

GEM-Analytics: Cloud-to-Edge AI-Powered Energy Management

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Combine Heat and Power (CHP) Systems

Energy consumption analysis:

- Data collection and analysis
- Forecast of the exported energy (produced and consumed)
- Several inputs (environmental, economic and operational)
- Errors in the energy production prediction
- **Objective**: cost reduction

Issues in CHPs:

- Data manually collected
- Large amount of data from several devices
- Off-line procedures
- No prediction





Figure: "IoT and Predictive Analytics: Fog and Edge Computing for Industries versus Cloud"

Computation and data closer to things

- Reduction of data traffic
- Low latency



Energetic analysis

- Huge amount of data generated by IoT devices and smart meters
- Displace processing tasks among cloud to edge continuum
- AI methods at the edge

GEM-Analytics



FogAtlas: https://fogatlas.fbk.eu/



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Main Operations

Once data have been collected:

- Future hourly prices of selling and buying energy
- Efficiency curve of every equipment involved in the CHP
- Forecasted amount of energy (electricity and steam)
- Select the best economic balance that minimise the overall cost



Case Studies Pharmaceutical Factory











Outcomes: Use case 1

	Gas	Electricity	White Cert.	CO2	Total
Current (€)	335.26K	-75.31K	-166.23K	56.11K	149.84K
Suggested (\in)	356.75K	-103.22K	-174.79K	61.97K	140.71K
Saving (%)	-6.41%	37.05%	5.15%	-10.43%	6.09%

	Edge to cloud avg throughput (Mbps)	Analytic avg response delay(ms)
Cloud solution	0.538	53.92
Fogatlas	0.044	3.61
Reduction (%) 91.82%	93.30%



Outcomes: Use case 2

	Gas	Electricity	White Cert.	Total
Current (€)	132.02K	3.08K	-41.50K	93.57K
Suggested (\in)	161.73K	-21.64K	-56.95K	83.14K
Saving (%)	-22.50%	810.10%	37.23%	11.15%

	Edge to cloud avg throughput (Mbps)	Analytic avg response delay(ms)
Cloud solution	0.818	58.25
Fogatlas	0.051	4.88
Reduction (%) 93.76%	91.62%



Conclusions

- > Problem: energy analysis for the cost reduction of CHP energy management
- > Proposed solution: Predictive and real-time solution
- > New Platform: exploit the cloud to edge continuum
- ▶ **Results:** Significant cost reduction



Future Works

- Different scenarios: retail scenario
- **Different analysis:** different parameters to analyse
- **Fog Computing:** IoT data management

