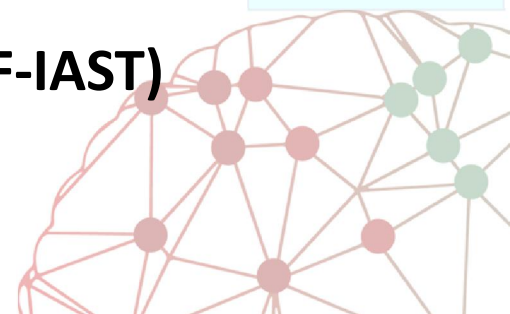
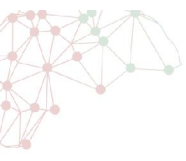




The Role of Artificial Intelligence (AI) in Power System Planning and Operation

**Dr. Sohail Khan, Associate Professor,
Sino-Pak Center for AI,
Pak-Austria Fachhochschule:
Institute of Applied Sciences and Technology (PAF-IAST)
Haripur, Pakistan**



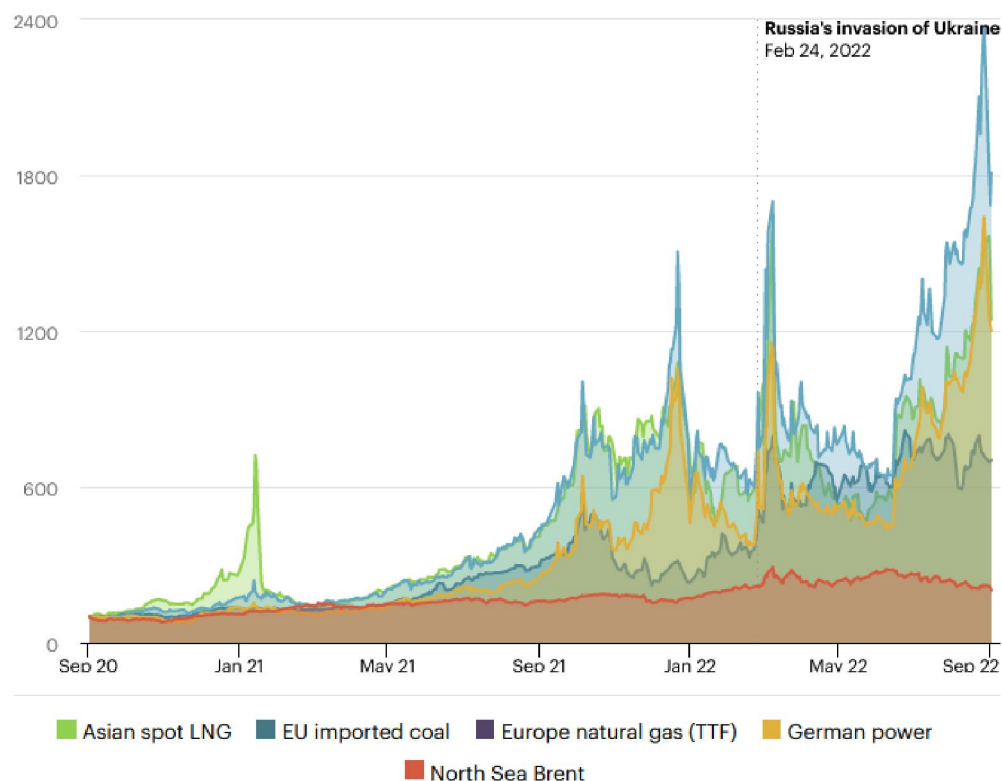


The Global Energy Challenge

The global energy challenge is the increasing demand for energy and the need to reduce greenhouse gas emissions to combat climate change.

Exacerbated by global crisis

Change in key energy prices
Index (1 September 2020 = 100)

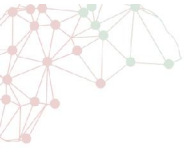




The Global Energy Challenge

- The global temperature has increased by 1.1°C since the pre-industrial period, and it is projected to reach **1.5°C between 2030 and 2052** if current trends continue. (source: IPCC)
- The United Nations estimates that by 2030, climate disasters could cost the global economy **\$54 trillion in economic losses**. (source: UN)
- In 2020, **the United States** alone experienced **22 climate disasters** that each caused over \$1 billion in damages, resulting in a **total cost of \$95 billion**. (source: NOAA)
- According to the World Bank, over **143 million people in Sub-Saharan Africa, South Asia, and Latin America could be displaced** by climate change by 2050. (source: World Bank)

