

Intelligent Energy

How AI can have a positive impact in energy

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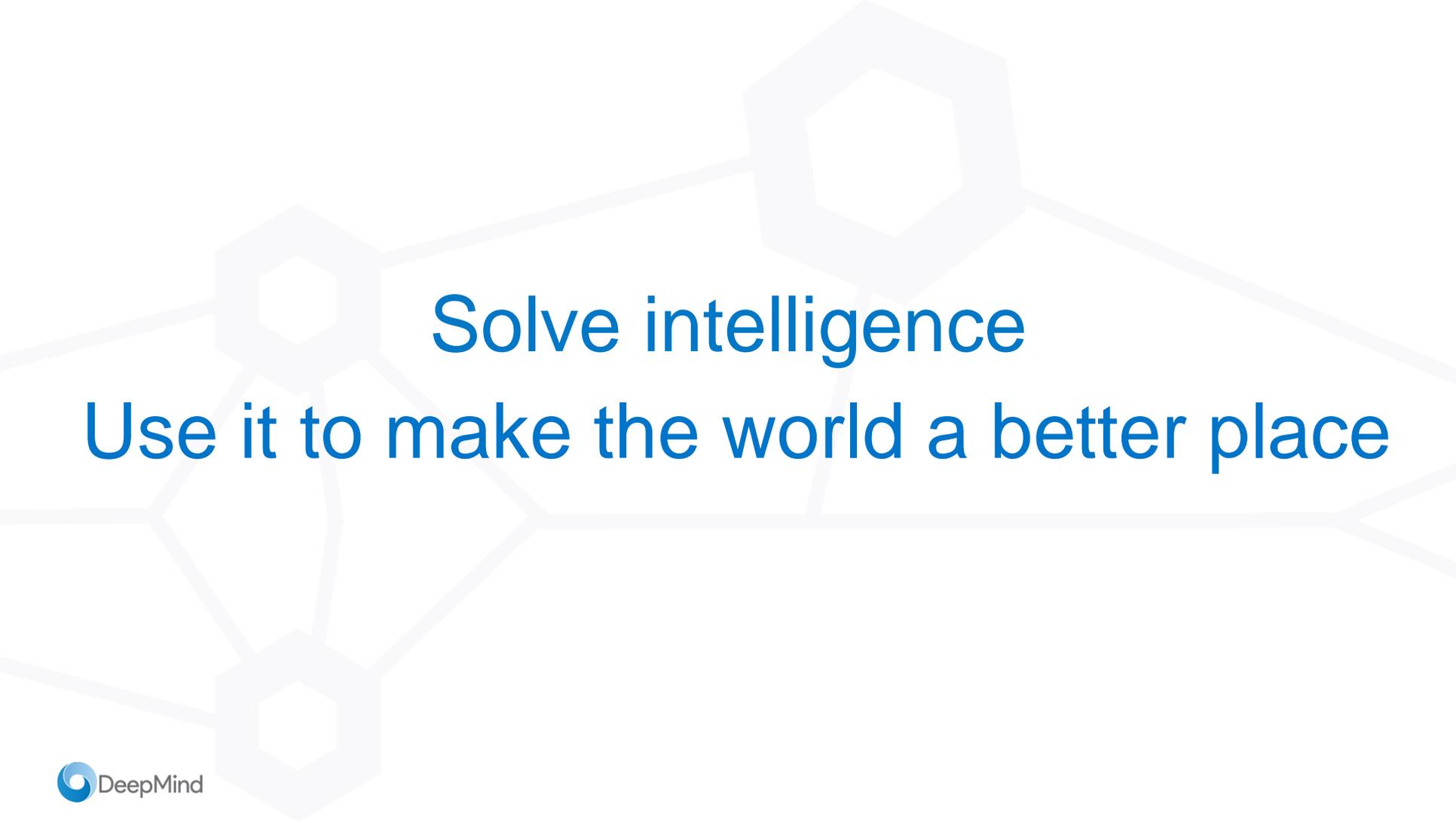




A hybrid organisation:

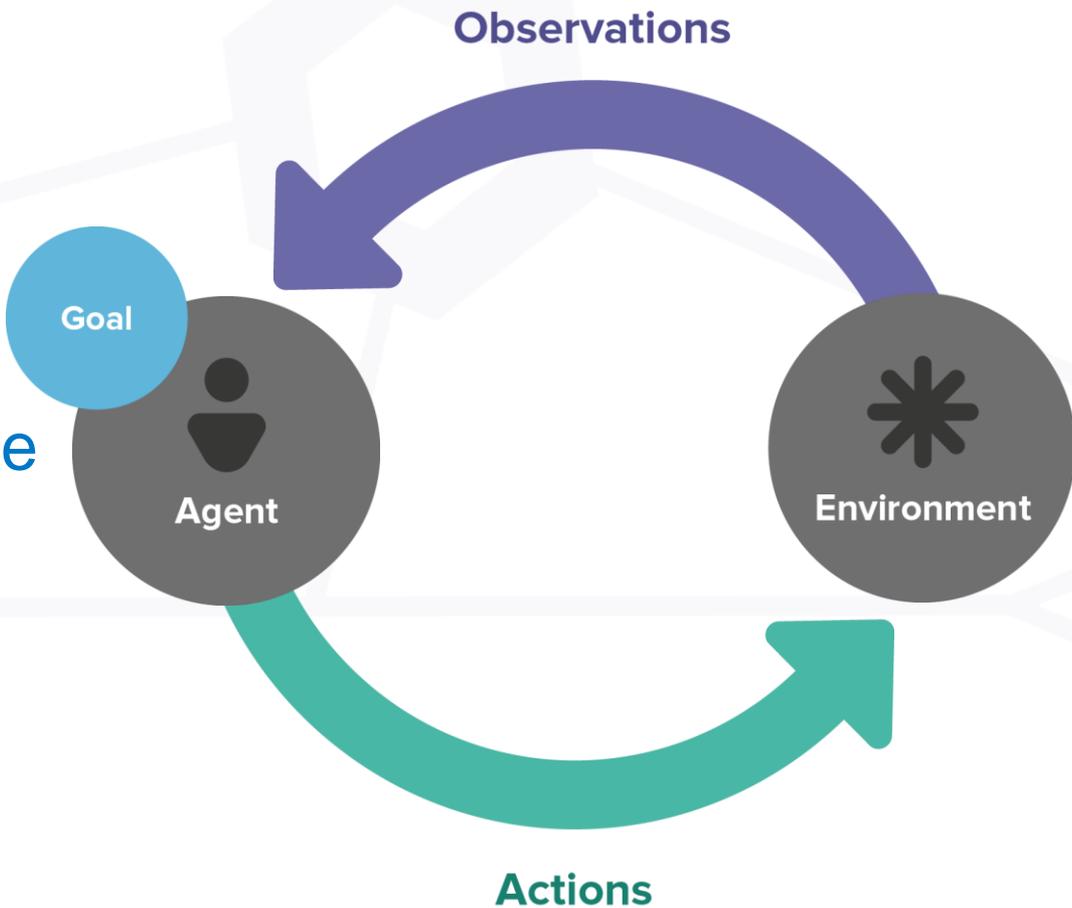
- Research at heart
- Pace, scale of a company
- A social mission



