MUYE RU, PhD

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A former academic with 10 years of quantitative experience in modeling commodities and weather/climate.
Currently, I develop models and analytics on energy transition and climate to support quant and fundamental analysis at MS.
I look to contribute to analytics that support commodity trading.

PROFESSIONAL EXPERIENCES

Energy-Climate Analytics Lead, Sustainability Insights Lab, Morgan Stanley, NY, USA **Mar 2022 – present**

Firm-wide expert on modeling energy transition and integrating climate analytics via statistics, econometrics, and Machine Learning

- Built a coupled automated system, including an energy supply/demand model, a reduced climate model, weather/climate datasets, and various self-developed algorithms and functions, used to:

  Understand supply and demand of the energy market through forward-looking simulations:

  - Built scenarios for the US power sector with demand for AI data centers, simulating different mix of nuclear, natural gas, and renewables with energy storage. Integrated fundamental views on costs, capacity, and technologies from MS Research. Results include electricity production, consumption, prices, and inter-grid flow by generation technology at the state level.
  - Estimated the demand gap for Sustainable Aviation Fuels by simulating IATA's mandate and Airline's net zero goals, and modeled the supply and demand impacts on different biofuel feedstocks.

  Develop models and analytics magnifying risks from physical climate hazard:

  - Built ML-based company-level models to quantify the sensitivity of company's fundamentals to physical climate hazards. Conducted feature reduction and model selection. Quantify a company's sensitivity compared to peers in each subsector.
  - Contribute to design of the infrastructure for storage and UI for flexible application of spatial data and analytics.
- Collaborate with a Tech team to productionize the tools I built. Obtained a patent as the primary inventor. Conducted 50 demos across MS and with an external client. Lead author of a thought-leadership paper on CCS deployment in US power sector.

ACADEMIC RESEARCH EXPERIENCES

Postdoctoral Research Fellow, The Earth Institute, Columbia University, NY, USA **Oct 2020 – Mar 2022**
PhD Focused on Climate Impacts on Energy and Crop, Duke University, NC, USA **Sep 2016 – Oct 2020**
Independent Consultant, International Institute for Applied Systems Analysis, Austria **June 2019 – June 2022**

Building predicative models on supply and demand of energy and agricultural commodities

- Built a global-scale non-linear regression model of energy consumption as a function of income, population, daily temperature (HDD, CDD) and precipitation at a 30x30km grid-cell-by-day-level. Results allow high precision power demand forecast for any location any day.
- Estimated the relationship between daily temperature extremes and crop yield using two weather datasets, significantly improving the average temperature model. Predicted corn and soybean yields.
- Studied behaviors of 600 oil and gas facilities in response to the methane policy lift using TROPOMI satellite retrievals.
- Simulated various energy policy scenarios, such as the Clean Air Act to evaluate the impacts on the energy sector, the associated emissions, and to model the climate impacts. Attribution analysis of the model uncertainty from natural variability.

Investigating systematic patterns in weather, climate, and teleconnections to understand impacts on commodities

- Tested what sources of weather data, climate projections, and ENSO events have been "priced-in" for weather futures through regressions between historical prices and weather data. Quantified additional premium for February HDD.
- Investigated the relationship between February cooling, polar vortex weakening, teleconnections, and prices of commodities.
- Quantified the amplification of Pacific Northwest wildfires between 2002 to 2018 using satellite retrievals for carbon monoxide.

EDUCATION

Duke University, Durham, NC, USA
PHD IN ATMOSPHERIC SCIENCE, September 2020
MASTER IN ENERGY SYSTEM, May 2016

Peking University, Beijing, China
BACHELOR OF SCIENCE IN EARTH SCIENCE, June 2013
BACHELOR OF ART IN ECONOMICS, June 2013

SKILLS

Programming: Python, R, Linux, Tableau, PowerBI. **Statistics and Econometrics:** regression, time-series analysis, causal inference, Machine Learning, uncertainty quantification. **Commodity and Climate:** global climate model, energy supply/demand modeling, emission/carbon market modeling. **Datasets:** 3-dimensional weather/climate data, satellite data, other alternative data.

SELECTED PUBLICATIONS

Du, X., **Ru, M.**, Almond, D., 2024. Rapid Increases in Methane Emissions from the Oil and Gas Industry. *AEA Conference Paper.*
– Derived O&G activities using satellite data. Compared O&G stock prices before and after a policy lift. Conducted causal inference.

Tao, S., **Ru, M**.,, et al., 2018. Quantifying the residential energy transition in China through a national survey. *Nature Energy*, 3(7), 567.
- Reconstructed spatial-temporal patterns over 30 years from 30,000 samples. Derived residential energy demand model for China.