

# An Analysis of a Detailed Engineering Study in Accordance with IESO IAP Requirements

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Presented at the Seventeenth North American  
Mine Ventilation Symposium

April 28 to May 1, 2019

Montréal, Quebec, Canada

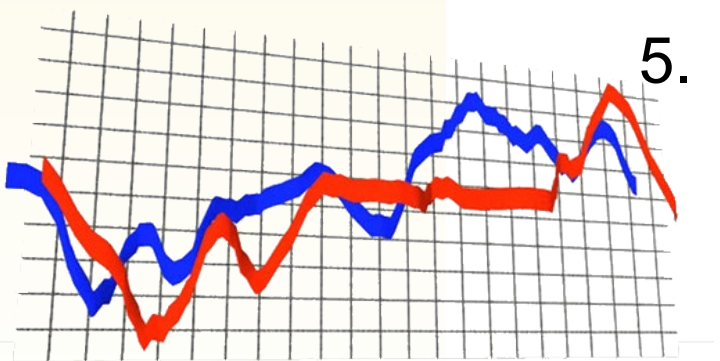
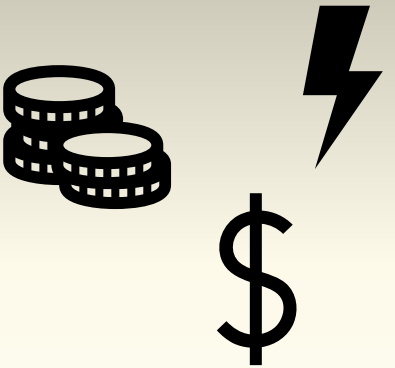
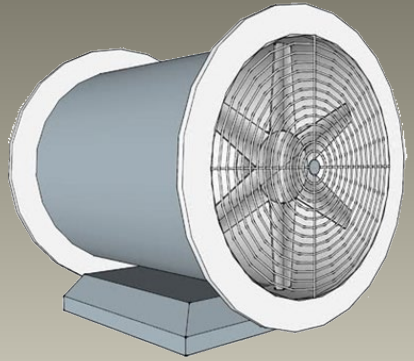
# IESO IAP Program

- Provides financial assistance for fast tracking capital investment for energy conservation projects in Ontario, CA.
- Four Initiatives
  - Retrofit
  - Process and Systems, including Small Capital Projects
  - High Performance New Construction
  - Energy Managers



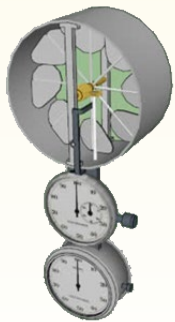
# Mining Study

- Process & Systems Initiative
- Detailed Engineering Study
  1. Baseline Methodology and Data Collection
  2. Measure Analysis
  3. Economic Analysis
  4. Recommendations
  5. Implementation Action Plan



# Baseline Methodology

- Full Ventilation Survey
  - Airflow Quantities
  - Gauge and Tube pressure measurements
  - Fan Pressures and Airflows
  - Pressures – Regulators, Doors, Bulkheads
  - Psychrometrics (Barometric P., R.H., Temp.)
- Correlated Ventilation Base Model
- Fan Power Measurements
  - Volts
  - Amps
  - Power Factor

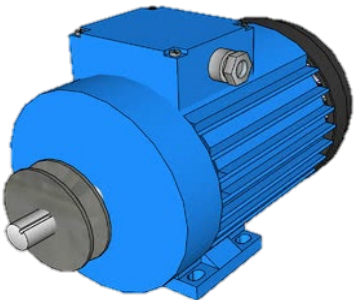


# Main measure requirements<sup>5</sup>

- Save mine electricity demand
- Financial Incentives based on lowest of:
  1. 70% of the Eligible Costs of the Project
  2. Product of annual electricity savings multiplied by \$230/MWh
  3. Amount that provides a Project Payback of 1 year.
- Measures with Payback < 1 year are ineligible for incentives

