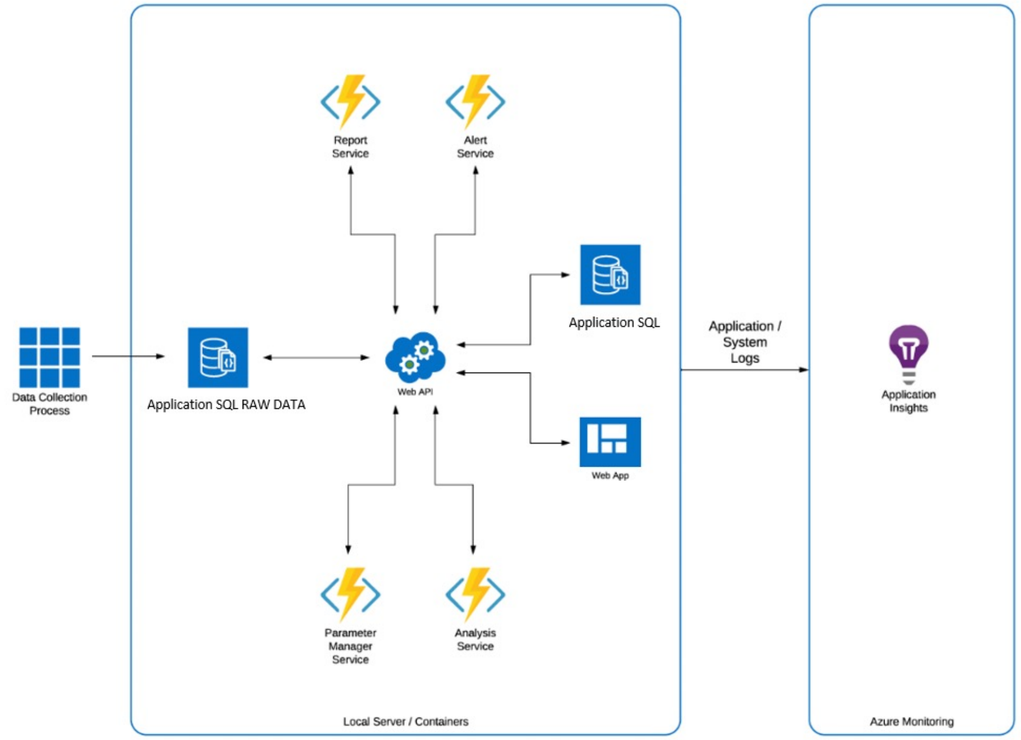
# Machine to surface, functional overview

