CanmetMINING mine electrification research: Goldex Railveyor study

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October 4, 2023

Canada

Outline

- 360 electric assessment research plan (5 years)
- Description of Railveyor system in place
- System energy analysis
- How to use the results for other studies
- Conclusions and next steps

360 electric assessment research plan (5 years)

Mobile Equipment Energy
(BEV, Trolley, Railveyor,…)

Case Study
&
Publication

Smart Charging Strategy
&
Grid Demand

Fossil Fuel
Mine

Environment

Life Cycle
Assessment

360 electric assessment research plan (5 years)

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Description of Railveyor system in place

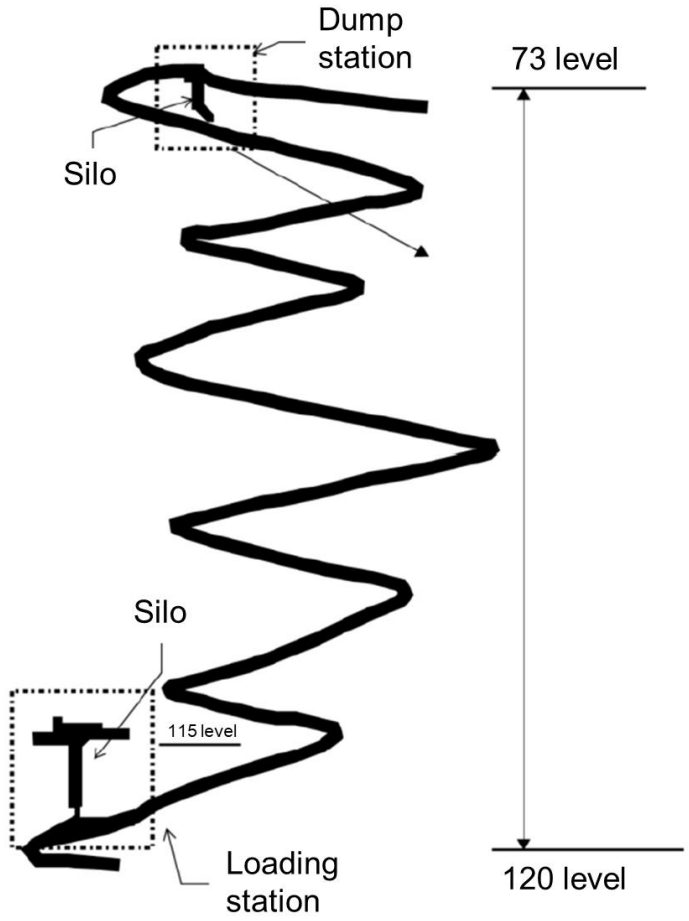
- General specifications Goldex Railveyor system (1 train)

Item	Value	Unit
Head car	1	car
Transporting cars	66	car
Tail car	1	car
Railveyor train total	68	car
Car length	2.44	m
Railveyor train length	165.92	m
Empty train weight	31.33	tonnes
Maximum payload	60	tonnes
Maximum speed up ramp	10.8 (3)	km/h (m/s)
Maximum speed down ramp	12.6 (3.5)	km/h (m/s)

Description of Railveyor system in place

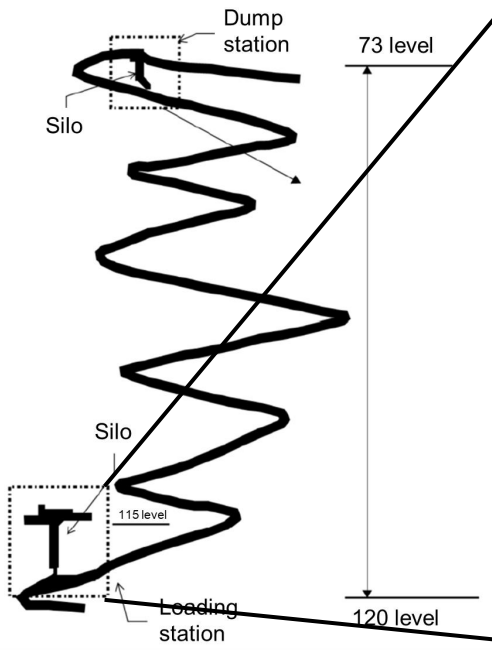
- General specifications Goldex Railveyor system (cont.)