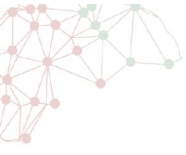




AI and Energy Efficiency

- The ability to use less energy to perform the same task
- How AI can improve energy efficiency in **buildings**, **transportation**, and **industry**?
- Examples of AI applications in energy efficiency: smart thermostats, predictive maintenance, and energy management system





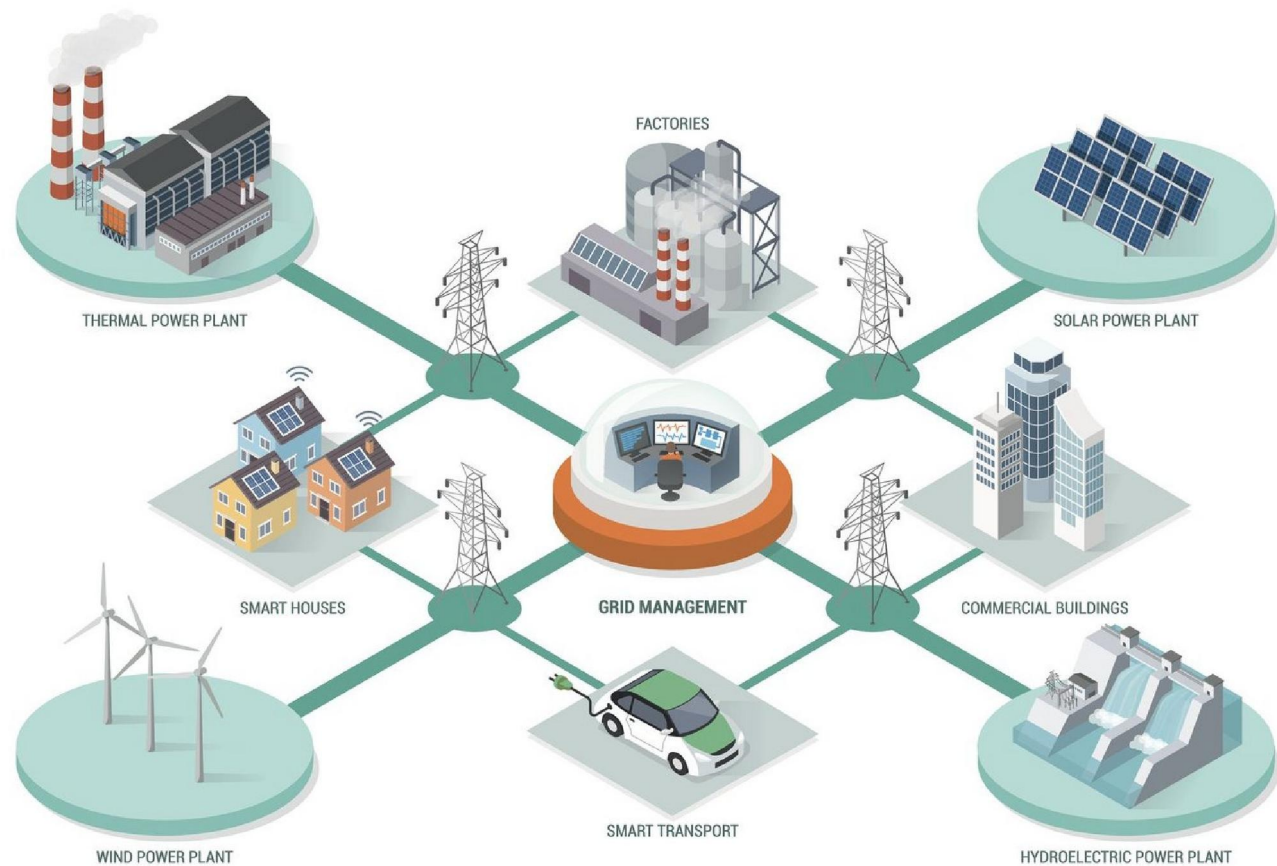
AI and Energy Efficiency

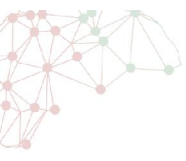
- According to a study by the American Council for an Energy-Efficient Economy (ACEEE), **AI-enabled energy management systems in commercial buildings can reduce energy consumption by up to 20%.** (source: ACEEE)
- A report by the International Energy Agency (IEA) found that AI can help reduce global energy demand by **10-15% by 2040** through improved energy efficiency in buildings, transportation, and industry. (source: IEA)



AI and Renewable Energy Usage

Renewable energy, such as solar, wind, and hydropower, is a critical component of reducing greenhouse gas emissions and achieving net-zero emissions targets.





