One-Page Bio Summary

Founder, Nirav H. Poptani & Associates
Visionary behind ProCTech Transformation – Process | Compliance | Technology

About Nirav H. Poptani

CA Nirav H. Poptani is a forward-thinking Chartered Accountant and founder of *Nirav H. Poptani & Associates*, a consulting and advisory firm that bridges the gap between financial governance and emerging technologies. With over a decade and a half of professional experience across risk management, internal audit, and technology integration, Nirav has worked extensively with organizations in fintech, hospitality, manufacturing, and infrastructure sectors to enhance transparency, compliance, and performance efficiency.

Nirav's approach blends financial discipline with innovation by helping organizations move *beyond compliance* toward data-driven decision-making. His work focuses on embedding analytics, automation, and real-time monitoring into business processes to create intelligent, self-improving control environments.

About ProCTech

ProCTech, a strategic initiative founded by Nirav, stands for **Process, Compliance & Technology** – a next-generation consulting framework that integrates audit intelligence with digital transformation.

Under ProCTech, the firm develops and deploys **technology-driven governance solutions**, combining domain expertise with analytical tools such as **Caseware IDEA, Power BI, RPA frameworks, and process dashboards**. These solutions empower organizations to:

- Continuously monitor critical operations and detect anomalies in real-time.
- Automate routine financial and compliance checks through smart scripting.
- Build insightful dashboards that transform complex data into actionable intelligence.
- Strengthen control systems through predictive and preventive analytics.

ProCTech's mission is to create **intelligent, measurable, and technology-embedded processes** that not only assure compliance but also drive strategic value and resilience.

Nirav's Areas of Expertise

- Risk Advisory & Governance Consulting
- Internal Audit Transformation
- Data Analytics & Process Automation
- Continuous Monitoring & Fraud Detection
- ERP-Integrated Audit Solutions (SAP, Tally, Oracle)
- Technology-Enabled Compliance Systems

Speaker Vision

"The future of governance lies at the intersection of process intelligence and technology. My goal is to help organizations transition from reactive compliance to proactive, data-driven control ecosystems."
— *CA Nirav H. Poptani*

Data Analytics for Smart Buildings: From Sensor to Insight in Utilities & Systems

A. Objective

To provide a clear framework for how smart building technologies – hardware (IoT/sensors), software (analytics, dashboards), data capture (heating, electricity, water, sewer, natural gas) and process (data ingestion → analysis → action) that can be applied in a building portfolio to drive operational efficiency, sustainability, predictive maintenance, and enhanced occupant comfort. This session will illustrate a structured example like using various data sources for selection of location, sustainable construction planning, sensor architecture, and predictive maintenance analytics.

B. Intended Takeaways

By the end of the session, attendees will be able to:

1. Understand the key technologies and data flows in a smart building environment.
2. Appreciate how data from multiple utility streams (electricity, heating, gas, water, sewer) can be collected, integrated and analysed.
3. See the importance of location/geography, neighbourhood data and ESG factors in building planning for smart systems.
4. Understand how to design sensor networks and IoT architecture for data capture in smart buildings.
5. Recognise how analytics and dashboards drive predictive maintenance, anomaly detection and optimisation.
6. Review a practical example roadmap—from site selection to construction/planning to sensor deployment to analytics and action.

C. Session Outline

1. Introduction

- Brief overview: "Why smart buildings, why analytics now"
- Agenda for the session

2. Smart Buildings – Definition & Drivers

- Definition: A "smart building" is a property in which various systems (HVAC, lighting, security, utilities) are networked and managed via data and analytics. (Cisco)
- Key drivers: rising energy costs, variable occupancy (e.g., hybrid work), ESG/sustainability obligations, regulatory pressure. (Avigilon)
- Key benefits: reduced operational cost, improved occupant comfort, improved sustainability, optimised maintenance. (Cisco)

3. Smart Building Technologies Overview

- Hardware: IoT sensors (temperature, humidity, occupancy, water flow, gas flow, sewer monitoring, energy meters) (Avigilon)
- Connectivity & network: wired, wireless (LoRaWAN, WiFi, Ethernet/PoE) (enertiv.com)
- Software/analytics: Building Management Systems (BMS), cloud platforms, dashboards, AI/ML for anomaly detection. (Cemex Ventures)
- Integration: Convergence of systems (lighting, HVAC, utilities, security) onto a unified data platform. (Enel X)

4. Utility Streams & Data Capture in Smart Buildings

- List utility streams relevant: Electricity, Heating (or HVAC/steam), Natural Gas, Water supply, Sewer/wastewater (or drainage)
- For each utility: outline typical sensors/meters (e.g., sub-metering for electricity, flow meters for natural gas, smart water meters, sewer flow sensors)
- Data frequency, granularity (real-time vs periodic), and key performance indicators (KPIs) (e.g., kWh/m^2, m^3 of water per occupant, gas consumption peaks, sewer return flows)
- Example: how sensor readings can feed into analytics to spot anomalies (e.g., sudden spike in water usage in non-occupied hours)

5. Data Flow & Analytics Architecture

- Diagram: sensors → edge gateway → network → cloud/local server → data lake/time-series database → analytics engine → dashboard / action system
- Explain data ingestion, cleansing, time-series alignment, ETL, analytics, anomaly detection, predictive models.
- Mention semantic modelling & interoperability (reference research) (arXiv)
- Highlight role of dashboards for facility managers and executive reporting