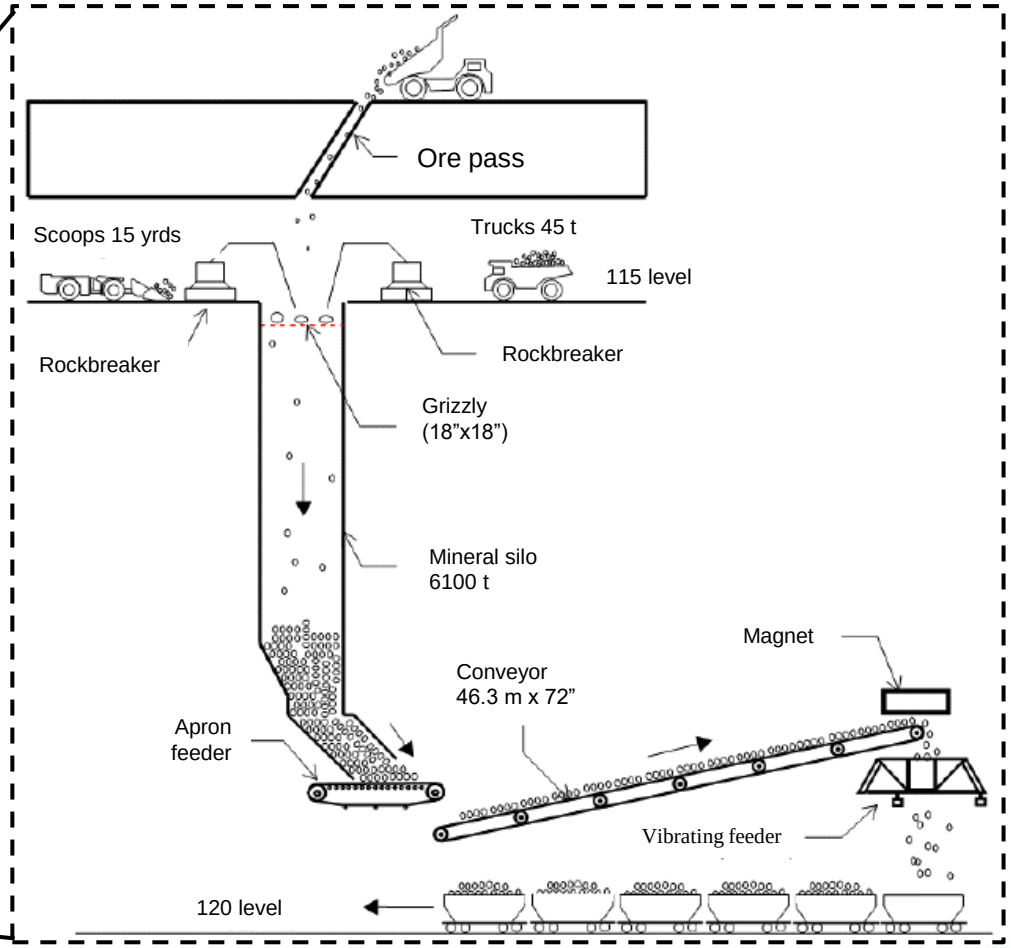
Item	Value	Unit
Top level	73	level
Bottom level	120	level
Vertical elevation	553	m
Ramp distance	3,000	m
Drive stations	91	-
Electric motors per station	2	-
Electric motor power	75 (100)	kW (HP)
Up ramp trains	3	-
Down ramp trains	3	-



Description of Railveyor system in place

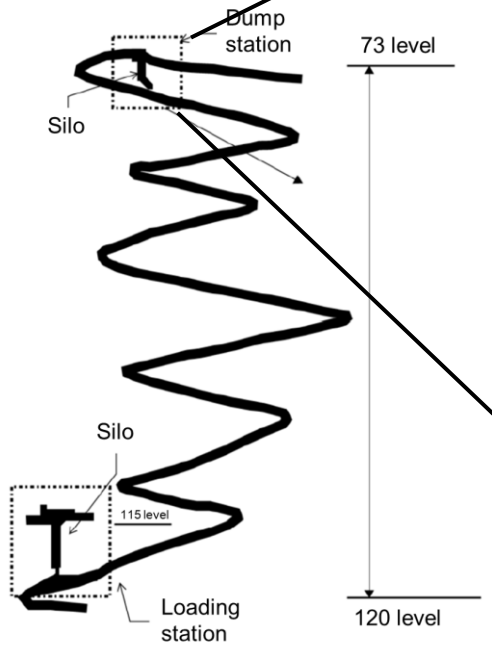
- General specifications Goldex Railveyor system (cont.)
  Loading station

