Designing a new OLE system optimised for high output construction

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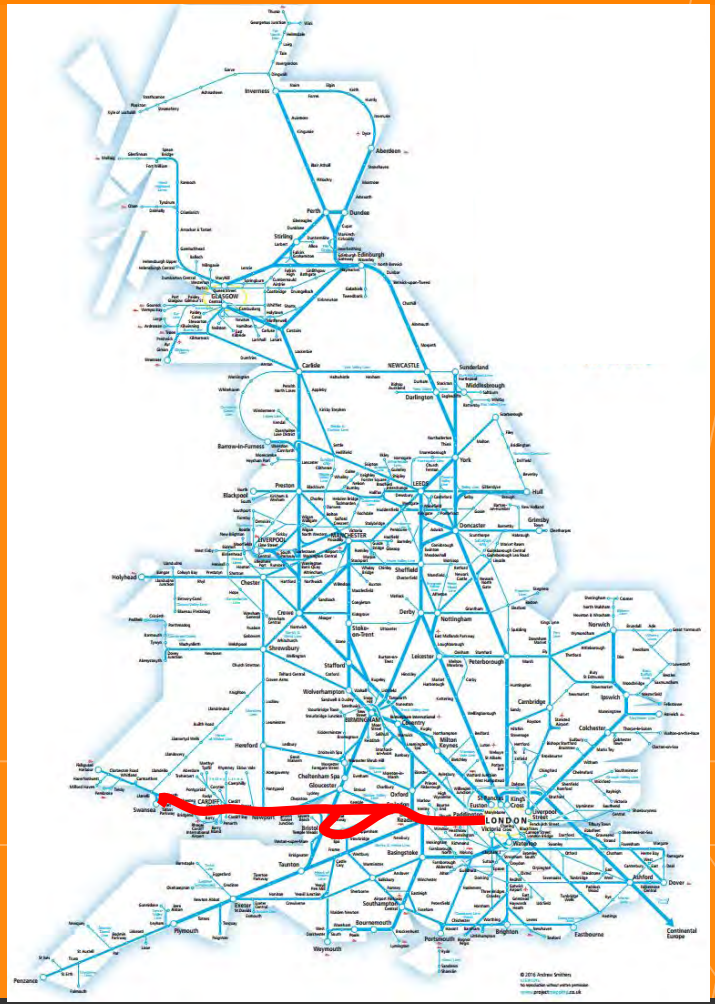
Furrer+Frey®
Overhead contact lines

Agenda

- Why use high output?
- What really is high output?
- Series 1 OLE Remit
- Our High Output Journey:
  - Relationships
  - What was difficult
  - What went well
  - What would we do differently next time
  - Where are we now



Why use high output?

- Reduce project time and cost
- Cost of staff and access is highest part of the whole project
- Great Western Route:1000km to electrify
- 16,000 foundations
- Mid week night 7 hour possession
- 2 tracks of 4
- 1.75 to 2.5 hours “real” working time
- Cost of staff and access is highest part of the whole project
- Adjacent Line Open “ALO” working
- Easy to install = easy to renew

Early Expectations

+ **Early Promotional Video**

What really is high output?

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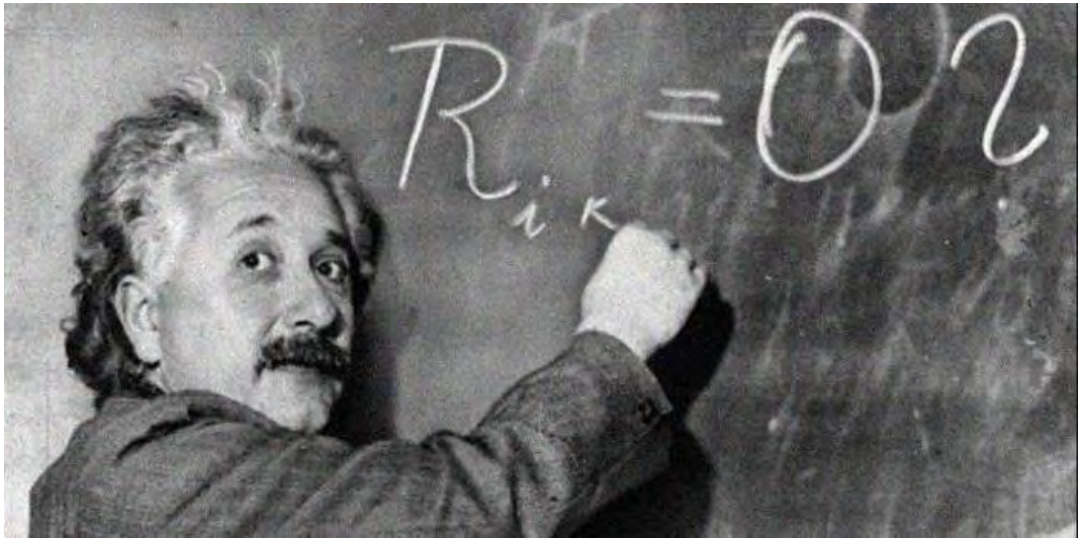
+ It is NOT *just* a clever / efficient train:

What really is high output?