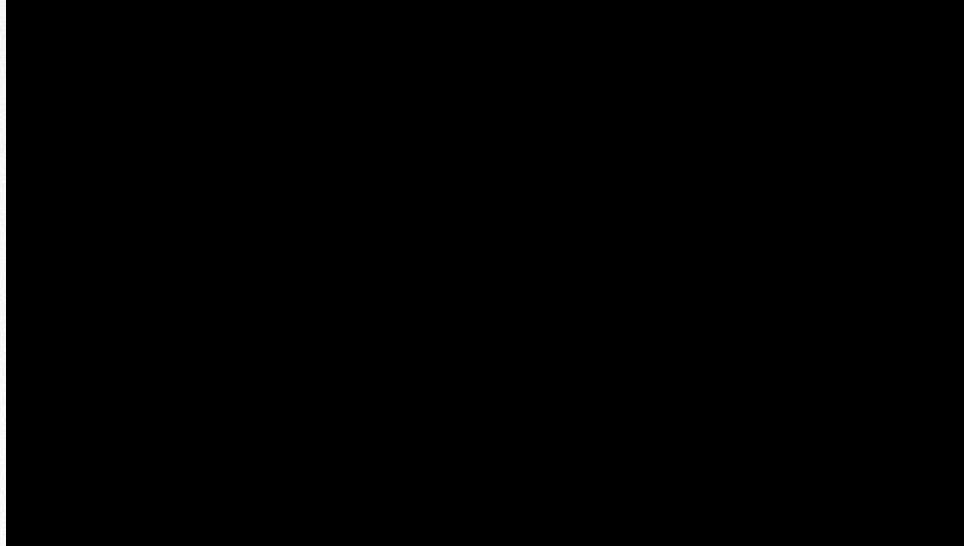


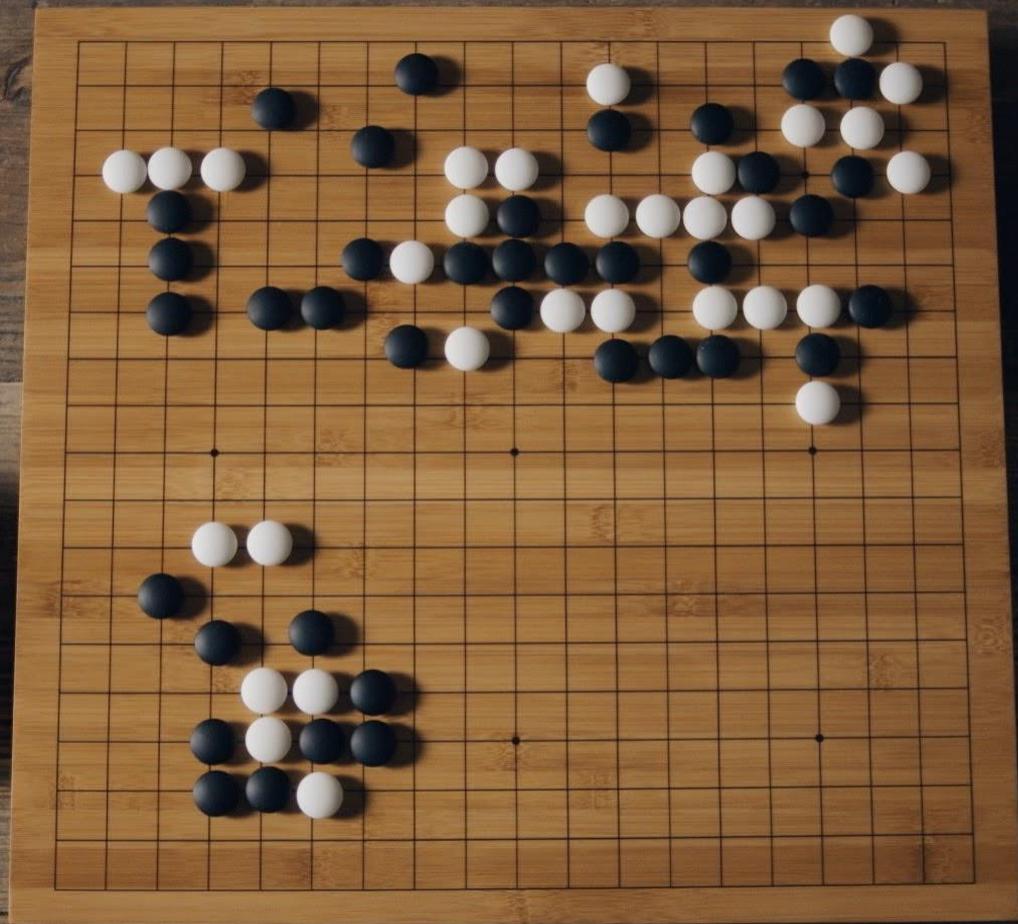
Solve intelligence
Use it to make the world a better place