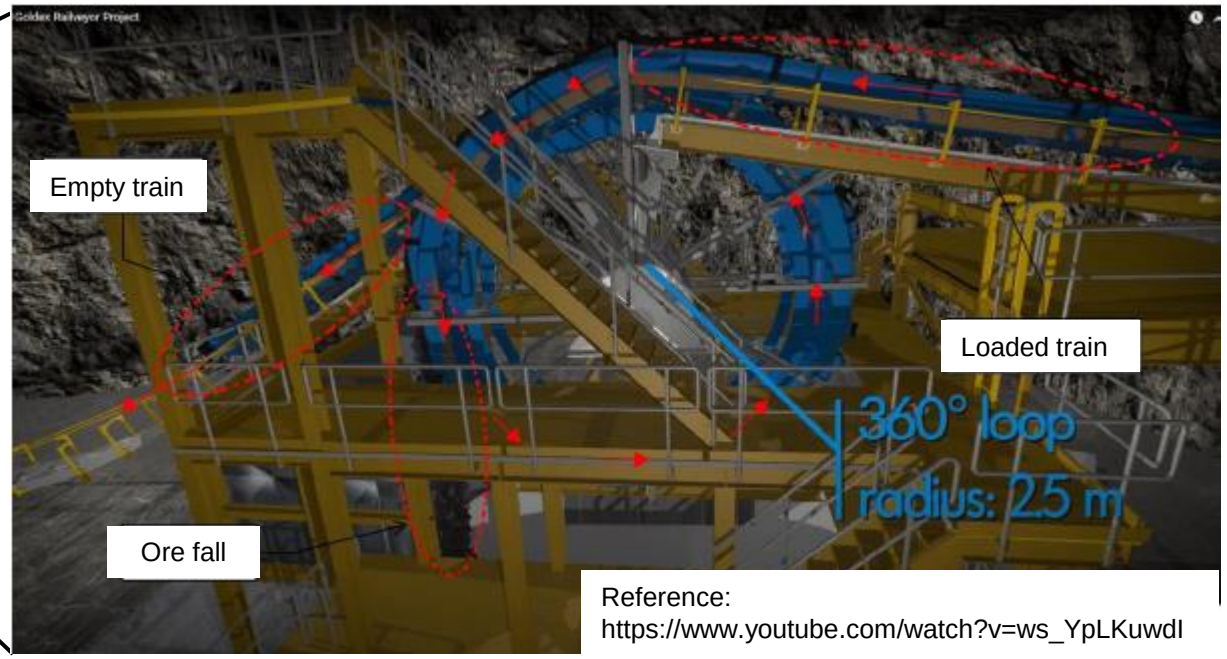




Description of Railveyor system in place

- General specifications Goldex Railveyor system (cont.)
  Dump station

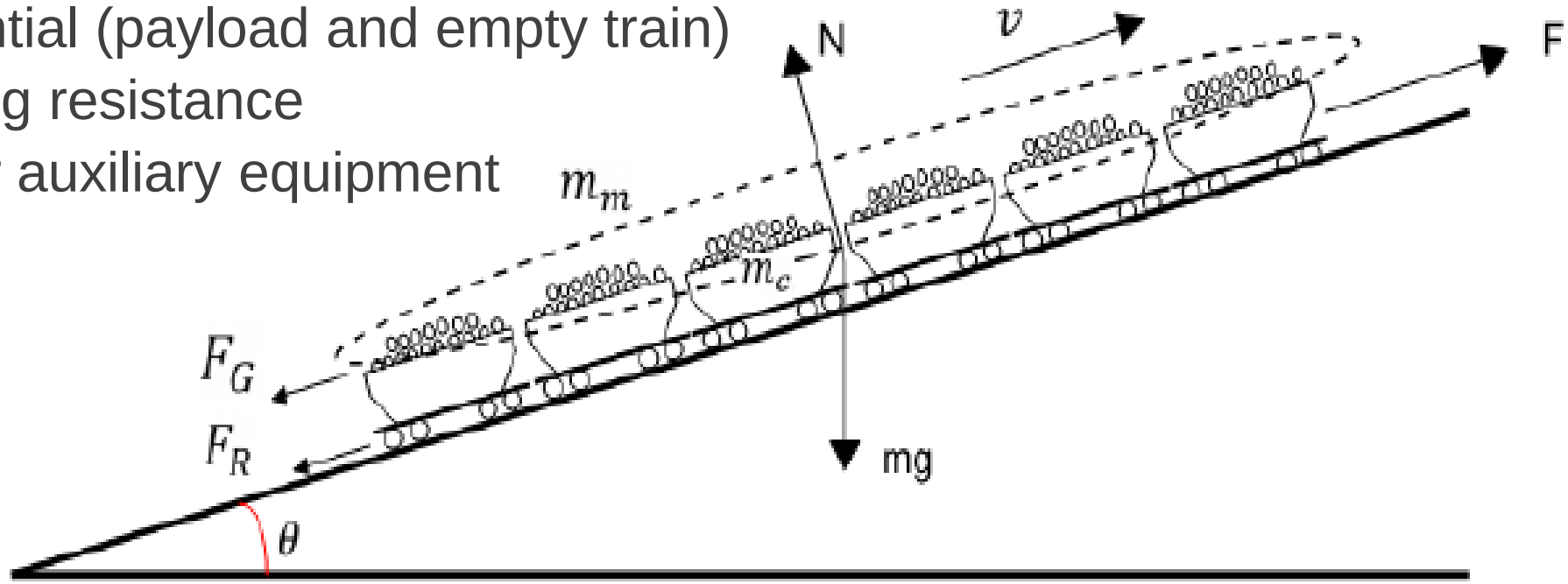




Reference:
https://www.youtube.com/watch?v=ws_YpLKuwdI

