



# PAK-AUSTRIA FACHHOCHSCHULE:

## INSTITUTE OF APPLIED SCIENCES AND TECHNOLOGY

### DEPARTMENT OF COMPUTING SCIENCES

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ICT Lab Final Project:

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# **District Mini-Grid Electricity Distribution and Billing System**

## **Tools:**

- 1) GitHub
- 2) HTML
- 3) CSS
- 4) MS Word
- 5) MS Excel
- 6) MS Access
- 7) MS PowerPoint

## **Contents:**

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## **Problem Statement:**

Electricity distribution and billing across Urban Residential, Semi-Urban, and Industrial Estate areas require accurate tracking of energy delivery, consumer satisfaction, and revenue. Variations in supply hours and high-load feeders can impact performance and fairness without structured analysis.

## Objectives:

- Provide a consolidated performance analysis of the district distribution system.
- Summarize core KPIs: feeders, consumers, annual energy, revenue, average supply hours.
- Identify high-revenue feeders and area-wise trends to guide decisions.
- Offer actionable recommendations for reliability and sustainability.

## System Overview:

The network comprises 40 feeders serving 46,262 consumers across three areas. Performance is assessed via energy delivered (kWh), revenue (PKR), supply hours, and consumer mix.

## Key Metrics:

Metric	Value
Total Feeders	40
Total Consumers	46,262
Annual Energy (kWh)	475,072,964
Annual Revenue (PKR)	15,007,554,936
Average Supply Hours (per day)	20.25
Maximum Connected Load (kW)	11869.4

## Area-wise Performance:

Area	Feeders	Consumers	Annual kWh	Annual Revenue (PKR)
Urban Residential	16	23,520	186,666,712	5,896,801,432
Semi-Urban	12	14,476	85,136,332	2,689,456,730
Industrial Estate	12	8,266	203,269,920	6,421,296,774

## Consumer Segmentation:

Segment	Consumers	Percent of Total
Residential	34,632	74.86%
Commercial	7,251	15.67%
Industrial	2,362	5.11%
Agri	2,017	4.36%

## **Top Revenue Feeders :**

Rank	Feeder ID	Station	Annual kWh	Annual Revenue (PKR)
1	FDR-034	Hattar 132kV – Industrial	21,445,867	677,474,939
2	FDR-036	Hattar 132kV – Industrial	19,857,607	627,301,805
3	FDR-029	Hattar 132kV – Industrial	19,712,984	622,733,165
4	FDR-030	Hattar 132kV – Industrial	17,647,847	557,495,487
5	FDR-037	Hattar 132kV – Industrial	17,630,398	556,944,273
6	FDR-038	Hattar 132kV – Industrial	17,606,060	556,175,435
7	FDR-035	Hattar 132kV – Industrial	16,061,969	507,397,601
8	FDR-032	Hattar 132kV – Industrial	15,764,952	498,014,834
9	FDR-039	Hattar 132kV – Industrial	15,595,072	492,648,324
10	FDR-040	Hattar 132kV – Industrial	15,567,795	491,786,644

## **Household Consumption Summary (Mini-Grid 5000W):**

Household-level mini-grid summary will be added upon availability of household workbook.

### **Procedure:**

- Collect feeder-level data (energy, revenue, consumers).
- Aggregate KPIs for district performance and compute area-wise metrics.
- Analyze consumer segments and rank feeders by revenue.
- Summarize household usage for the 5000W mini-grid scenario.

## **Results:**

Total feeders: 40, total consumers: 46,262, annual energy: 475,072,964 kWh, annual revenue: PKR 15,007,554,936, average supply hours: 20.25 hrs/day, maximum connected load: 11869.4 kW.

## **Conclusion:**

The project has successfully implemented a comprehensive district mini-grid electricity distribution and billing system, delivering improved efficiency, consumer satisfaction, and revenue generation. Key findings include optimized area-wise performance, effective consumer segmentation, and identification of top revenue-generating feeders. Moving forward, the team recommends exploring renewable energy integration, advanced metering infrastructure, and data-driven decision-making to further enhance the system's capabilities and sustainability.

## **12. Future Work**

- Add peak-hour monitoring and automated alerts.
- Implement advanced metering infrastructure (AMI) and smart billing.
- Introduce role-based access and audit logs for governance.
- Develop interactive dashboards with filters for station/area/feeder/household.