+ It is NOT *just* clever Series 1 overhead line

What really is high output?

+ It is a state of mind!



What really is high output?

+ Factory process mentality

Ford: 1920s

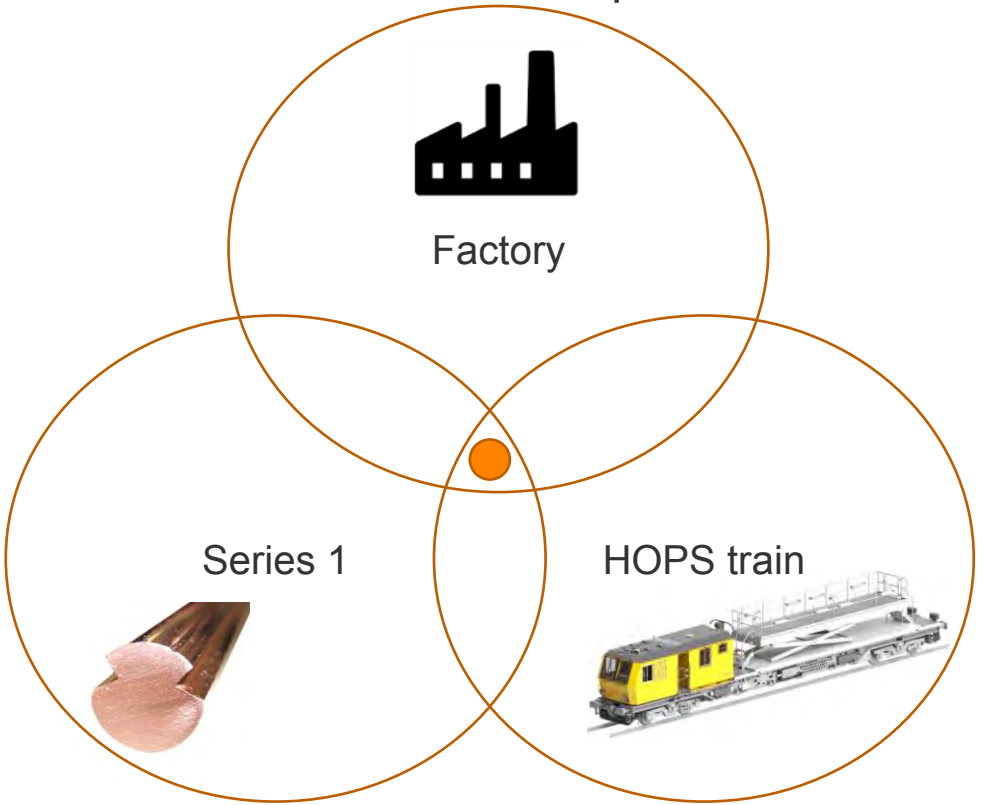
What really is high output?

+ Factory process mentality

Boeing: 2009

What really is high output?