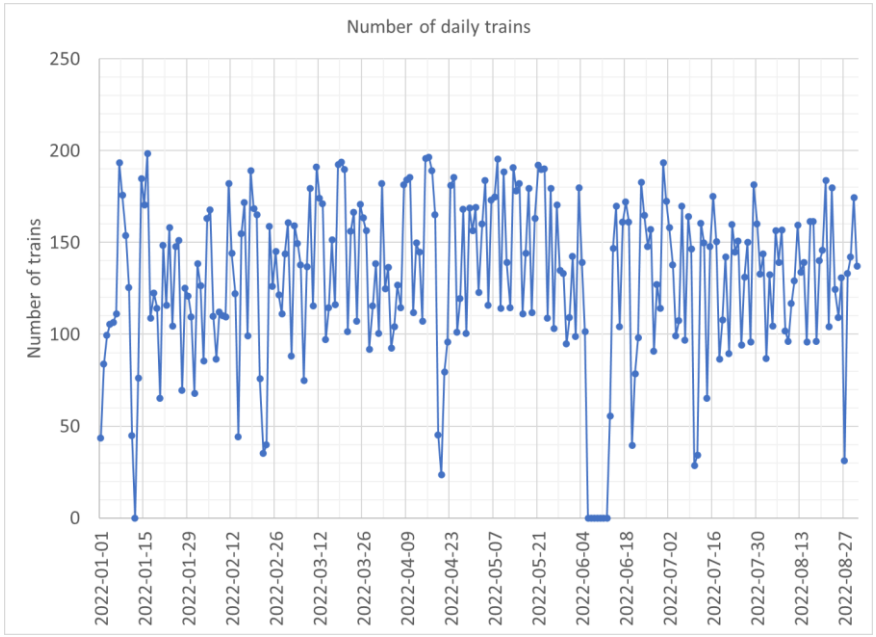
System energy analysis

- Data from the 1st January to the 31st September 2022 (243 days).
- Energy separated by categories:
  - Potential (payload and empty train)
  - Rolling resistance
  - Other auxiliary equipment



