RYDER SCOTT

21st ANNUAL RESERVES CONFERENCE

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MARC SPIELER

Senior Managing Director

NVIDIA

Marc Spieler is Senior Managing Director for the Global Energy Industry at NVIDIA, where he leads business development and go-to-market strategy across oil and gas, renewables, power generation, and utilities. He applies NVIDIA's accelerated computing platforms—including HPC, AI, deep learning, data science, and visualization—to help energy companies accelerate decisions and optimize outcomes.

Prior to NVIDIA, Marc spent 13 years at Halliburton in leadership roles spanning strategic alliances, technology operations, customer financial services, and corporate development. With over 20 years of experience in business development, technology, acquisitions, finance, and operations, he has a strong record of driving innovation and measurable impact.

Marc holds an MBA from Rice University, a Master of Science in Professional Development and Leadership, and a B.S. in Marketing from Winona State University. He is passionate about advancing sustainable energy solutions and building industry ecosystems that create lasting value worldwide.

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AI in Reservoir Engineering and Reserves Assessment

Marc Spieler

Senior Managing Director, Energy at NVIDIA

Pioneering Accelerated Computing and AI

Full Stack, Data Center Scale

6+ Million Developers

62 Million CUDA Downloads

4,000+ Accelerated Applications

20,000+ Inception Startups

The AI Revolution is Here and Accelerating

Perception AI

Speech Recognition
Deep RECSYS
Medical Imaging

Generative AI / Physics AI

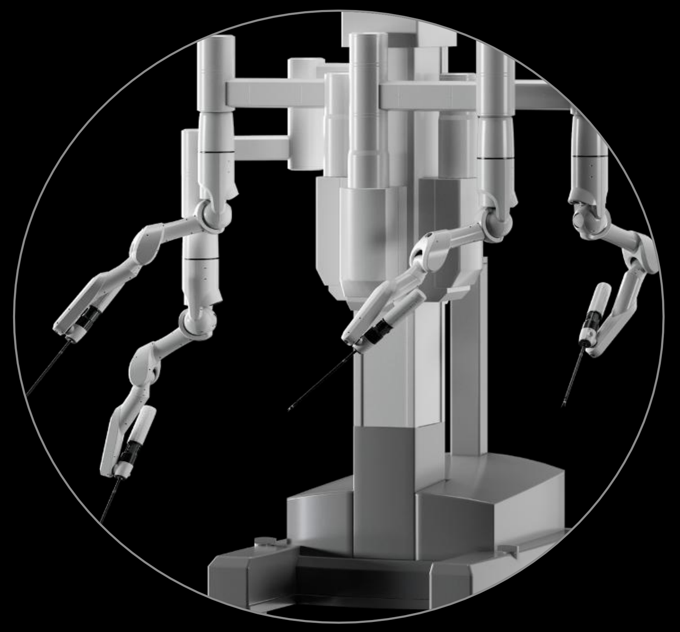
Digital Marketing
Content Creation
Surrogate Models