# Measure Development

- Fan Optimizations
  - Inlet Cones
  - Outlet Evasés
  - VFDs
  - New fans
- Fan efficiency increases
- Reduction of losses
- Power decreased using VFD to original operating airflow



# Measures Cont.

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- Infrastructure Changes
  - Turning off main/booster/aux fans
  - Installation of airlock doors
  - Sealing inactive levels
  - Adding new parallel raises
  - Adding new primary ventilation raises
  - Interactive effects

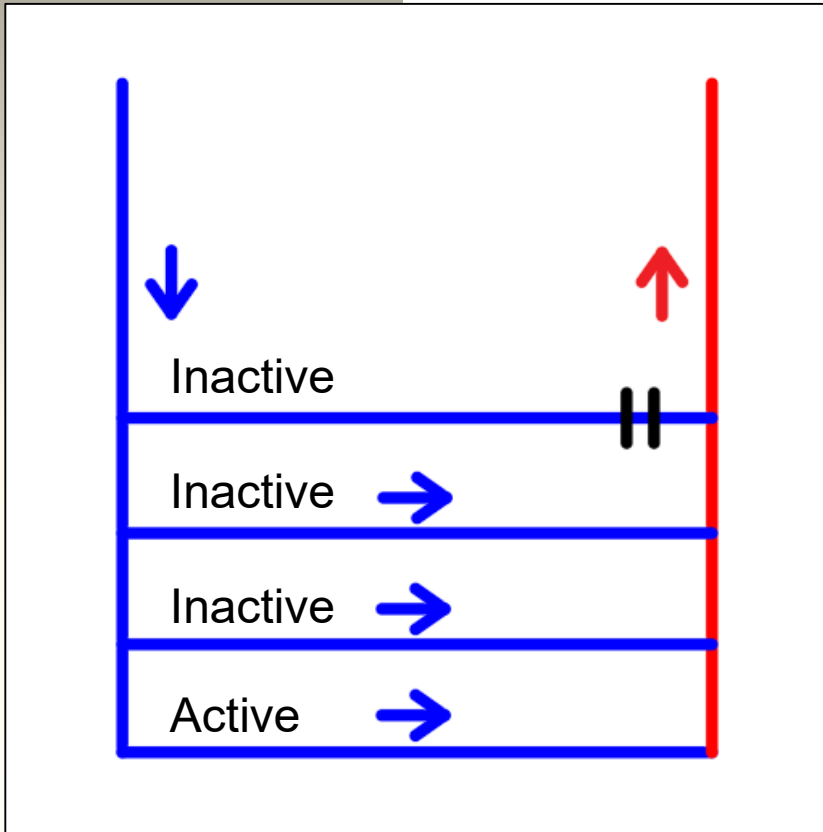
# Measure Results

- Fan Optimizations
  - Immediate Savings
  - Low Capital Costs
  - Payback < 1 year for single infrastructure changes
    - No Incentives
  - 2 or more fan changes
    - Incentives calculated
  - New Fans
    - Adequate savings with an acceptable Payback



