Case Study: Textile Dyeing VAT Energy Optimization

GIBES INOV – Industrial Automation & Energy Engineering

Industry Overview

The textile sector is one of Pakistan's largest industrial energy consumers, contributing nearly 60% of the country's total exports. Dyeing processes, particularly VAT dyeing, are known to be energy-intensive due to continuous heating, steam consumption, and motor-driven agitation. Inefficient control significantly increases energy cost, steam losses, and batch inconsistency. Studies across Pakistan's textile hubs (Faisalabad, Lahore, Karachi) indicate that VAT dyeing energy waste ranges from 15–25% in factories lacking automation and optimized controls.

Client Profile

A major Pakistani textile dyeing facility operating 34 dyeing vats reported high electrical and thermal energy wastage. Their legacy motor control and open-loop temperature regulation resulted in unstable dyeing curves and frequent reprocessing losses.

Objective

GIBES INOV was engaged to:

- Reduce per-vat electrical energy consumption.
- Stabilize temperature profiles for higher batch quality.
- Modernize the control system with an ROI-driven, low-cost automation upgrade.

Key Metrics

Metric	Before GIBES INOV	After GIBES INOV	Result
Energy Consumption (per vat/month)	10,500 kWh	8,610 kWh	18% Re
Payback Period	N/A	7 Months	ROI A
Batch Quality Variance	±4°C	±1°C	High Co

Problem & Operational Constraints

The facility operated with:

- Outdated three-phase induction motors running at fixed speed irrespective of load.
- Steam-valve systems unable to maintain consistent temperature, causing thermal overshoot.
- High peak load demand due to unregulated motor acceleration.
- No real-time monitoring of energy or process parameters.

These constraints led to monthly wastage of 1,500+ kWh per vat, increased re-dyeing cycles, and unnecessary steam bleed-off.

GIBES INOV Solution Architecture

GIBES INOV deployed a fully integrated automation and energy optimization system using industry-proven techniques aligned with modern textile engineering benchmarks.

Hardware Layer

- High-efficiency Variable Frequency Drives (VFDs) with soft-start capability.
- Industrial-grade PT100 RTD temperature sensors (Class A).
- Delta PLC (DVP series) and HMI for local monitoring.

Control Logic Layer

- Closed-loop PID temperature control with adaptive gain tuning.
- Real-time motor speed modulation based on vat load, fluid level, and dyeing stage.
- Steam valve modulation using pulse-width thermal regulation to eliminate overshoot.

Data Layer

- HMI displays for:
  - Instantaneous energy consumption
  - Batch temperature curves
  - Motor load graphs
- Automated audit logs exported for monthly energy analysis.

Deliverables

- Updated single-line diagrams and electrical schematics.
- Calibrated control loops with optimized PID values.
- Pre- and post-implementation energy audit report.
- On-site operator training and maintenance guidelines.

Implementation Timeline

- **Week 1–2:** Factory survey, energy baseline mapping, hardware procurement.
- **Week 3–5:** Installation, PLC programming, sensor calibration.
- **Week 6–7:** System testing, optimization tuning.
- **Week 8:** Final audit, documentation, handover.

Outcome & Impact

The implemented solution delivered:

- 18% electricity savings validated through metering.
- Improved thermal stability with highly predictable dyeing results.
- Reduction in reprocessing batches by 22%.
- ROI within 7 months, making it one of the fastest-payback upgrades for textile dyeing units.

About GIBES INOV

GIBES INOV specializes in industrial automation, mechatronics solutions, and high-impact energy optimization across Pakistan and Europe. Our approach blends engineering expertise with ROI-driven strategy to deliver measurable performance improvements.