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TITLE :

Bangalore Utilities Consumption and Sustainability Dashboard Full Stack Project

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INTRODUCTION

Bangalore, one of India's fastest-growing cities, faces increasing pressure on its **water and electricity** resources.

💡 This project introduces a **smart dashboard** to track, analyze, and optimize utility consumption in **real time**.

🌍 It aligns with the **UN Sustainable Development Goals (SDGs)**, promoting **efficient resource use, transparency**, and **data-driven decision making**.

📊 By combining **IoT**, **predictive analytics**, and **interactive simulations**, the dashboard empowers **citizens, utilities**, and **policymakers** to build a **sustainable urban future**.

Why We Chose This Project

Urban Relevance

Bangalore faces real urban challenges—**water scarcity**, **power outages**, and **rapid population growth**—making it ideal for a smart utilities solution.

Data Accessibility

Open data and APIs from **BWSSB**, **BESCOM**, and **climate sources** enabled a real-time, analytics-driven approach.

🌐 **SDG Impact**

We aligned the project with key Sustainable Development Goals:

- **SDG 6** –Clean Water
- **SDG 7** – Affordable & Clean Energy
- **SDG 11** – Sustainable Cities & Communities
- **SDG 13** – Climate Action

Full-Stack & Tech Focused

The project combines **IoT**, **machine learning**, **geospatial analytics**, and **dashboard design**, offering a real-world platform to apply full-stack dev skills.

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System Architecture & Key Technologies

Full Stack Architecture

- **Frontend**: React.js – responsive and dynamic UI
- **Backend**: Node.js – API handling and logic
- **Hosting**: Vercel – fast, serverless deployment

Data Integration

- Real-time data from **BWSSB**, **BESCOM**, and **IoT sensors**
- **Climate APIs** for weather-aware resource planning

Geospatial Analysis

- **Leaflet.js** for interactive maps
- Zone-wise heatmaps to detect leaks and prioritize action

User roles:

- **Citizens** 👥 → Access personalized usage stats, conservation tips
- **Utility Providers** ⚙️ → Leak maps, non-revenue reports, predictive maintenance
- **Policymakers** 🏛️ → SDG dashboard, investment forecasts

Data access secured via **JWT-based authentication** and **Firebase Auth**

Audit logging through **MongoDB + LogDNA API**

Intelligence & Sustainability Features

➔ Simulation & Forecasting

- ➔ **Technologies:** Python, SciKit-Learn
- ➔ Built machine learning models to simulate **scenarios** like:
  - ◆ **Population growth**
  - ◆ **Water conservation efforts**
  - ◆ **Energy demand surges**
- ➔ Trained on historical utility data and climate patterns.
- ➔ Uses **open government datasets** + **climate APIs (Open-Meteo API / Climate Data API)** for real-world parameter tuning.

➔ Dashboards & Analytics

- ➔ **Platform:** Power BI
- ➔ Interactive dashboards for:
  - ◆ Real-time **utility usage** (water & electricity)
  - ◆ Zone-wise heatmaps (via **Leaflet.js** + **BWSSB geospatial data**)
  - ◆ Trend analysis (daily/monthly/yearly)
- ➔ SDG tracking using custom visuals and filters
- ➔ Integrated with **BWSSB + BESCOM APIs** to fetch live data

FEATURES

Real-Time Utility Monitoring: IoT-powered tracking of BWSSB water and BESCOM electricity consumption

SDG Progress Tracking: Automated alignment with UN Sustainable Development Goals 6 (Water) & 7 (Energy)

Geospatial Analysis: Zone-wise heatmaps for targeted resource allocation and leak detection

Scenario Simulation: Predictive modeling for conservation measures and climate scenarios

Stakeholder Engagement: Role-based insights for citizens, utilities, and policymakers

Sustainability Scoring: Composite metrics combining consumption efficiency and SDG compliance

Impact Measurement: Targeting 15% water reduction and 20% renewable energy increase

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SDG INTEGRATION

Our Urban Sustainability Intelligence Platform is designed to directly support and align with the United Nations Sustainable Development Goals (SDGs). Each feature of the platform contributes to data-driven decision-making, sustainable infrastructure, and smarter urban living.

SDG	Goal Title	How Our Project Contributes
6	Clean Water & Sanitation	Tracks water usage, detects wastage, simulates conservation, supports efficient water governance
7	Affordable & Clean Energy	Monitors energy consumption, supports solar adoption, forecasts demand
11	Sustainable Cities & Communities	Enables urban resilience via data analytics, policy simulation, and citizen engagement
13	Climate Action	Provides emission metrics, climate insights, and supports adaptive planning

CONCLUSION

This project exemplifies how innovative technology and data integration can transform urban infrastructure, leading to smarter, more sustainable cities. Below are the key pillars that define our solution:

- **Scalable, data-driven approach addressing water and energy challenges in Bangalore.**
- **Targets a 30% reduction in water wastage and a 25% improvement in energy efficiency.**
- **Employs advanced analytics through IoT, machine learning, and geospatial mapping.**
- **Delivers real-time visualization and interactive dashboards for diverse stakeholders.**
- **Provides a replicable model for sustainable urban solutions in other smart cities.**
- **Aligns with key SDGs, promoting clean water, clean energy, sustainable cities, and climate action.**

Our final goal is to transform urban infrastructure using data-driven innovation to build smarter, more sustainable cities—explore our demo at https://bescom-bwssb.vercel.app/.

RESEARCH PAPERS USED

Resource	Type	Focus	Key Feature
Geckoboard	Dashboard	Corporate	Visual KPI tracking
Asia-Pacific Tool	Framework	Regional	Localization strategies
India PIB	Report	National	Policy implementation
Glynt	Tech Stack	Data	AI extraction tools
Goal Tracker	Visual Tool	Global	Interactive SDG tracking
UN Statistics	Database	Official	Global SDG indicators
New Relic	Corporate	ESG	Real-time monitoring
Green Developer	Software	Dev Tools	Code efficiency metrics
SoPact	Method	Alignment	Target-indicator mapping
SDG Indicators	Reference	Measurement	Official metrics list
India SDG Index	Framework	National	Localized benchmarking