Agentic AI

Coding Assistant
Customer Service

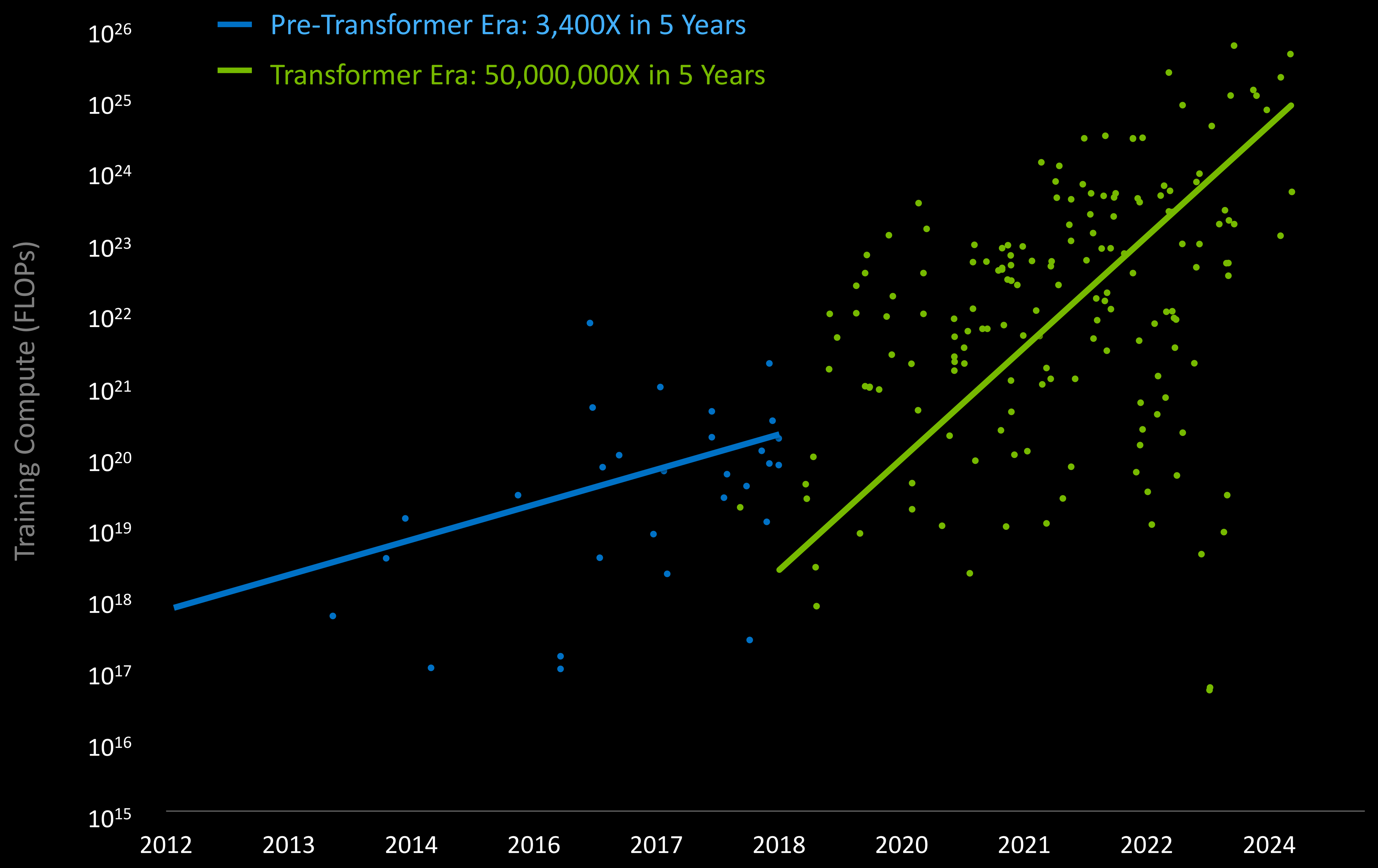
Embodied AI

Self-Driving Cars
General Robotics



Growing Energy Usage in Data Centers