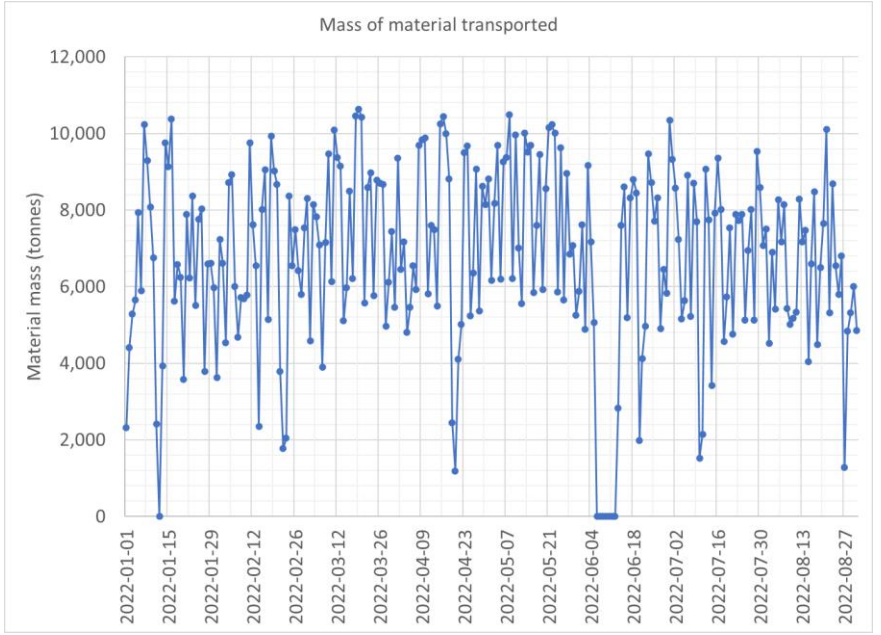
System energy analysis

- Data from the 1st January to the 31st September 2022 (243 days).
- Data includes:
  - Number of daily trains.



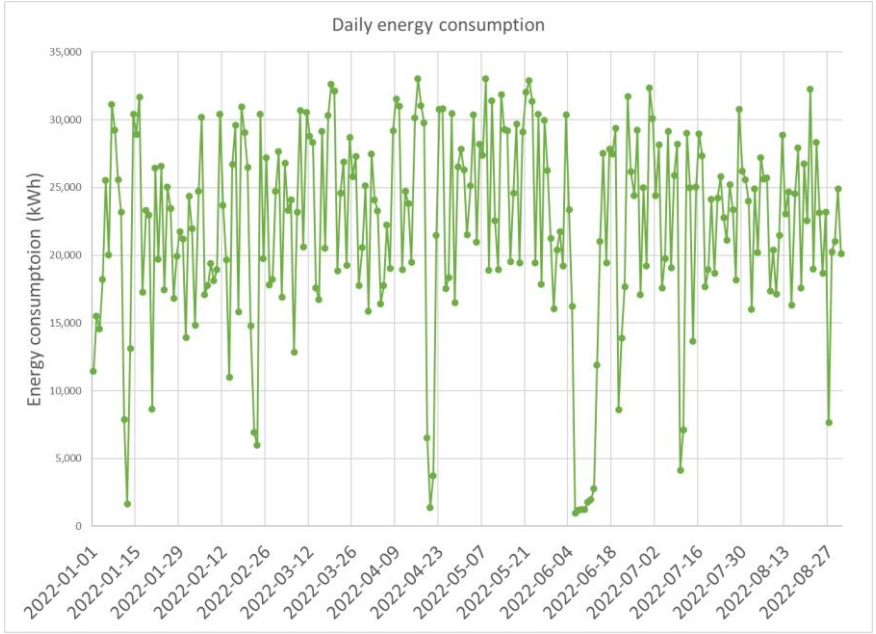
System energy analysis

- Data from the 1st January to the 31st September 2022 (243 days).
- Data includes:
  - Number of daily trains.
  - Tonnage (mass) of transported material



System energy analysis

- Data from the 1st January to the 31st September 2022 (243 days).
- Data includes:
  - Number of daily trains.
  - Transported ore tonnage
  - Energy consumption (kWh)



