**📄** Week 5 – CI/CD Automation with Azure DevOps

CI/CD Automation Overview

Continuous Integration (CI) and Continuous Deployment/Delivery (CD) are practices that automate code integration, testing, and deployment.  
For the **Smart Home Energy Usage Tracker**, CI/CD ensures that the **energy reports are generated, cleaned, and delivered automatically** every week without manual intervention.

Automation brings:

* Faster report generation
* Reduced manual errors
* Scalability for handling larger energy datasets
* Alerts and monitoring for abnormal energy consumption

**Pipeline Flow for Energy Report Generation**

1. **Data Fetching Stage**
   * The pipeline connects to data sources (CSV, API, sensor logs).
   * New logs are automatically pulled into the system.
2. **Data Cleaning Stage**
   * Remove missing or malformed records.
   * Standardize formats (timestamps, energy\_kwh as float).
3. **Summarization Stage**
   * Aggregate daily and weekly usage per device and room.
   * Generate summaries in CSV or Delta format.
4. **Report Generation Stage**
   * Generate an output file (CSV/Excel/PDF) with usage statistics.
   * Save results for dashboards or send via email notifications.

**Threshold Alerts**

* Business rule: *If any device consumes more than 10 kWh in a day, trigger an alert*.
* The pipeline includes a **conditional step** to check daily usage.
* If threshold exceeded → log entry is created or an automated email notification is sent to the user/admin.
* Helps in **early detection of energy wastage**.

**Sample Azure DevOps Pipeline YAML**

*trigger:*

*- main*

*schedules:*

*- cron: "0 0 \* \* 0" # Run every Sunday at midnight*

*displayName: Weekly Energy Report*

*pool:*

*vmImage: 'ubuntu-latest'*

*steps:*

*- task: UsePythonVersion@0*

*inputs:*

*versionSpec: '3.x'*

*- script: |*

*pip install pandas numpy*

*python scripts/clean\_data.py*

*python scripts/generate\_report.py*

*displayName: 'Run Data Cleaning and Report Generation'*

*- script: |*

*python scripts/check\_threshold.py --limit 10*

*displayName: 'Check Threshold Alerts'*

*- task: PublishBuildArtifacts@1*

*inputs:*

*pathToPublish: 'reports/'*

*artifactName: 'EnergyReports'*

**Execution Log (Example)**

* ✅ Data fetched from energy\_usage.csv
* ✅ Missing records cleaned
* ✅ Daily/weekly summaries generated
* ⚠ Alert: Device **AC** consumed **12.3 kWh** on *2025-08-01*
* ✅ Report saved in /reports/weekly\_energy\_report.csv

**Final Deliverables**

1. **Azure DevOps Pipeline YAML** (automation definition)
2. **Execution Log** (showing pipeline steps and alerts)
3. **Report Output** (CSV/Excel/PDF for dashboards/alerts)