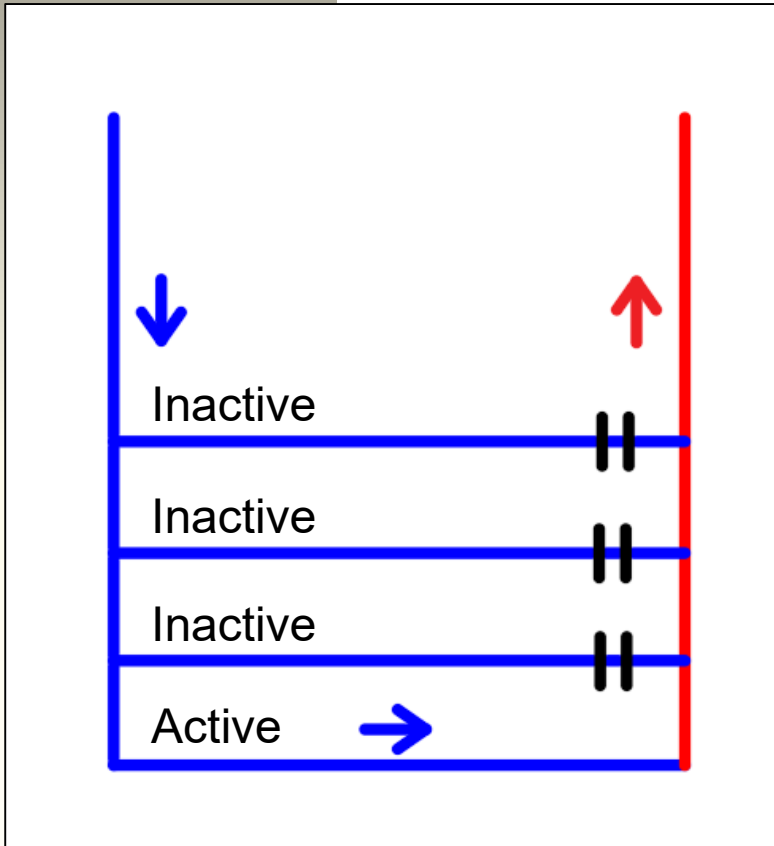


# Measure Results Cont.



- Raise development measures
  - high capital cost
  - High Payback period
- Individual Infrastructure Changes
  - No savings
  - Air reroutes to other levels (emphasizes need for multiple bulkheads)
  - Removed fans cause other fans to work harder

# Measure Results Cont.



- Interactive effects
  - Doors
  - Bulkheads
  - Fans removed
  - Fans turned down
- Reasonable payback
- Significant Project Incentives

# Discussion of Results

- Potential paradox between IESO objectives and mining objectives
  - Turn down fan
    - Electricity savings
    - Realized incentives
  - Turn up fan
    - Boost production



# Discussion of Results Cont.

- Measures recommended despite lack of incentives
  - Single evasé – payback < 1 year
    - No incentive
    - Best practice