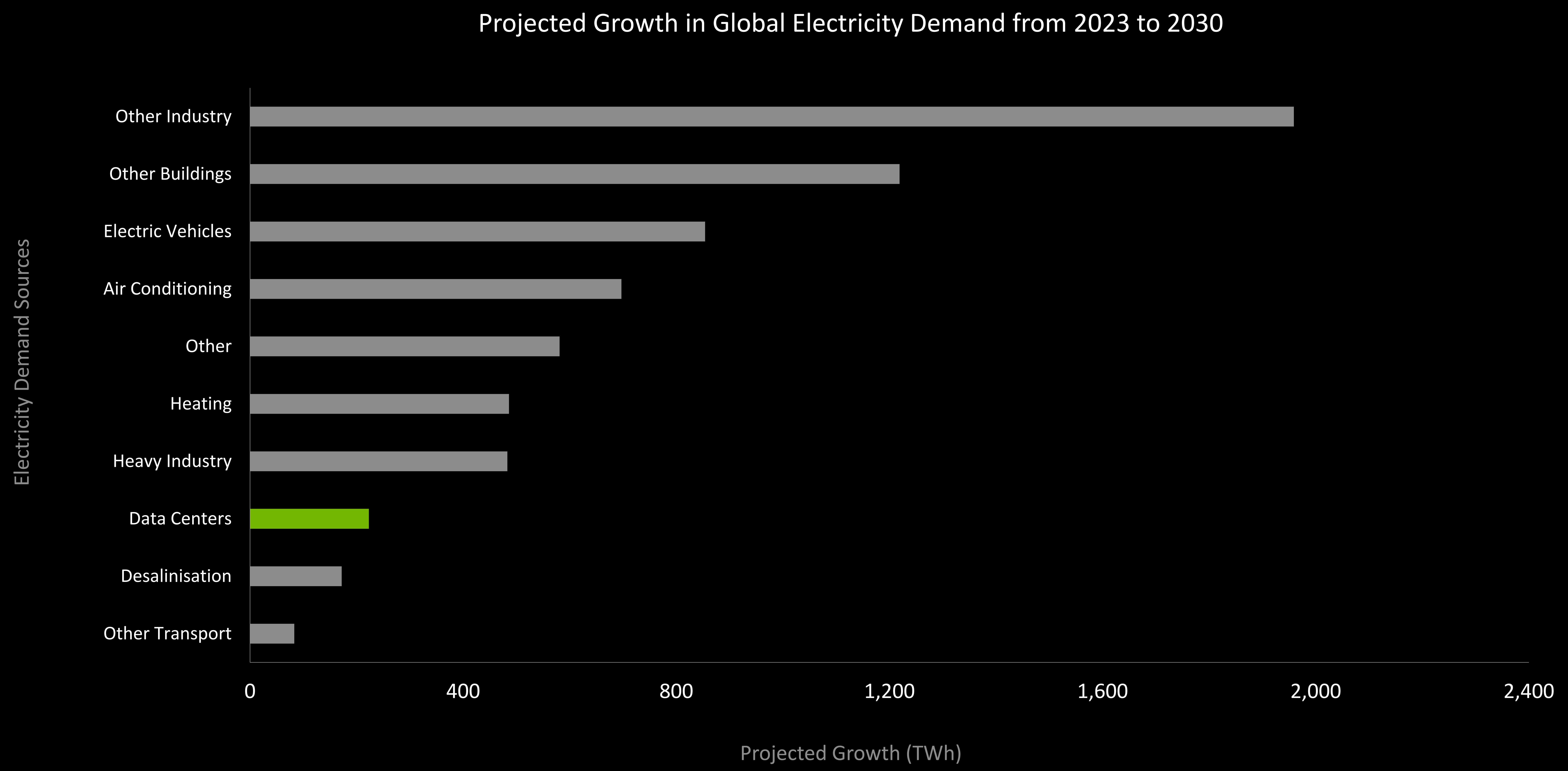
Model Sizes Demanding More Compute



Data Center Electricity Usage	>300 TWh/year
Share of Global Energy Usage	2%
Forecasted Share of Energy Usage	5% by 2030

