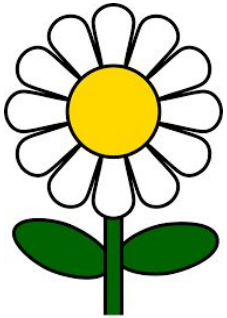
Team Daisy



Stakeholders

- Primary user: Ontario power generation authorities
  - Concerns: cost, reliability, environmental impact, usability
- Ontarian consumers of power
  - Reliability, environmental impact
- Neighbouring power jurisdictions
  - Quebec: net exporter to Ontario due to excess of renewable energy
  - Minnesota, New York, Michigan: net importers of renewable energy from Ontario
- Public (in Ontario, around generating plants)
  - Safety, health, comfort
- Other developers and engineers
  - Readability, reliability, extensibility

Ongoing focus on Technological Stewardship

- Deliberate values
- Realise diversity

Technical Challenges: Breakdown

1. Forecasting nuclear power generation

- Hydro > nuclear >> other
- Nuclear is slow to ramp up and down
  - Too little, we risk blackout
  - Too much, we use less hydro
- Uncertain, requires knowledge of future

2. Balancing emissions, green power, profit

- Some resources interchangeable
  - Carbon capture converts $$ -> green
- Positive-sum trades available
  - Supply green power to coal-burning neighbors
- Certain, optimal solution exists for any set of priorities.

Technical Challenges: Approaches

1. Forecasting nuclear power generation

Approach: Control system

- Estimate future power needs
- Estimate future hydro supply
- Power shortfall is target amount of nuclear
- Adjust production up or down towards target

2. Balancing emissions, green power, profit

Approach: Linear programming solver

- Assign numerical weights to each outcome
  - Selected based on real-world quantities
- Maximize sum-of-weights
- Allocate power for hour to combine
  - Minimize emissions
  - Maximize green power
  - Maximize profit
- Extensible - easy to add new priorities
- Mathematically optimal!

Selecting weights

Partly balancing stakeholders' priorities.

Partly looking for positive-sum trades.

- Canada prices carbon at $50 per tonne in terms of social impact.
- Hypothetical future carbon capture plants could cost $150 per tonne captured.

We conservatively value removing one tonne of carbon at $2000 by default, but this is configurable.

Open-Source Code

Python libraries

- **csv**, for csv I/O
- **numpy**, for high-performance matrices

Used a linear programming solver previously written by one of our teammates for the ICPC programming competition.