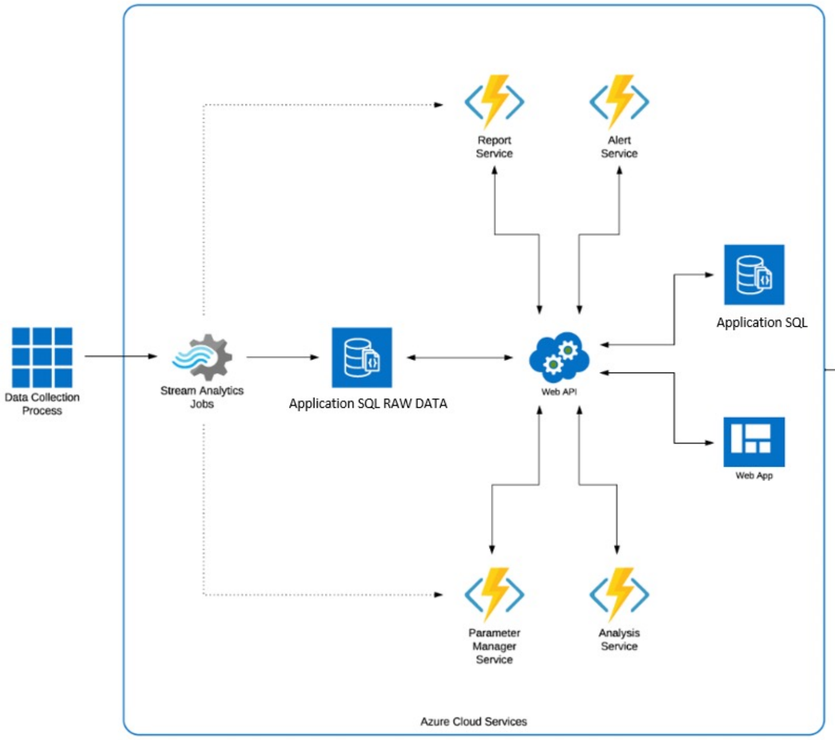
Mining Telemetry

## Data Analysis / Visualization




Application / System Logs




Application / System Logs

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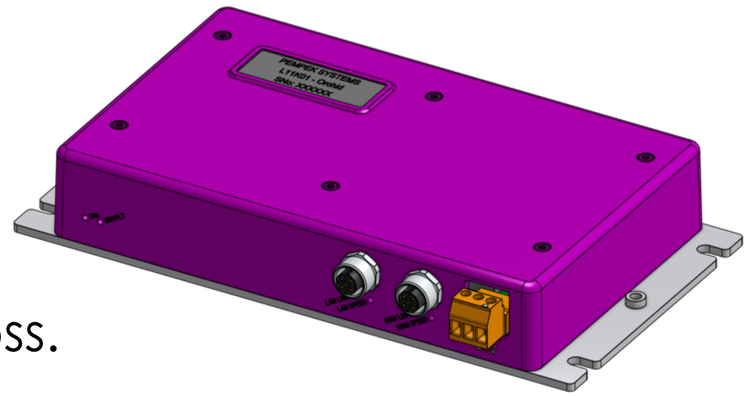
# Pempek's Intelligent collector protects against data loss!

Mining Telemetry

**NO CONNECTION? – NO PROBLEM WITH PEMPEK ORCHID UNIT**



- Provides a point of collection from a number of sources.
- Has on board, data buffer. Data disconnection? No data lost!
- Data connection can be down for up to five days without data loss.
- Once reconnected, collector will feed stored and live data simultaneously.

- Has EIP functionality setup.
- Has Diagnostic tool, which is useful to validate system setup and health.

# Nautitech, how we choose to get information from A to B

Mining Telemetry

**Data Movement:**

- For establishing a link between machine and server, we have opted to utilize Nautitech, with whom we are having great success with in ongoing projects

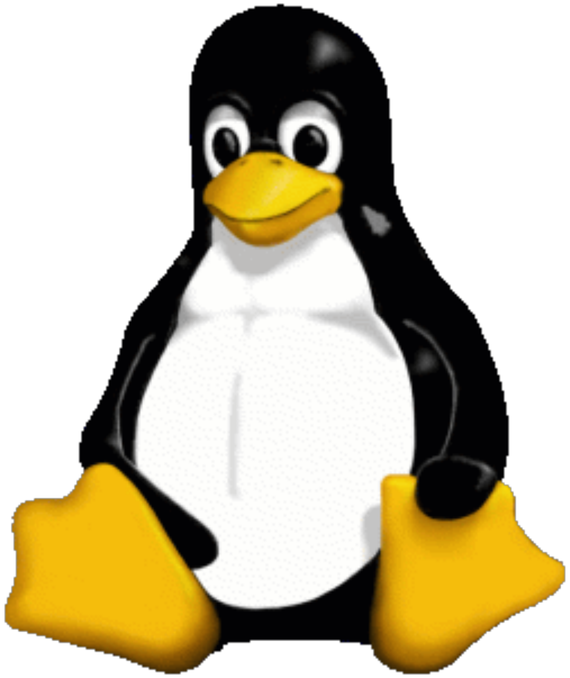
- Nautitech Power line solution, the Spitfire, is our top option. It is hardy, needed for a mining environment, and requires little additional infrastructure to implement.

- They also offer wireless solutions, which require more setup, but is certainly an exciting option, looking into the future.

- Finally they too have a Fibre solution, which provides the fastest link, but only works as a solution if it can maintain structural integrity in the target use case environment.

# Future proofed with .Net

## Mining Telemetry



Microsoft .NET

ROYCE works on any Operating System Platform



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# WRAP

## Mining Telemetry

**ALL the data All the time**

- Live collection
- Live capture
- Live storage
- Live display
- Live reporting

- Standard or user generated reporting
- User query function
- Any Operation System
- Local or Cloud data base
- Future proofed

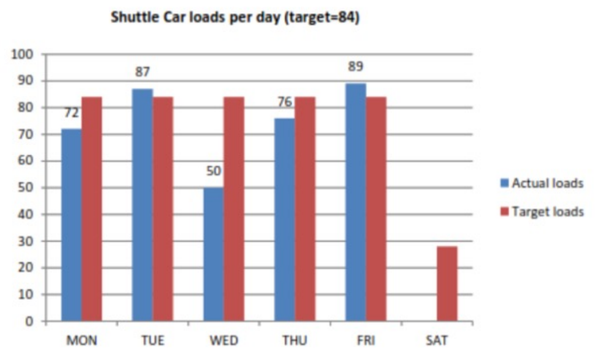
**An annual subscription service to keep the platform in the forefront of telemetry practise in mining!**