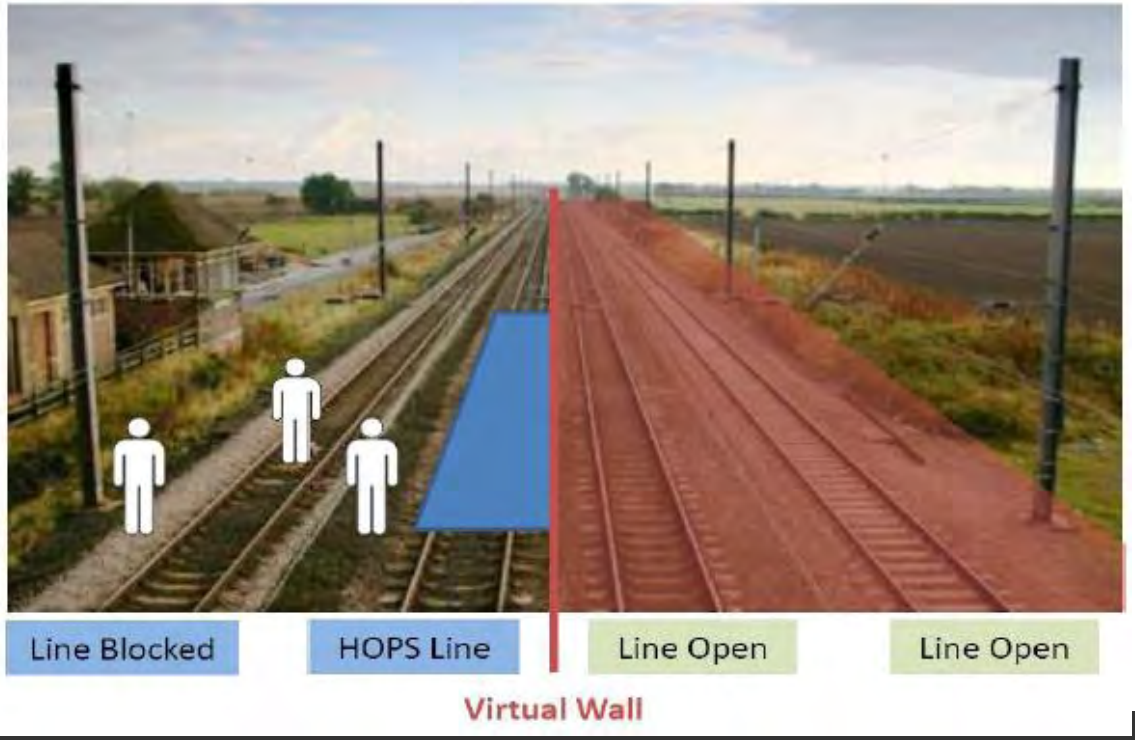
+ Slowest element drives the production rate



Hops Train: Key Benefits

- Take track possession around the train
- Welfare, messing, stores all within the train
- Lifting / racking equipment matched to OLE dimensions
- Increased mechanisation
- High capacity working platforms
- ALO working at 125mph / 200km/h

Hops Train: ALO Working



High Output Concept: Difficulties

- “Feed the factory”:
  - Design progress/ linear working
  - Design changes / rework
  - Materials have to be ready / in stock
  - Production gaps are not a production line
  - One-off structures / foundations

- Money saved on fewer train driving cabs has reduced flexibility

Series 1 OLE Remit

"*Installation Efficiency and Build Quality*"

What does this really mean?

+ Minimise on track work: Maximise pre-assembly
+ Minimise all-line access: Land and leave, minimise portal structures
+ Minimise component count: "One size fits all"

Series 1 OLE Remit

"*Reducing the material supply chain complexity*"

What does this really mean?

+ Reduce component count by standardisation
+ Reduced range: small, medium or large
+ Apparent **increased** material costs
+ BUT **reduced** procurement/storage/logistics/maintenance costs and complexity

Series 1 OLE Remit

"Achieve economy by standardisation"

What does this really mean?

+ Maximise adjustment and tolerance
+ **Increases** component cost and weight
+ **Reduces** logistics and storage and mistakes

Series 1 OLE Remit

"*Capital and whole life cost of the system*"

What does this really mean?

+ Spend up front to reduce long term costs
+ Sounds sensible (before you have to find the money)
+ Getting the arguments across was key

Our High Output Journey

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Relationships

- Co-ordinator / Client
- Train Manufacturer
- OLE System
- Installer / Operator
- Approval Body
- Approval Body
- Materials Logistics
- Detail Designer

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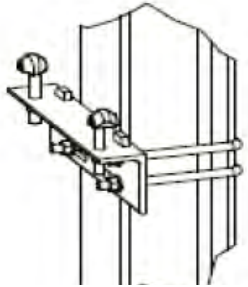
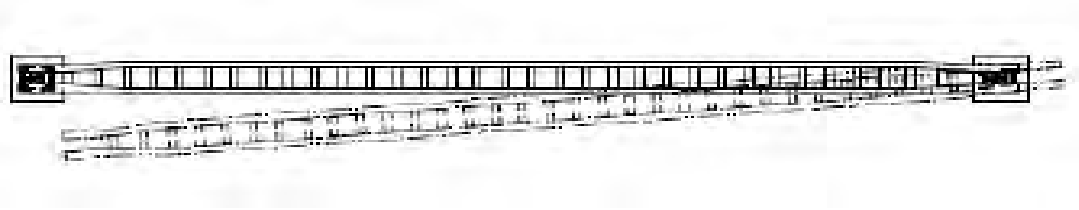
What didn't go so well?