Building General Purpose Learning Systems with reinforcement learning

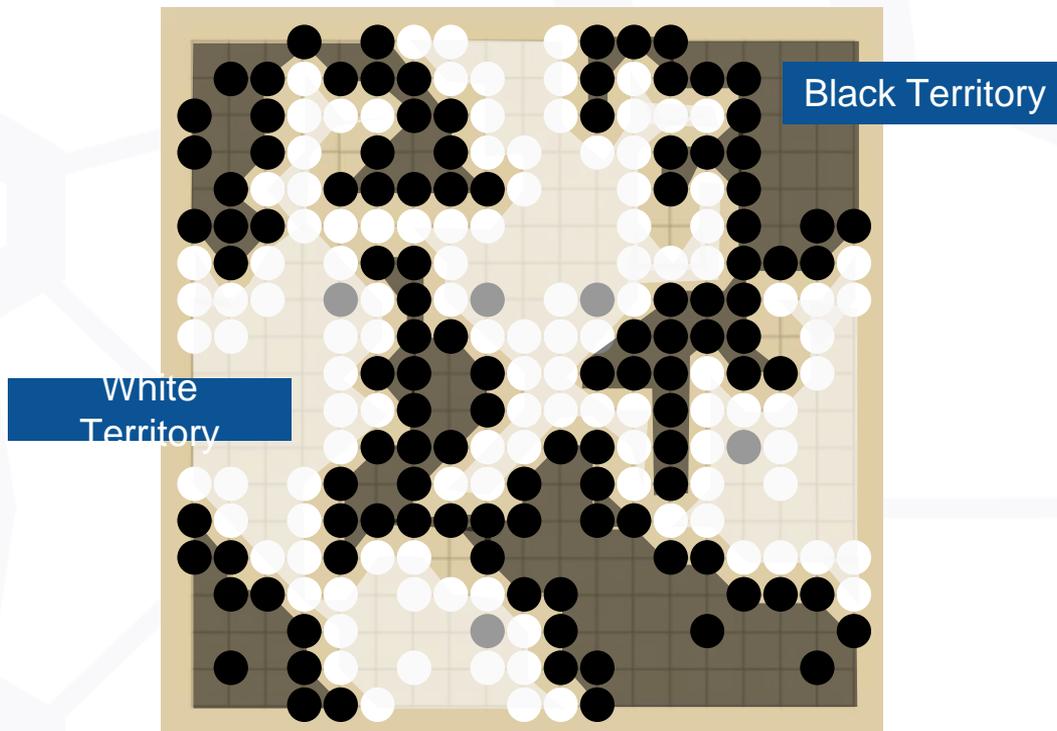


Deep Reinforcement Learning (DQN)



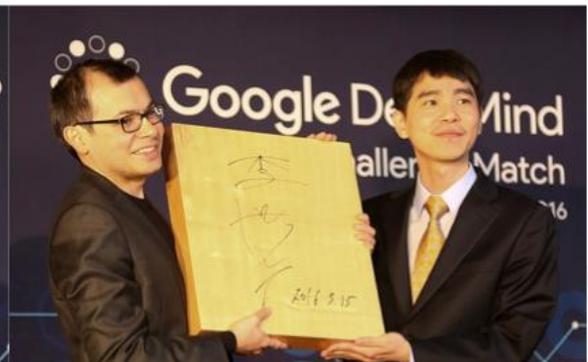
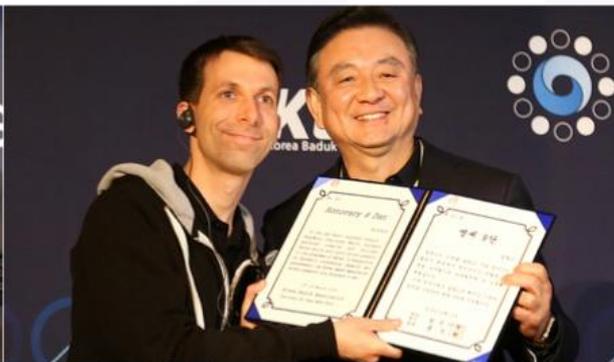