### SC WEEK TO DATE KPI REPORT

14/04/2019 23:00 to 19/04/2019 21:45

Mine:
Section: 18
Machine ID: 40
Machine no: SC3272

| | Ave. No of loads per shift | Ave. est. tonnes per shift | Ave. travel FB to CM per shift | Ave. travel CM to FB | Ave. late 1st start up | Ave. early last shutdown | Ave. late 1st load | Ave. early last load | Total weekly tonnes |
|---|---|---|---|---|---|---|---|---|---|
| ACTUAL | | | | | | | | | |
| TARGET | | | | | | | | | |




| Fault | | Duration | Count |
|---|---|---|---|
| 1 | Traction Cont supply below limit | 100milliseconds | 2 |
| 2 | Machine powered up | 15seconds | 1 |
| 3 | Left Drive: Mains supply under voltage | 12seconds, 100milliseconds | 6 |
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| 6 | Right Drive: Lost phase lock on mains supply | 250milliseconds | 5 |
| | Total | 29seconds, 750milliseconds | 21 |

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OTHER FEATURES

- FUNCTIONAL LAYOUT
- INFRASTRUCTURE
- FUTURE PROOFING

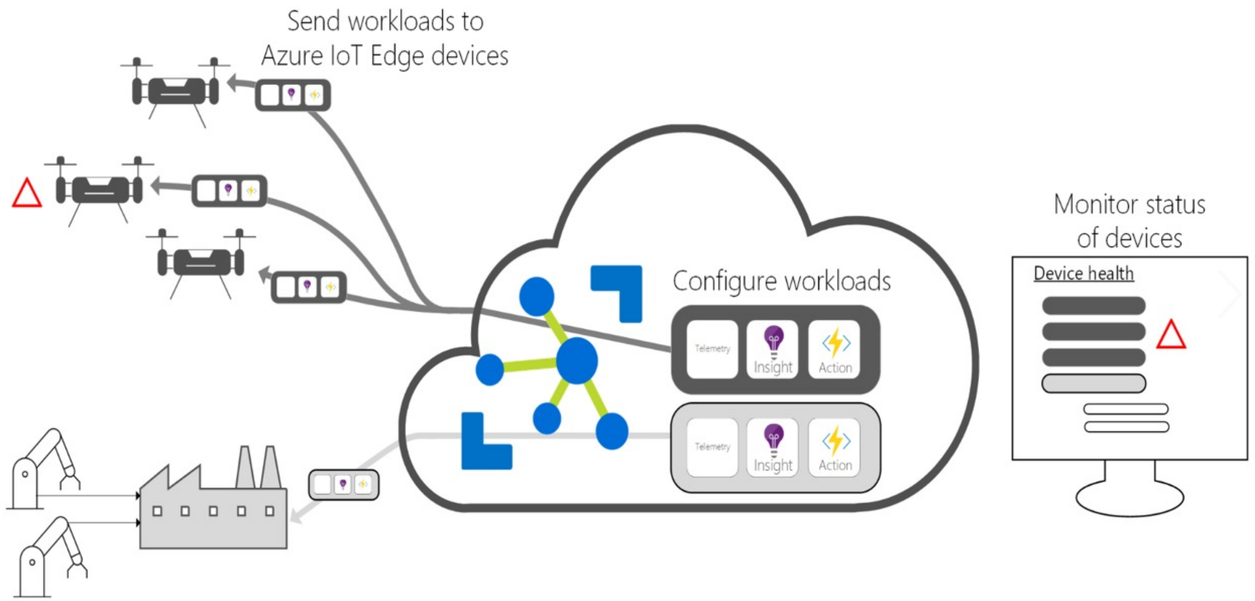
# Future proofed with Cloud data

## Mining Telemetry

The future of data storage, control and analytics, lies in cloud based systems.

We propose that the platform be redeveloped to support both local and cloud databases.

Taking this step now will prevent costly future redevelopment and bring a major and important upgrade path to your clients.



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# Live Telemetry CM2763 Online Night Shift

IgorK (Administrator)
17/03/2020 03:21:04

DASHBOARD | CONFIGURE | REPORTS | FAULTS | SHIFT REPORT

By clicking on the conveyor image (red coloring shows fault)


Current values of key conveyor tags are displayed

| DESCRIPTION | DATA VALUE |
|---|---|
| Conveyor Current | Value 1 |
| LH Conveyor Max Current [A] | Value 2 |
| RH Conveyor Max Current [A] | Value 3 |
| LH Conveyor Phase A Current | Value 4 |
| LH Conveyor Phase B Current | Value 5 |
| LH Conveyor Phase C Current | Value 6 |
| RH Conveyor Phase A Current | Value 7 |
| RH Conveyor Phase B Current | Value 8 |
| RH Conveyor Phase C Current | Value 9 |
| Conveyor Temperature | Value 10 |
| Conveyor FWD Auxiliary ON | Value 11 |
| Conveyor Motor Water Flow | Value 12 |