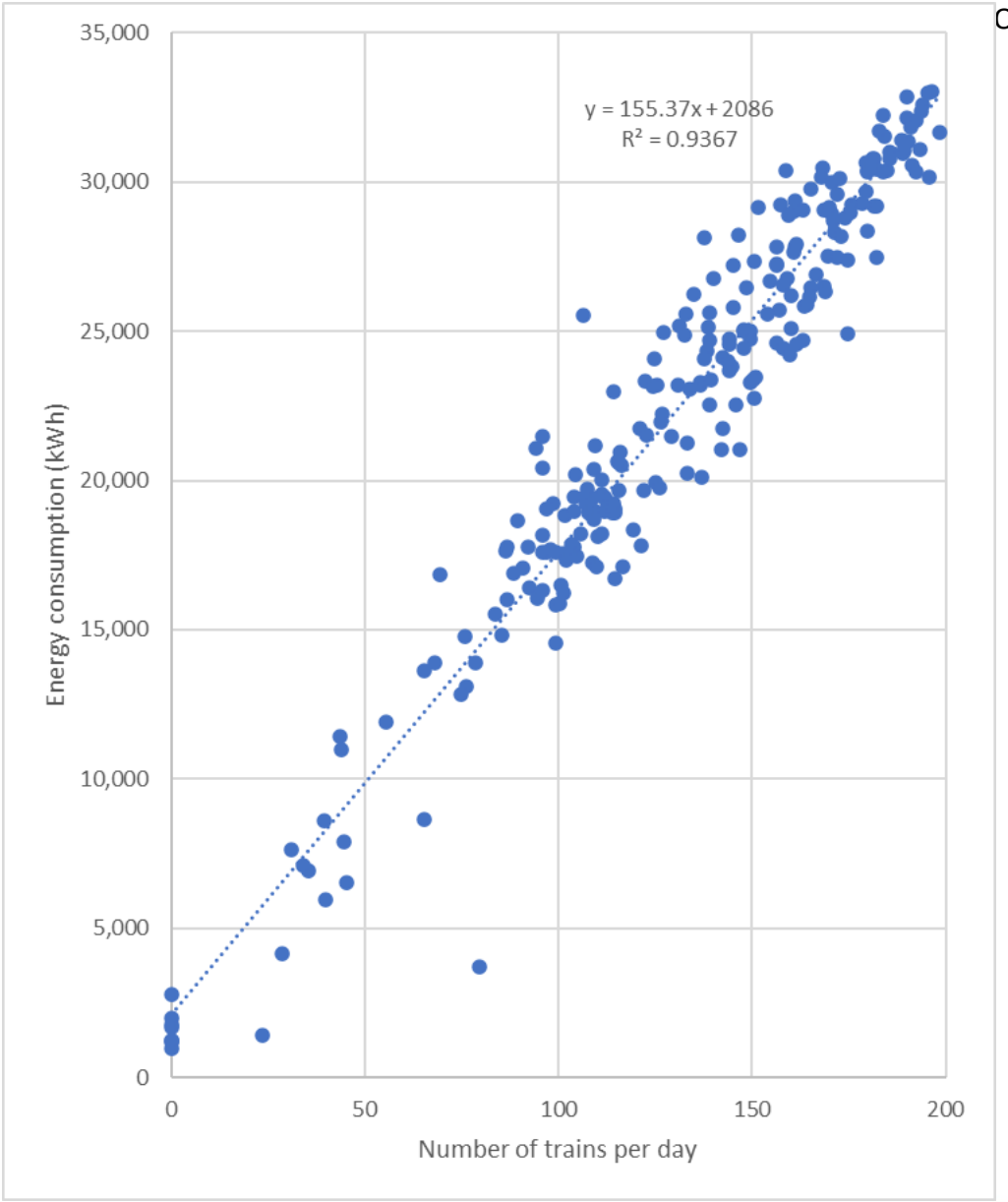
From the 6 electrical stations that feed the Railveyor system

System energy analysis

- The average transported tonnage per train was 52.25 tonnes (± 6.6 tonnes)

System energy analysis

- On average the total energy per train is 155.4 kWh.
- Trend line shows that close to 2,100 kWh are spent daily by the systems other than the Railveyor driving stations
- From the 155.4 kWh per train:
  - 126.0 kWh are consumed by the potential energy of the transported material (payload) and the train empty mass
  - 29.4 kWh are consumed by the rolling resistance per train