Source: Model sizes: Github AI Memory Wall, Arxiv papers | Data Center Electricity Usage: IEA Report

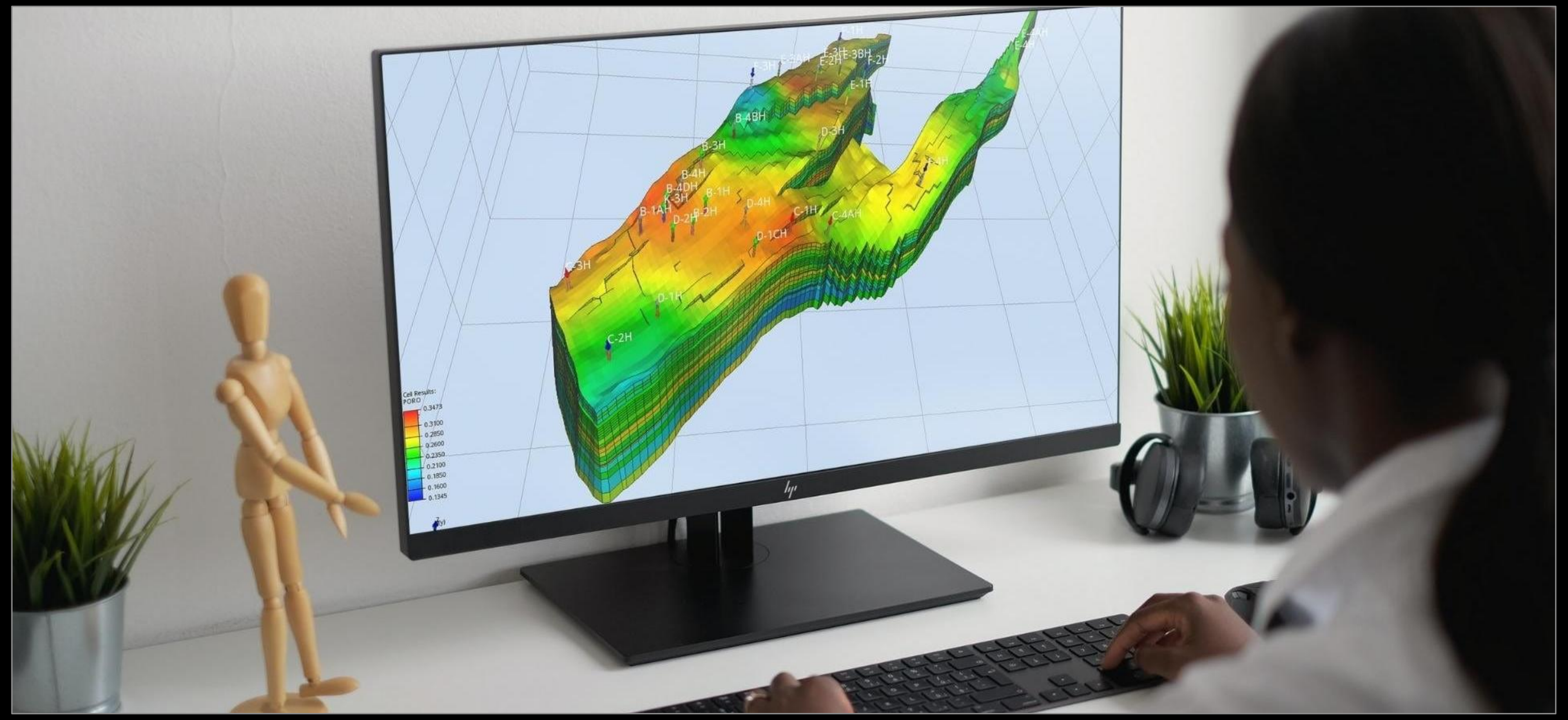
Rising Energy Demand Goes Beyond Data Centers and AI