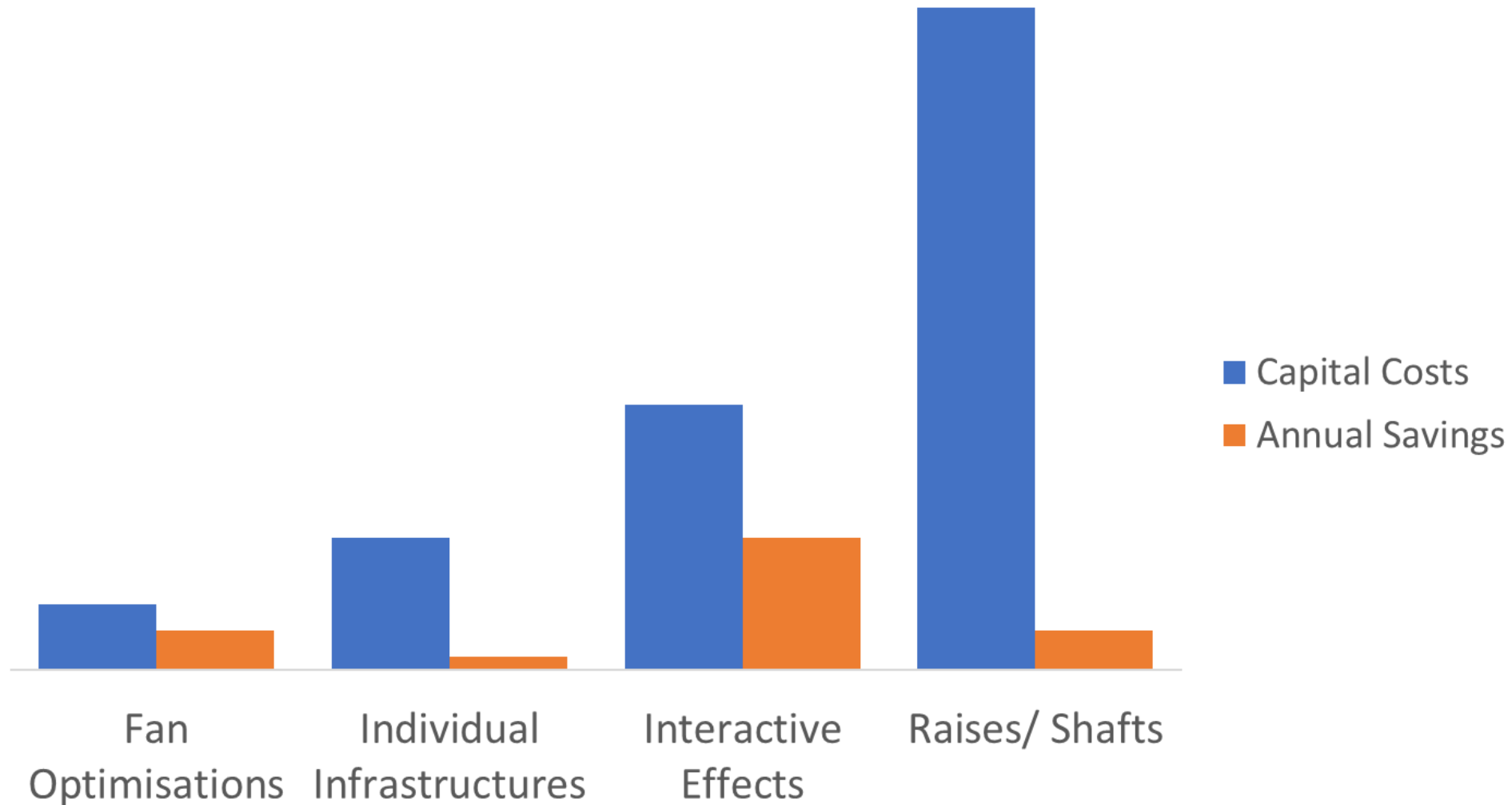


# Discussion of Results Cont.<sup>13</sup>

- Lack of significant savings of measure not necessarily required for implementation
- New Raise – no acceptable payback (IESO)
  - Relatively small incentive
  - Needed for mine expansion



## Capital Costs vs Annual Savings



## Conclusions Cont.

- Scope did not cover future tradeoff scenarios
- Trade off costs of raises may provide incentives when compared with alternatives
- Other reason for installing raises - safety (US – egress, CA – secondary access to refuge)

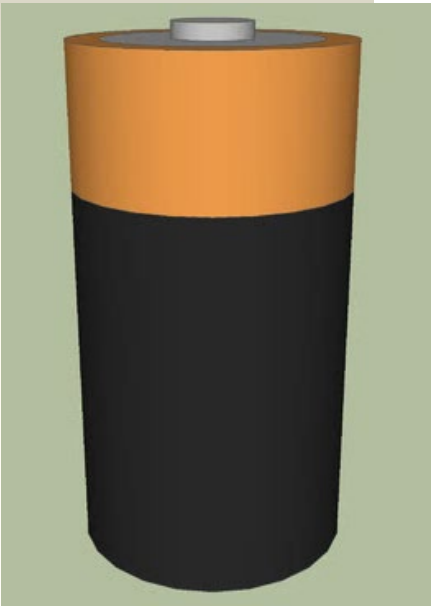
# Conclusions Cont.

- Infrastructure changes in tandem with fan adjustments
- Multiple infrastructure changes may be recommended
- Individual changes – slight redistribution of airflow – little to no energy savings
- Adding infrastructure adds the effect of added air resistance – fans must be turned down to save electricity



# Opportunities

- Future Trade-off studies
- Battery Electric Vehicle replacement
  - Decreased ventilation costs
    - Reduction in heat produced
    - Zero Emissions
  - Electrical cost increase for charging fleet
  - Trade-off



# Thank you!