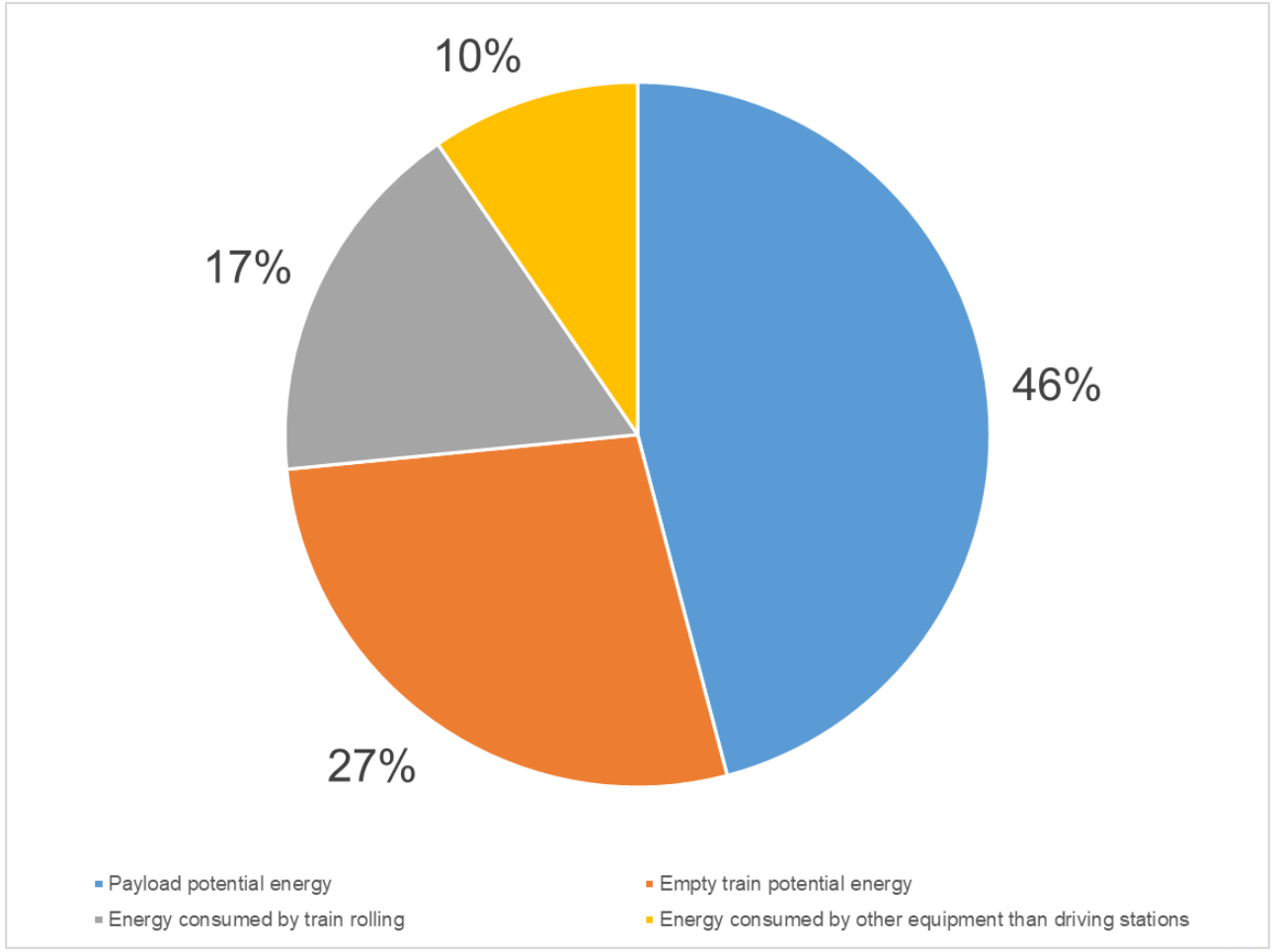


System energy analysis

Energy consumption category	Energy consumption (kWh)	Average energy consumption per train (kWh)	Daily average of energy consumption (kWh)	Energy ratio for train (kWh/tonnes·km)
Payload potential energy	2,470,296	78.8	10,166	0.502
Empty train potential energy	1,481,098	47.2	6,095	0.301
Energy consumed by train rolling	913,907	29.4	3,761	0.186
Energy consumed by other equipment than driving stations	515,624	16.4	2,112	0.105
Total consumed energy	**5,380,925**	**171.8**	**22,134.0**	**1.094**