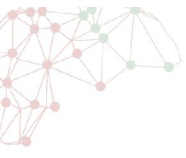
AI for Transforming Energy Grids of Future



 Climate Change AI

Many more ...

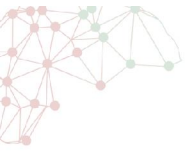




How AI Contribute to the areas of Innovation

- Ref: [G-PST Research Agenda 2021](#)

Research Program	Description
<i>Inverter Design</i>	Development of capabilities, services, design methodologies and standards for IBRs.
<i>Stability Tools & Methods</i>	Development of new tools and methods, as well as modifications or supplements to existing tools and methods, required to ensure reliability, security, and stability in power systems.
<i>Control Room of the Future</i>	Development of new technologies and approaches for enhanced real-time visibility and analysis in power system operator control rooms.
<i>Planning</i>	New planning metrics, methods, and tools to capture the characteristics and influence of a changing resource mix.
<i>Restoration & Black Start</i>	Creating new procedures for black starting and restoring a power system with high or 100% IBR penetrations.
<i>Services</i>	Quantifying the technical service requirements of future power systems to maintain the supply-demand balance reliably and at least cost.





AI-INTERACT

Develop an intelligent energy management system for buildings that actively control energy storage to minimize the energy costs

- Novel forecasting modules to estimate the building energy demand, power availability from grid, PV power forecasts
- Flexible and optimal use of energy storage