Source: International Energy Agency (IEA). World Energy Outlook 2024.

Top of Mind for Energy Executives

More Production

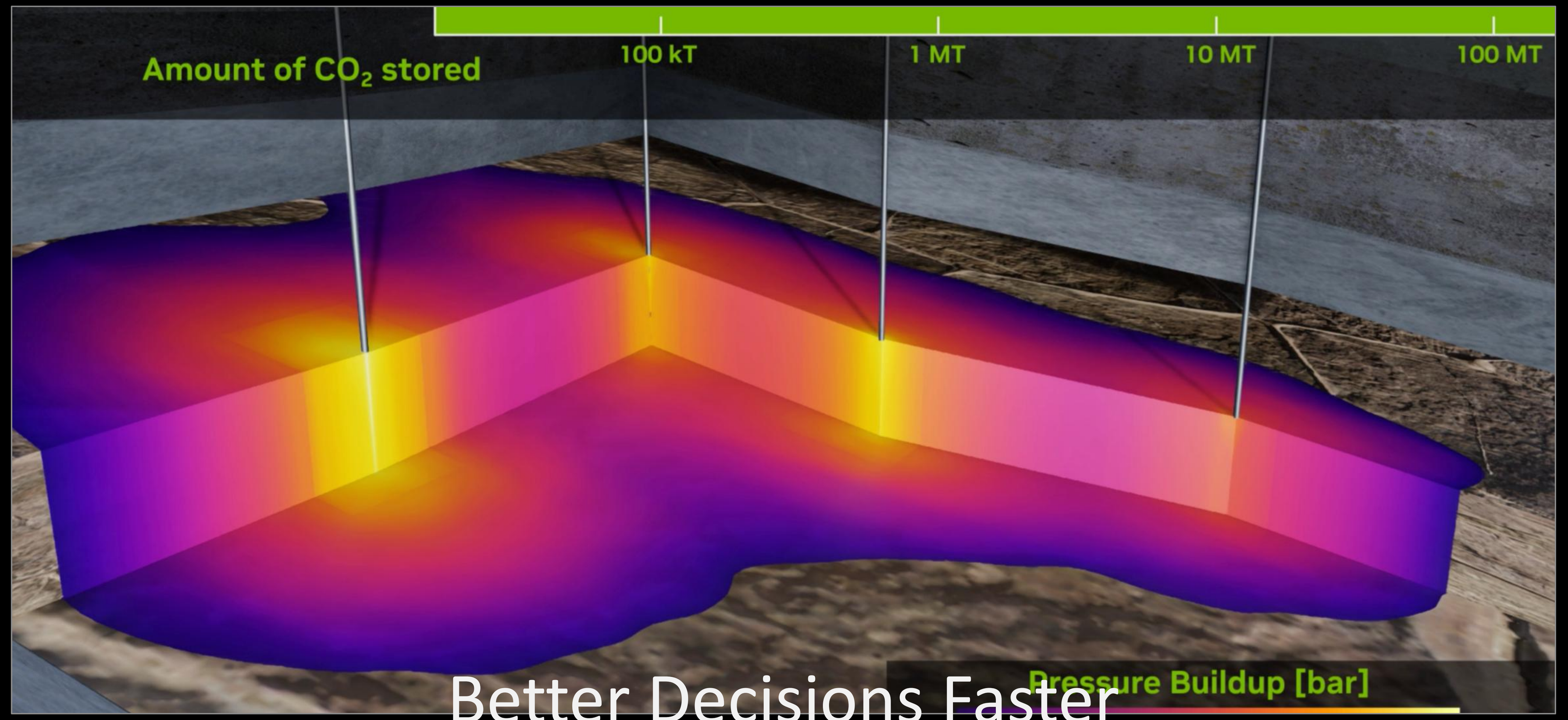


While Reducing Environmental Impact

Lower Cost

Improving Physical Systems at the Margin

Faster Time to Outcomes



Better Decisions Faster

Less Risk

Physical and Cyber Security and Safety

Lower Carbon Footprint

Accelerate Alternative Energy

Why Reliability Matters for Business Value

Stakeholder Confidence

Boards, lenders, and auditors demand consistency and defendability in 1P/2P/3P splits, ensuring transparent and trustworthy financial reporting.

Maintain Value

Re-runs and late changes erode confidence and diminish overall business value. Reliable data processes are crucial for sustained trust.

Achieve Efficiency

Our goal is tighter ranges, fewer surprises, and faster approvals, without compromising PRMS/SEC discipline or regulatory standards.

Applications that Move the Needle

Accelerated Analysis

Faster, governed type-curve and scenario analysis, reducing processing time from days to hours to minutes.

Enhanced Insights

Assisted history matching and connectivity insights to significantly reduce category uncertainty.

Proactive Detection

Earlier detection of breakthrough or under-performance to effectively protect bookings and CAPEX investments.

Partner Proof Points

SLB

- Standardize inputs and narratives with domain AI assistants.
- GPU-accelerated workflows to speed scenario sweeps and AI-assisted history matching.

CMG

- Calibrate physics-guided surrogates from high-fidelity CMG runs
- Pre/post-processing for large ensembles and sensitivity packs.

Shell

- Accelerated subsurface workflows feed better, timelier inputs to reserves assessments.

Stone Ridge Technology

- Leverage native GPU reservoir simulation to generate high-fidelity 'seed' cases.
- Integrate with Physics-NeMo to train fast, physics-aware surrogates.
- Execute large ensemble forecasts with explainable drivers at scale

OriGen.AI

- GPU-accelerated history matching/forecasting packages with clear driver explanations.

From Reservoir Simulation to Decision-Grade Forecasting

High-Fidelity Simulation

Calibrate physics once with high-fidelity simulations.

Physics-Guided Surrogate

Train a physics-guided surrogate (Physics-NeMo/Modulus) that respects conservation, BHP, and PVT.

Data Fusion & Bayesian HM

Fuse with real data and perform Bayesian history matching as new production/pressure arrives.

Ensemble Forecasts

Run ensembles (thousands of what-ifs) to produce a statistically relevant distribution curve to get a P10/P50/P90 with greater certainty.

PRMS/SEC Decision Kit

Package decisions: PRMS/SEC mapping, auditor kit, and CAPEX sequencing recommendations.