Learning to play Go



10^{170} possible board positions

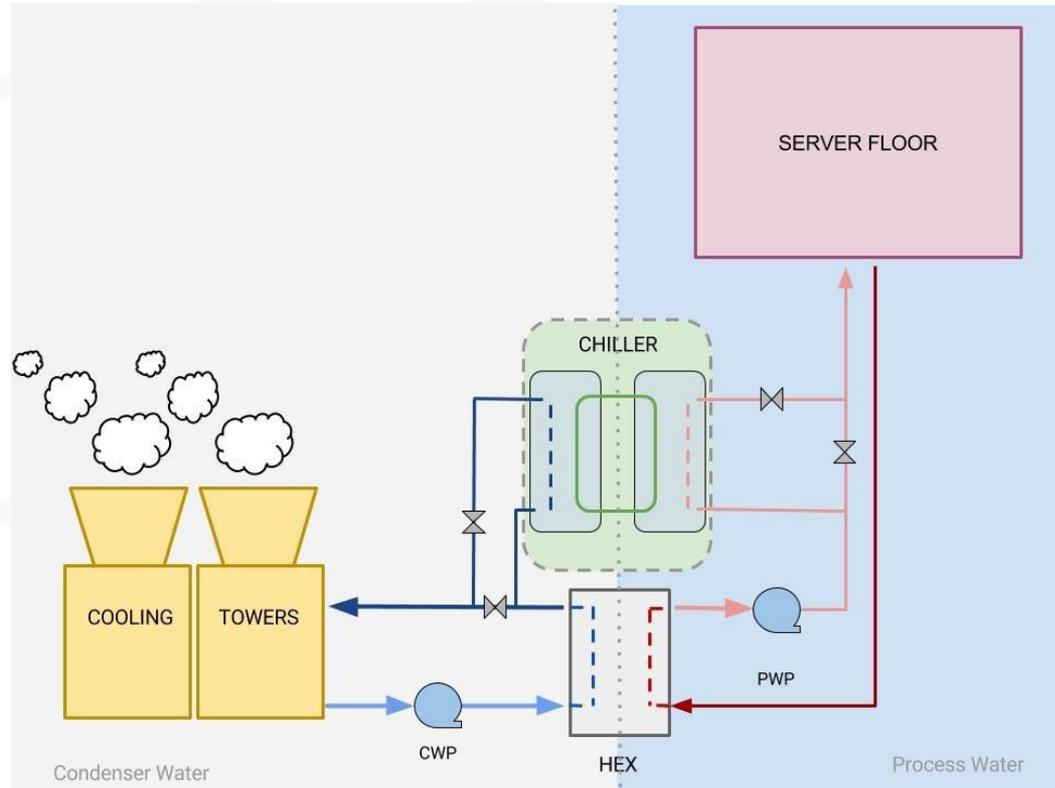
AlphaGo won 4-1: “decade earlier than expected”



Data Centre Cooling

Goals

- Maximise energy efficiency (PUE)
- Whilst satisfying temperature & pressure constraints



Typical DC Plant

Training Data

State

- ✓ Incoming IT load
- ✓ Power meters
- ✓ Pressure sensors
- ✓ Temperature sensors
- ✓ Water flow meters
- ✓ Pump and fan speeds
- ✓ Fault alarms
- ✓ Weather conditions