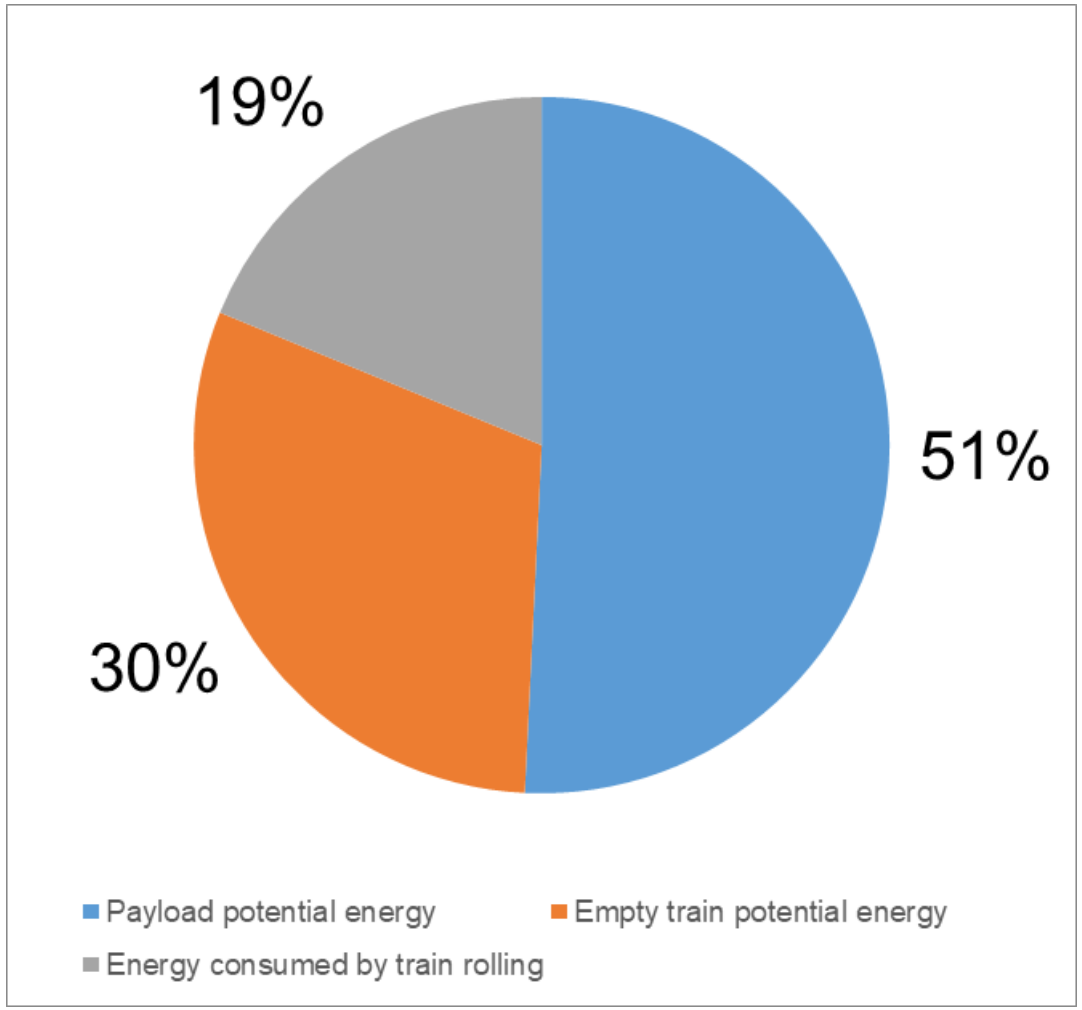
System energy analysis

- Potential energy:
  - 46% payload
  - 27% empty train
- Train rolling 17%
- Energy consumed by other equipment than driving stations 10%



Railveyor energy analysis

- The potential train energy (30%) is dissipated in the form of heat as the train goes back down from level 73 to the 120.
- Newer installations have the option of recovering the down ramp travel energy instead of dissipating it in the form of heat.



How to use the results for other studies

- A model can be derived from first principles to assess energy consumption
- Railveyor energy model considers:
  - Train potential energy
  - Train bearing resistance and rolling resistance
- Energy model results for tramming up ramp:
  - Railveyor energy consumption estimate is 146.5 kWh
  - Field data study energy consumption is 155.4 kWh
  - Estimated and measured values are within 6%

Conclusions

- The operational Railveyor EV technology setup implemented at Goldex Mine, Agnico Eagle, was presented.
- Field data obtained from 8 months of operation at Goldex mine operations was analysed and presented showing the energy consumption of the system and the Railveyor driving stations.
- Field data and Railveyor energy model estimates showed a 6% correlation.
- More studies will be required to determine the potential for capturing energy while the train travels downhill.

Thank you!
Questions?

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