RESERVOIR SIMULATION FORWARD AND INVERSE PROBLEMS WITH AI

Use Cases

- Reservoir simulation in energy, CCUS, enhanced oil recovery, water-flooding to boost oil production
- CFD for fluid flow simulation in reservoir, atmospheric flow, wind energy

Challenges

- Solving PDE with numerical solution, need to go through every grid point
- Forming large sparse matrixes during finite volume solution memory intensive

Solution

- AI-accelerated multi-physics simulation framework
- Using AI to solve complex mathematics in the reservoir simulation space

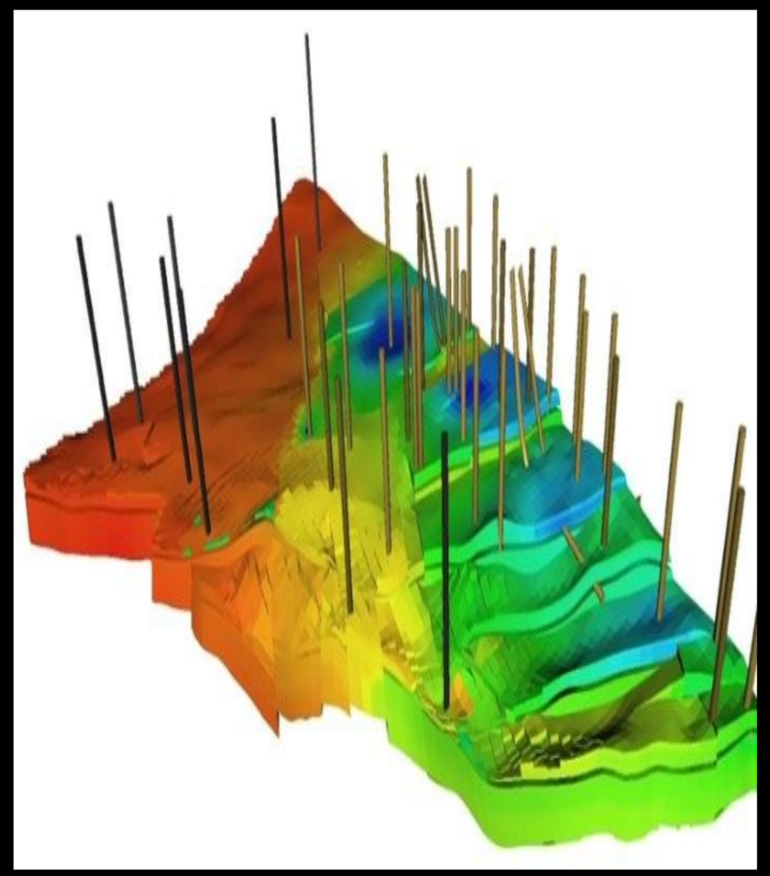
NVIDIA Solution Stack

- Hardware: A100