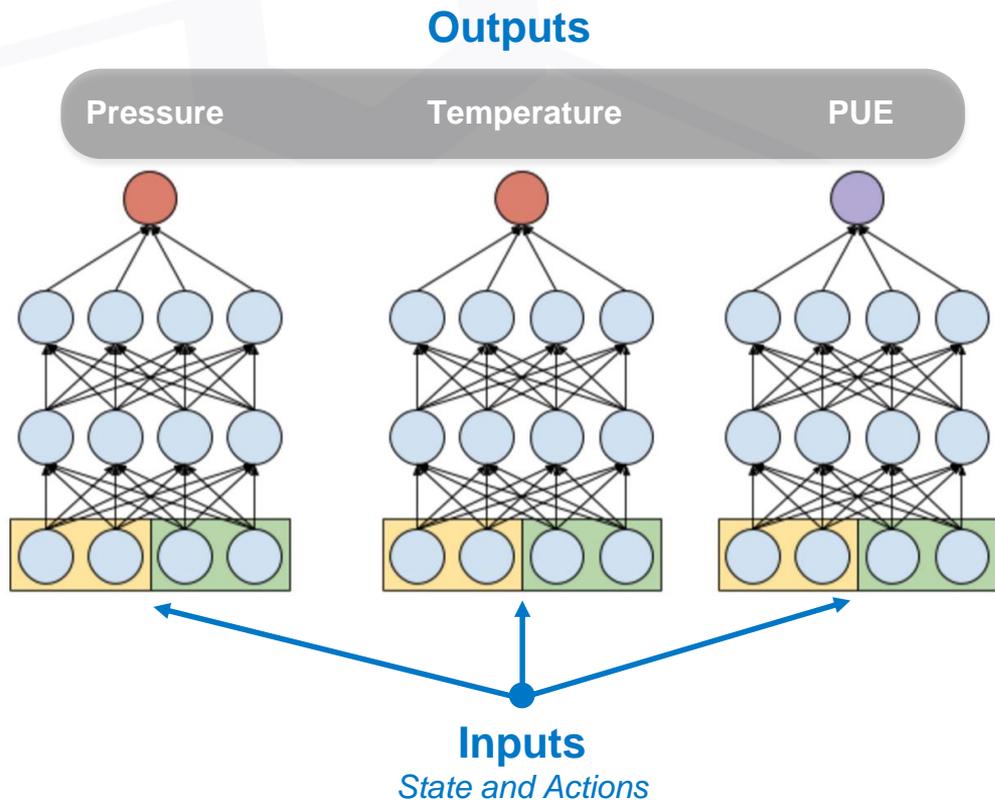
Actions

- Number of cooling towers ✓
- Number of chillers ✓
- Number of pumps ✓
- Temperature setpoints ✓
- Pressure setpoints ✓
- Flow setpoints ✓
- Valve positions ✓

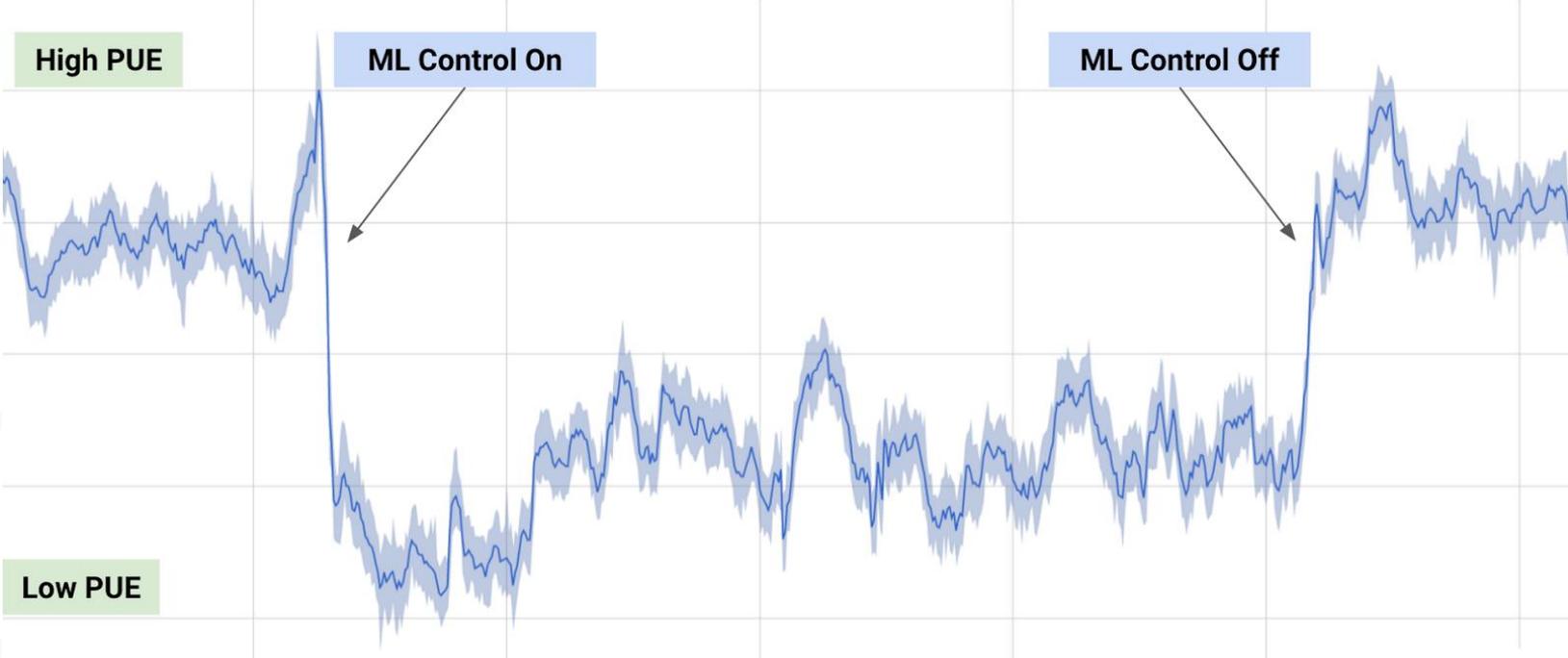
Over 1,200 state variables and 20 actions

General learning frameworks for DC operations

- State inputs**
 - Current IT load
 - Power meters
 - Pressure sensors
 - Temp sensors
 - Weather
 - Fan speeds
 - ...
- Actions**
 - # active coolers
 - # chillers
 - Pumps on/off
 - Temp setpoints
 - Valve setpoints
 - Pressure setpoints
 - ...