- Larger structures need larger foundations:
  Capacity 20 large piles vs 30 small.
- Larger structures visible and appear inefficient, despite reduced overall project cost
- Late changes / request for more component variety
- Silo mentality

What works well in Series 1?

+ Land & Leave Portals





What works well in Series 1?

+ Land & Leave TTC: 2 min vs conventional 40 min
+ **TTC Video**

What works well in Series 1?

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What works well in Series 1?

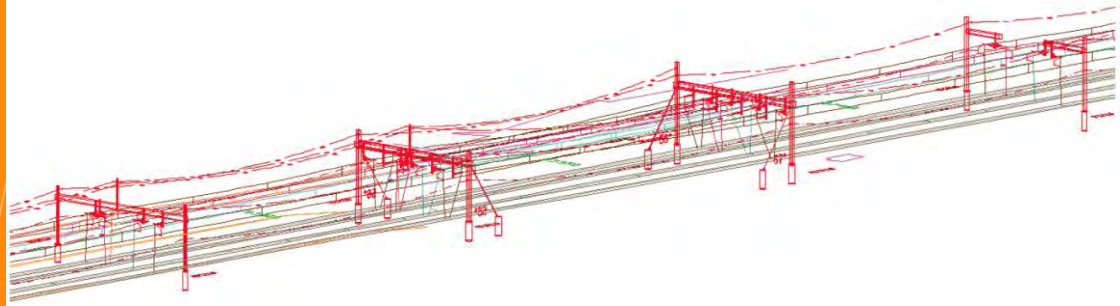
+ Mechanically independent wire runs & crossovers = simple installation

What works well in Series 1?

+ Rapid design using ELFF software

What works well in Series 1?

+ Single span overlaps



What works well on the HOPS Train?

- Pre-loading materials and removing waste outside track possession
- Minimal material handling within possession
- No need to on-track MEWPS
- Fewer safety incidents
- "*Its like its own delivery truck with safety fence*"
  (Production Director Amey Rail)

What would we do differently next time?

- Separate train program from the OLE program. Too many unknowns.
- Otherwise, align the contract scopes and goals tightly together : **Win:Win**
- Manage publicity and expectations
- Allow as much time as you can for development, and trials then feedback, several times over
- Focus on the factory process as a whole.
- Knowledge management: Focus on core goals

Where are we now?

- Success!
- HOPS is regularly delivering 100% planned work.
- Series 1 OLE is proven at 200km/h.
- TSI compliance
- Installation quality is understood and improving
- **VIDEO NEWS REPORT**

Where are we now?

Chicken or egg?

Design the OLE and train **together**:

Pros

+ Each can be tailored to the other for maximum efficiency
+ Changes can easily be made

Cons

+ Time = project cost
+ Complex management needed

Chicken or egg?

Design the **Train first**:

Pros

+ OLE can be customised strictly for compatibility with the train
+ Train becomes more adaptable: longer useful life

Cons

+ Less efficient train performance
+ Less innovation in the train

Chicken or egg?

Design the **OLE** system **first**:

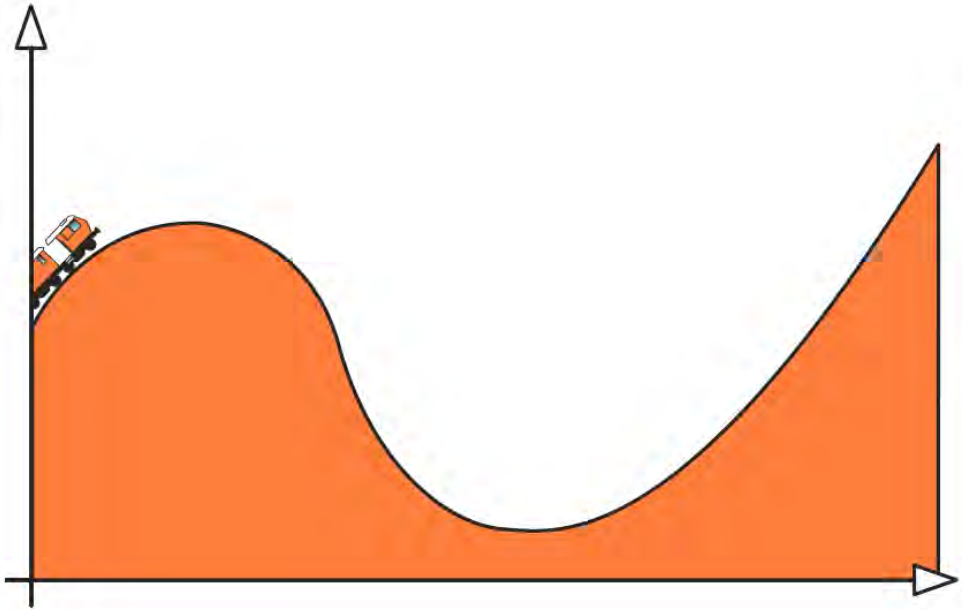
Pros

+ Train can be optimised to the OLE system for high efficiency
+ Stable program/costs/risks

Cons

+ The train can’t be used elsewhere without modification
+ Late OLE changes are restricted

The Journey



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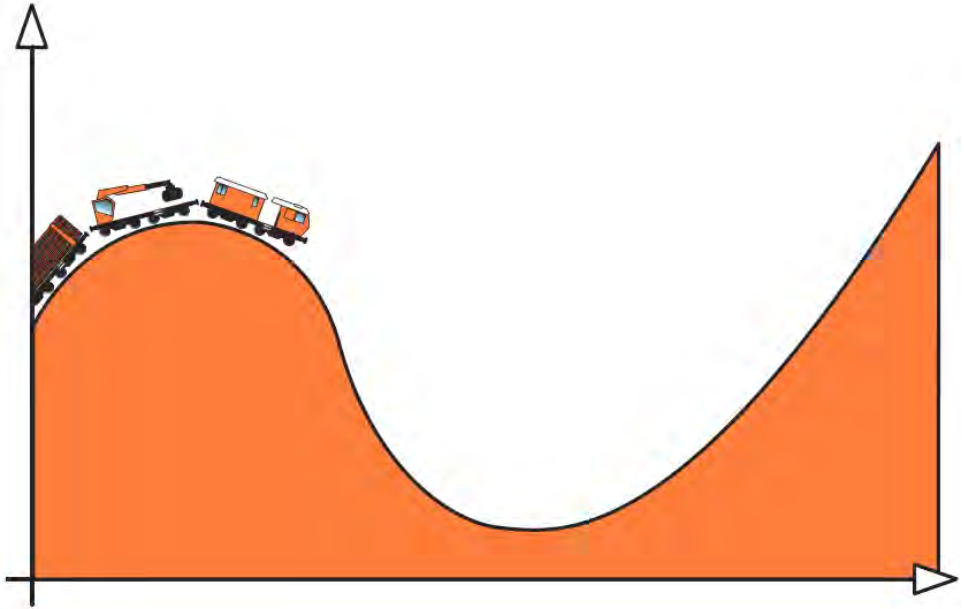

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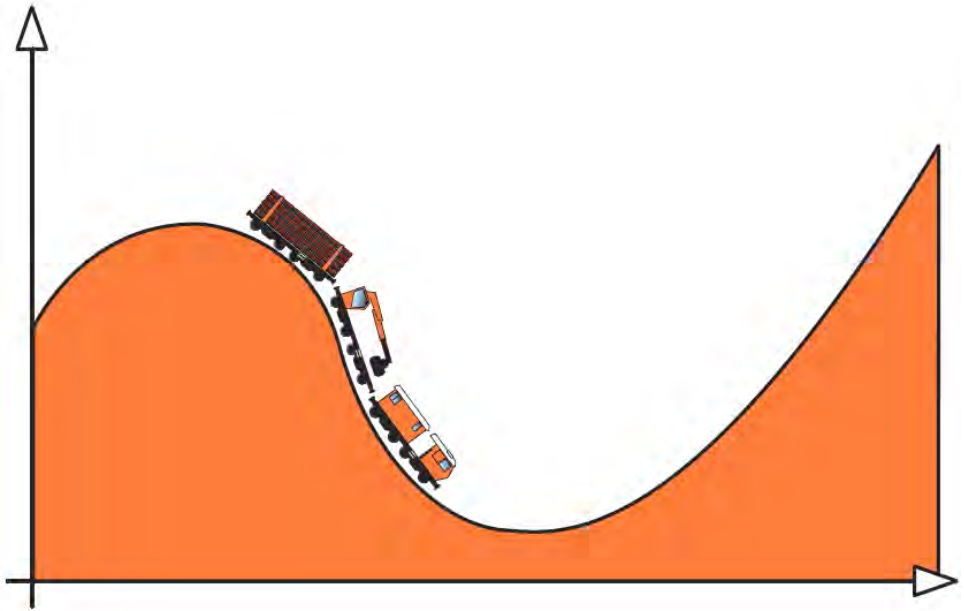