- Software: NVIDIA Modulus, PyTorch, PyAMGX, CuPy

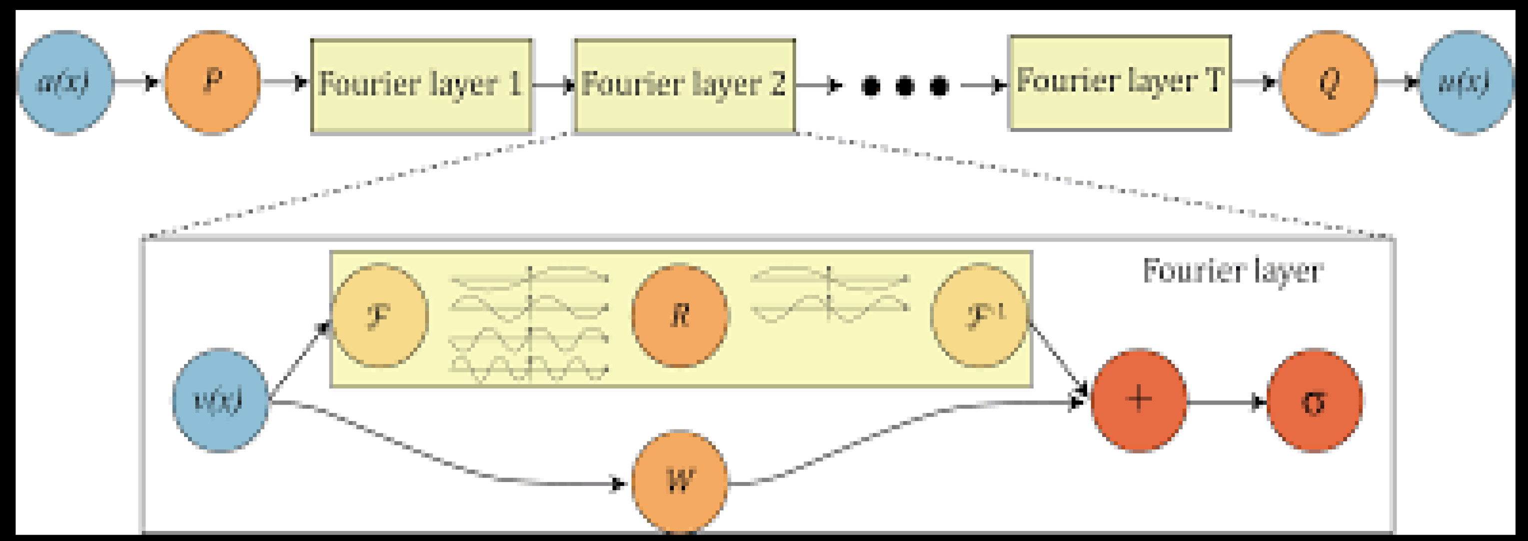
Outcomes

- Orders of magnitude faster, than full-physics approach inferencing is fast and ensemble UQ objectives met in minutes rather than hours

Obtain few *N* data points from finite volume solver



FNO (Fourier Neural operators)



Build surrogate model with *PINO* (FNO + Physics)

Physics

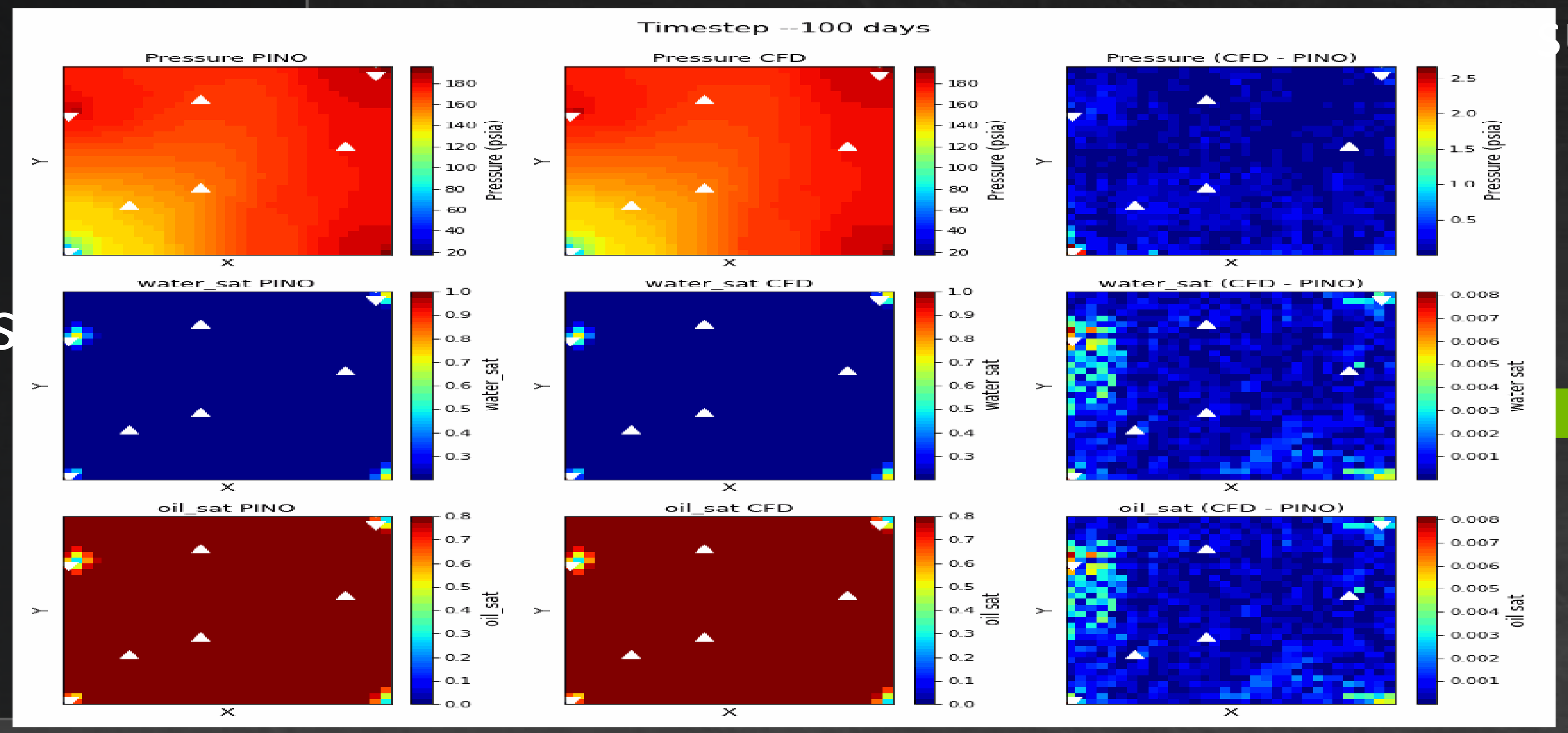
$$\varphi \frac{\partial S_\ell}{\partial t} = \nabla.\left(-K \frac{k_{r\ell}}{\mu_\ell}\left[\nabla p_\ell - \rho_\ell \hat{g} \nabla z\right]\right) + f_\ell \ldots \text{ Eqn.(2)}$$