DeepMind AI-assisted control improves overall building efficiency by 15%

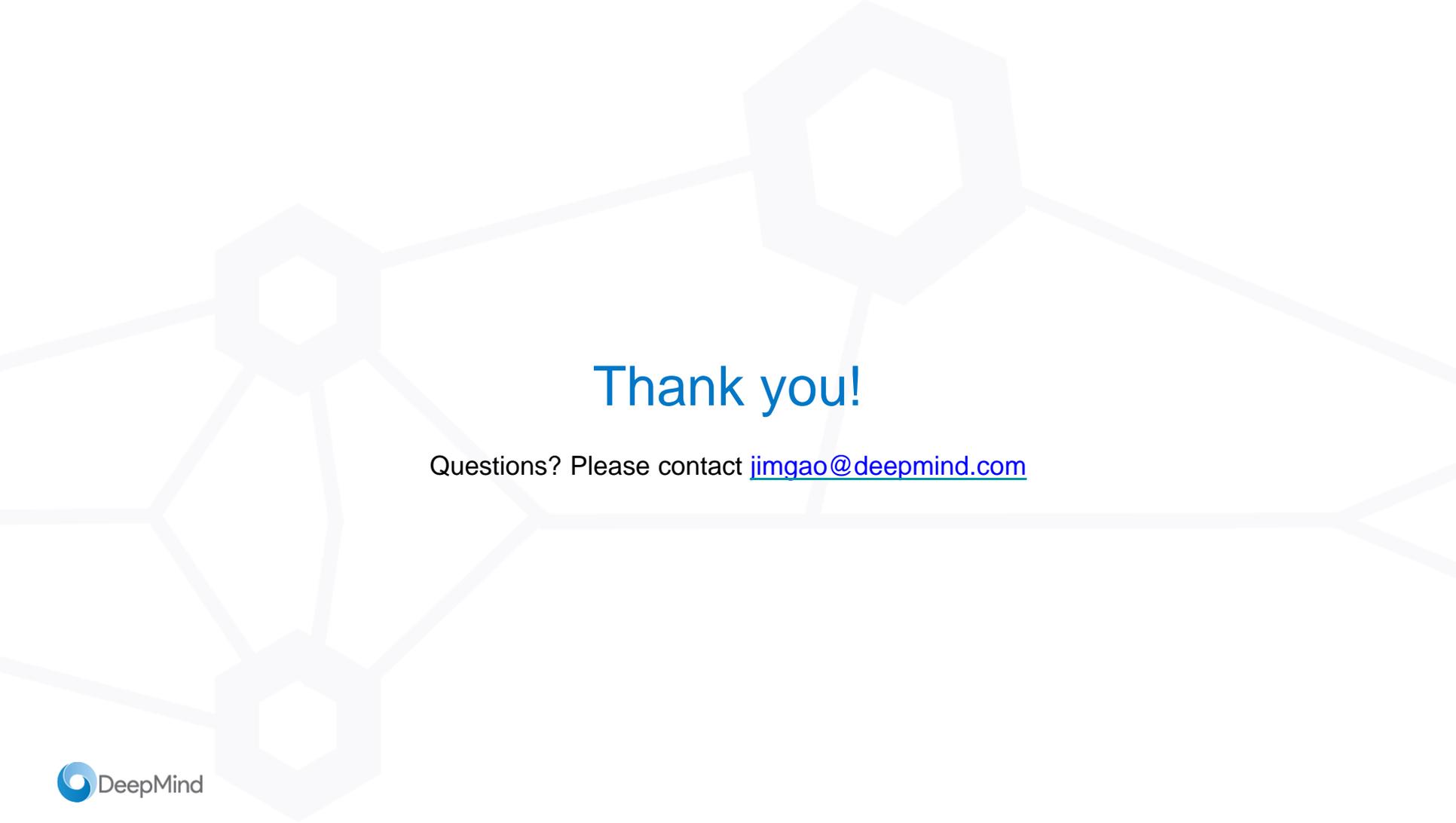


Discovering new knowledge

Insight 1: Spread the load across more equipment

Insight 2: Higher flow is not always better

Insight 3: Shifting the loads can increase flexibility



Thank you!

Questions? Please contact jimgao@deepmind.com