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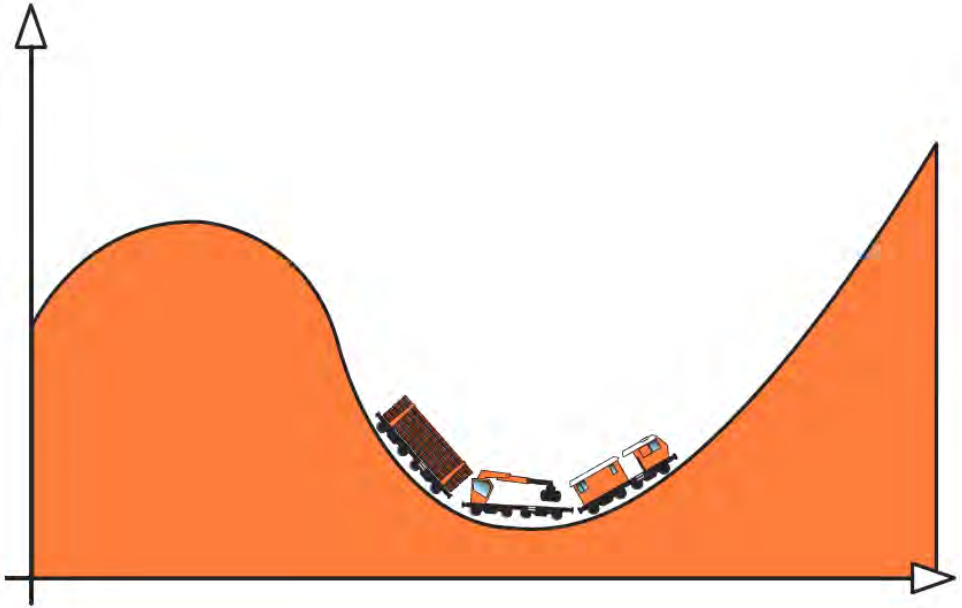

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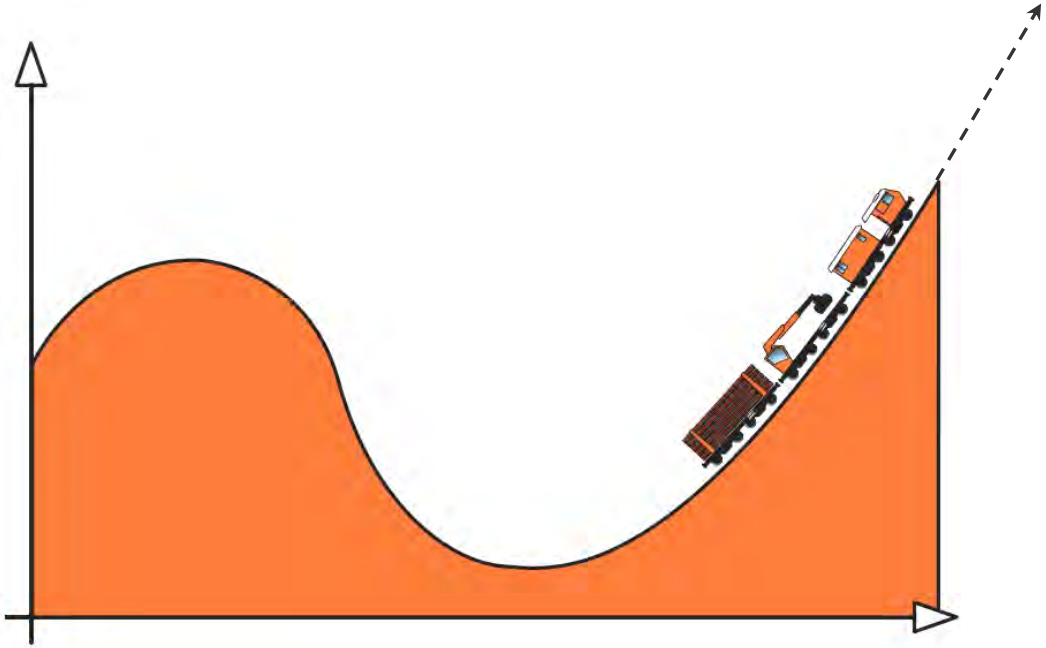

Reminder: What really is high output?