φ = effective porosity, S_ℓ = phase saturation for water (w) and oil (o), K = absolute permeability,

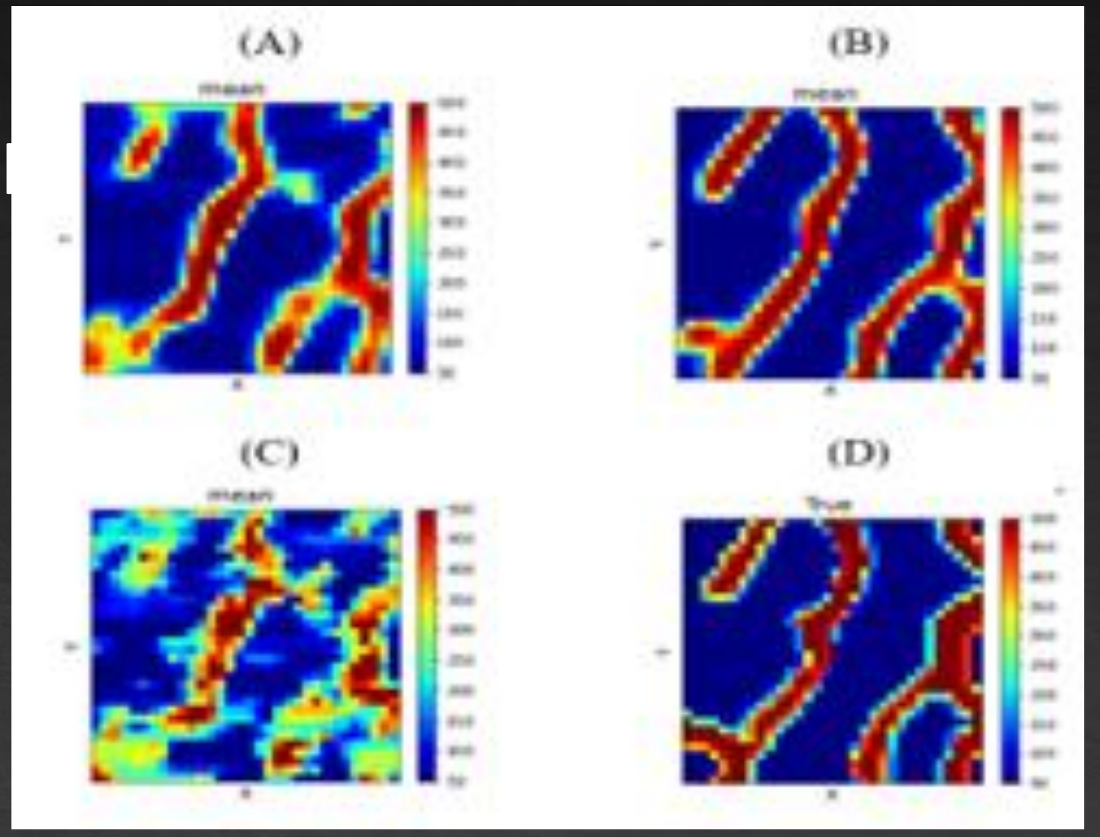
$k_{r\ell}$ = phase relative permeability and a function of the phase saturation, ρ_ℓ = phase density,

μ_ℓ = phase viscosity, $\hat{g}\nabla z$ = acceleration due to gravity. f_ℓ = source and sink terms representing the phase production and injection. The equation is closed by adding auxiliary equations for capillary pressure between oil and water ($p_{cow} = p_o - p_w$) and ($S_o + S_w = 1$).

PINO surrogate for solving the forward problem



Use *PINO* surrogate forward model in an inverse problem workflow



Thank You