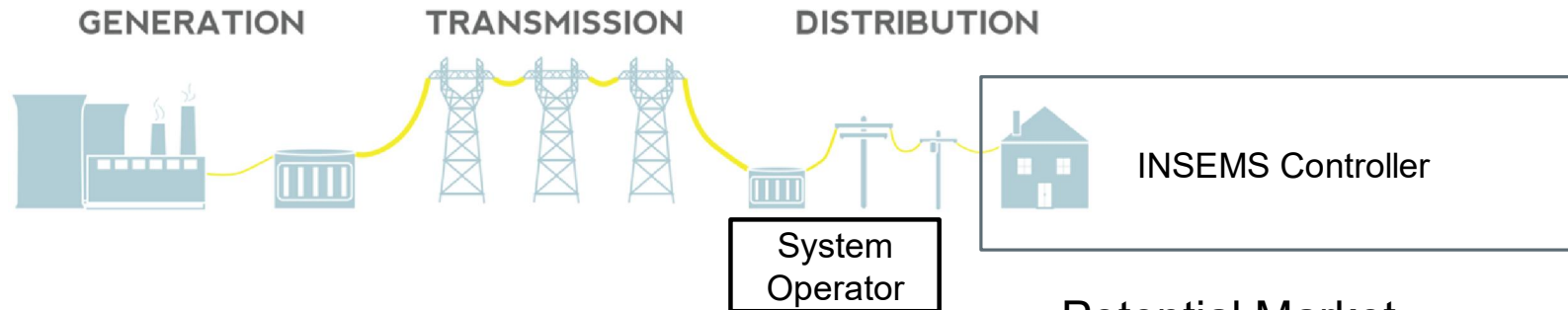


Forecasting
Module

Data Logging
Module

Building
Controller





- Market Competitors



- Potential Market

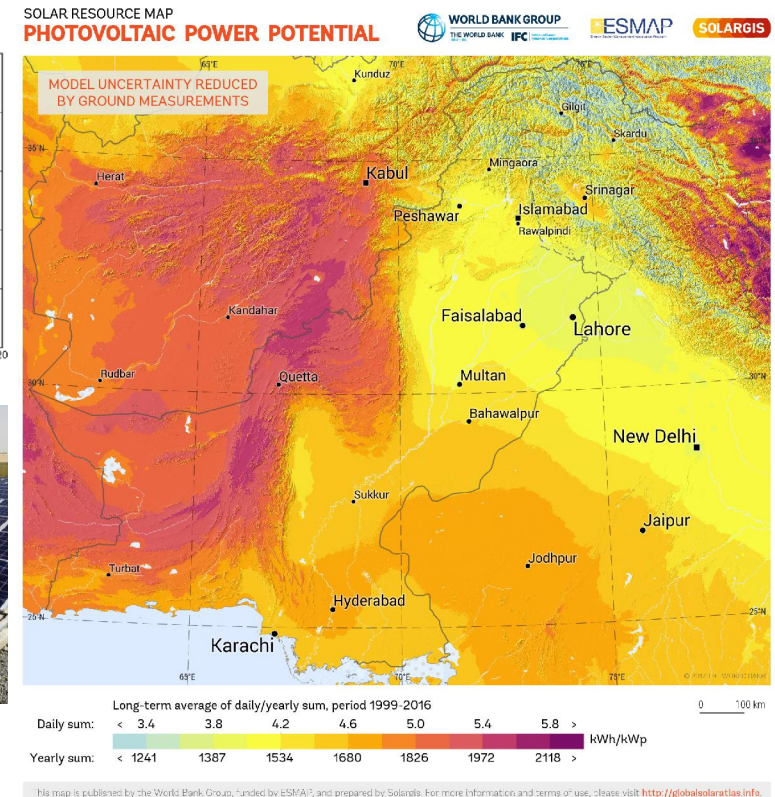
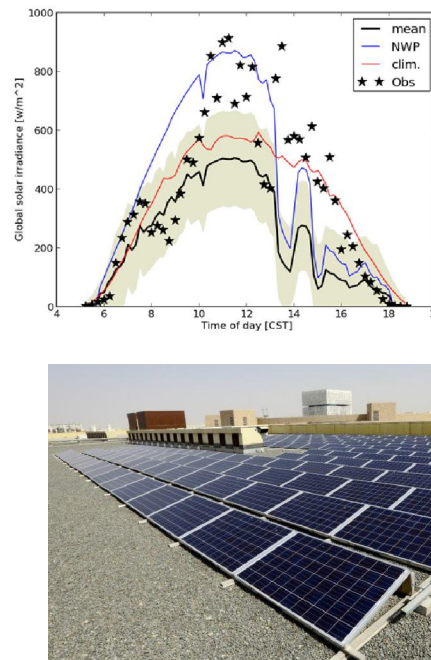
- commercial buildings like utility stores, offices, institutes,
- residential complex having a central energy management facility,
- building in educational institutes.

SMART CITY LAB

AI-SOLARCAST

Develop highly accurate AI-based forecasting tool that provide forecasts of the solar energy specific to the region and geographical coordinates in Pakistan

Impact: Disruptive impact on enabling PV enabled power generation in Pakistan
Budget: 9 Million PKR



© 2019 The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis

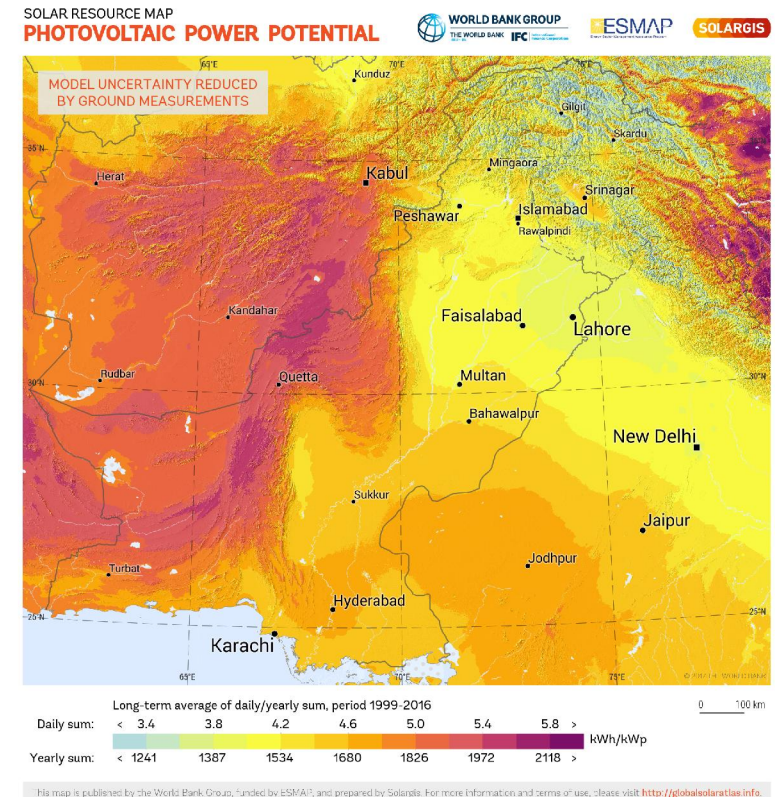
AI-SOLARCAST

Potential Market

- Highly accurate solar forecast as a service for industries and house holds
- Distribution system operators in supporting their operations
- Planning tool to deploy resources

Final Price (Product and Services):

The forecast as a service will be charged as pay-per-use and the desired resolution of the forecast



© 2019 The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis



Thank you!

**Sino-Pak Center for
Artificial Intelligence (SPCAI)**

SPCAI where Science Meets Business!