Scuola di Dottorato in ICT

PhD School in ICT

Research project for a PhD curriculum in ICT – Industrial applications of ICT

**Tutor**: Giovanni Simonini, PhD

**Co-tutor:** Prof. Sonia Bergamaschi

**Proposed Title of the research:**

Big Data and Artificial Intelligence for Energetic Virtuosity in Local Energy Communities

**Keywords: (5)**

Big Data, Energy Data, Data Integration, Stream Processing, Machine Learning.

**Research objectives:**

According to the strategic plan Horizon Europe 2021-2024, one of the fundamental objectives for climate, energy and mobility is the development of new solutions for the intelligent management of production, distribution and consumption of energy.

In full line with these guidelines, the goal of the PhD project is the definition of a Big Data architecture for the intelligent management and analysis of Local Energy Community (LEC) data, which aims at enhancing the energy virtuosity of communities of users. The identified solution shall integrate AI algorithms to forecast LEC consumption to support community regulatory policies (e.g., to define rules underlying smart contracts). As a matter of fact, these policies are dynamically determined based on intelligent monitoring of the state of the grid and on the forecasting of energy consumption, storage and production.

**Proposed research activity**

Expected activities (not limited to):

* Study of the state of the art:
  + software architectures, techniques and methodologies for the management and integration of heterogeneous and voluminous data, both static and dynamic (e.g., sensors data, weather data, energy consumption data, etc.)
  + AI and machine learning for the management of energy communities.
* Design and analysis of the requirements for the development of a Big Data management and analysis platform for LEC.
* Definition of AI algorithms for the prediction of energy consumption and LEC user behaviour.
* Prototype development for experiments within public partner entities (ENEA) and industrial partners (DataRiver and Energy Intelligence).

**Supporting research projects (and Department)**

DIEF UniMoRe

Regione Emilia Romagna  
ENEA project: “Tecnologie per la penetrazione efficiente del vettore elettrico negli usi finali”

**Possible connections with research groups, companies, universities.**

* AT&T Bell Labs - prof. Divesh Shivrastava
* Computer Science Potsdam University - prof. Felix Naumann
* Enea
* DataRiver S.r.l. (Modena)
* Energy Intelligence S.r.l. (Bologna)