As well as the last 20 faults, with active faults shown in red

FAULT TABLE

| | | |
|---|---|---|
| 52673 | Active | 1016-2 No Conv Fwd Feedback |
| 51284 | Active | 1016-5 R Conveyor Overload |
| 51293 | Active | 1016-5 L Conveyor Overload |
| 51315 | 1:50:00 pm | Water Module Valve4 Fault |
| 51317 | 1:45:00 pm | HPWater When Drilling LOWP Fault |
| 53201 | 1:40:00 pm | Feed Line SOL Output Open Fault |
| 53212 | 1:35:00 pm | STOP BUTTON FAULT |
| 53199 | 1:30:00 pm | Not Calibrated Gripper Sol |
| 53209 | 1:25:00 pm | Tow Arm Overtension REV Force Trip |
| 53215 | 1:20:00 pm | PumpOff-Oil Pump Turned On |
| 53219 | 1:15:00 pm | Conv State Machine Fault |
| 53220 | 1:10:00 pm | Oil Pump State Machine Fault |
| 53274 | 1:05:00 pm | Supply Module LOLU Fault |
| 53287 | 1:00:00 pm | Tram Fast Sol OutputFault |
| 53297 | 12:55:00 pm | 1032-17 Sump TD Fault |
| 53210 | 12:50:00 pm | LH e7 FAULT Magnetic Contamination – Spool #1 |
| 53211 | 12:45:00 pm | 1030-3 Cutter Ext. Sol OutputFault |
| 53212 | 12:40:00 pm | HMI REQUESTED PUMP OFF |
| 53213 | 12:35:00 pm | ModeLight Current Below Threshold |
| 53205 | 12:30:00 pm | 1016-13 No Conveyor Water Flow |

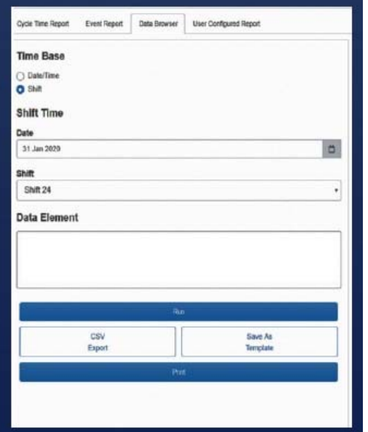
Selecting a fault or data element, will bring up an information tab, where previous notes concerning the faults or data can be viewed, and new information can be stored.

| ID | DESCRIPTION |
|---|---|
| 52673 | 1016-2 No Conv Fwd Feedback |

LESSON LEARNT

Check sensor is not loose

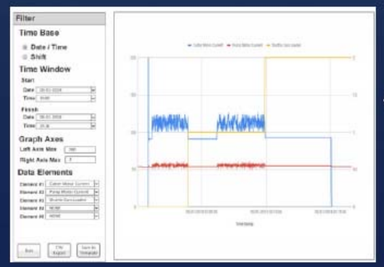
We can now select up to 5 data elements or faults




This is an example of how the ROYCE system can seamlessly navigate from general overview, into more detailed analytics and output.

| Timestamp | Main Pump Max Current [A] |
|---|---|
| 31 Jan 2020 15:00:00.337 | 55 |
| 31 Jan 2020 15:00:00.540 | 53 |
| 31 Jan 2020 15:00:00.737 | 47 |
| 31 Jan 2020 15:00:00.937 | 46 |
| 31 Jan 2020 15:00:01.950 | 58 |
| 31 Jan 2020 15:00:04.573 | 55 |

To generate a graphical output, or simply generate raw data report



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# Lessons learnt - guide future fault response!

Mining Telemetry

## Royce System "Lessons Learnt" Information Feedback

When querying a specific fault, a notes tab will come up displaying information previously stored on the fault.

The user can edit the notes on the fault that can be used to guide a response to a certain fault.

This may have helpful hints from people who previously troubleshot the issue and allows you to set a bread trail for people who query the fault after you in order to speedily resolve it!

**Event MSG Long Description (Customer Defined) :**

```
"The control system did not detect a 24VDC feedback from the
auxiliary contacts of the safety relay SR1.  Things to check:
- Relay is correctly installed and wiring is intact
- Check 24VDC power supply to relay coil is OK
- Check 24VDC power supply to aux contact is OK
- Check 24VDC input to module
- Replace Relay"
```

## Royce Cloud "Lessons Learnt"

As more sites come online with the ROYCE system, more information on particular faults can be collected. If permission is granted it, will allow sites to share fault information. Meaning technicians will avoid double work.

Eventually this will develop into a robust troubleshooting library, where any issue will have been seen before, and have some information on the issue stored.

This database will also serve as a means of evaluating machine function and highlight recurring issues, and areas for improvement.

# Mining Telemetry

"All the data, all the time"

Jason Koch – Telemetry Team Leader

sales@pempek.world



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