6. Example Roadmap – 1. Selection of Location

- Identifying the location with geo-mapping & geography: Choosing a building site (city, district, infrastructure connectivity, utilities availability, climate zone)
- Neighbourhood footfalls & market reviews + future projects in the vicinity: For e.g., ranking sites by future growth, proximity to transport, expected occupancy, environmental risk (flooding, sewage capacity)
- ESG component: Energy efficiency, water conservation, waste/sewer management, green certifications. Tie in smart building readiness as part of ESG.
- Suggest analytics/data sources: GIS mapping, demographic data, utility coverage maps, past building performance, local municipal disclosure data

7. Example Roadmap – 2. Sustainable Construction Structure & Planning

- Outline how the building design and construction must anticipate smart systems: wiring/conduits for sensors, network backbone, metering infrastructure, partitions for sensor placement, utility sub-metering design.
- Use of BIM (Building Information Modelling) to embed sensor/IoT elements early on. (Autodesk)
- Structural planning for utility segregation, maintenance access, retrofit-friendliness.
- Integration of renewable energy (solar PV, geothermal pumps), storage, waste water reuse, grey water systems.
- Role of analytics from day-one: baseline measurement of utilities, commissioning analytics, continuous monitoring post-construction.

8. Example Roadmap – 3. Type of Smart IoT Sensors for Data Collection & Analysis

- Provide list of typical sensors by utility, environment, occupancy:
  - Electricity: smart submeters, current sensors, energy disaggregation sensors (e.g., clamp-on CTs)
  - Heating/HVAC: temperature/humidity sensors, CO_2 sensors, airflow sensors, dampers with position sensors, steam/boiler sensors
  - Natural Gas: flow meters, pressure sensors, leak detectors
  - Water: smart water meters, flow sensors, pressure sensors, leak detection, water quality sensors
  - Sewer/Waste: flow meters, level sensors in drainage, sensors for grey-water reuse, monitoring for sewage back-up
  - Occupancy/Environment: motion sensors, CO_2, light/illuminance sensors, window/door status, occupancy counting
- Explain how sensor data is used: real-time monitoring, historical trend analysis, threshold-/rule-based alerts, feeding predictive maintenance models.
- Mention IoT protocols/standards: BACnet, Modbus, LoRaWAN, NB-IoT, WiFi, PoE sensors. (enertiv.com)

9. Example Roadmap – 4. Predictive Maintenance & Analytics

- Define predictive maintenance: use of sensor data and analytics to anticipate equipment or utility failures before they occur. (ServiceChannel)
- Analytics techniques: time-series anomaly detection, machine-learning trend models (e.g., LSTM or federated learning) for building utility behaviour. (arXiv)
- Use case examples:
  - Detecting abnormal electricity usage in a floor outside business hours → possible lighting/HVAC left running or fault
  - Water meter shows increasing baseline leakage – alert for plumbing fix
  - Natural gas boiler showing increased cycle time or deviance from predicted usage → schedule maintenance

- Sewer flow sensor indicating unusual surge → pre-emptive check of drainage systems

- Show dashboard example: KPIs, alerts, analytics insights, maintenance schedule integration, ROI/benefit tracking

- Emphasise continuous improvement: baseline → metrics → validate savings → refine analytics

10. Data Analytics Use-Cases & KPIs

- Use-cases summarised:

- Energy benchmarking (kWh/m^2, per occupant)

- Utility cost avoidance (peak demand management)

- Water consumption reduction & leak detection

- Sewer monitoring & waste-water reuse optimisation

- Occupancy driven HVAC/lighting scheduling

- Asset health dashboards (boilers, pumps, chillers)

- Sustainability/ESG reporting (carbon footprint, water footprint)

- KPIs to monitor: Energy Use Intensity (EUI), Water Use Intensity (WUI), Gas Use Intensity, Maintenance Cost per m^2, Unplanned downtime %, Occupant satisfaction index

11. Implementation Roadmap & Best Practices

- Phased implementation approach: Pilot → roll out → scale across portfolio

- Data governance: ensure data quality, security, privacy (occupant data, utility patterns)

- Interoperability: use open standards, avoid vendor lock-in. (Avigilon)

- Staff training & change management: Facilities team must use dashboards, act on alerts

- Costs & ROI: up-front cost for sensors/installation/analytics, ongoing savings from utilities/maintenance.

- Scalability: Plan for future – retrofit ability, new utility streams, integration with smart grid or building-to-grid.

- ESG alignment: Link analytics outputs to sustainability goals (carbon reduction, water reuse, reporting)

12. Challenges & Mitigation

- Data siloing / fragmented systems
- Legacy infrastructure / retrofit complexity
- Data overload – too many sensors, "needle in haystack" problem
- Connectivity/latency issues
- Integration across utility streams and systems
- Culture change in operations & maintenance teams
- Mitigation strategies: Start small, define clear objectives, build modular scalable architecture, use analytics to prioritise alerts

13. Future Trends in Smart Buildings & Analytics

- Increased use of AI/ML and digital twins (virtual model of building) (Autodesk)
- Edge analytics – processing nearer to sensors for real-time actuation
- Occupant-centric analytics (comfort, health)
- More integration with smart grids, renewables and storage
- Semantic building models and data platforms (for large portfolios) (arXiv)
- Move from "connected building" to "intelligent, autonomous building" (Enel X)

14. Real-World Example / Case Study (optional)

- Present a briefcase (you may use a generic/anonymous one) of a building/facility where smart building analytics drove X% savings in energy, or X% reduction in maintenance cost.
- Highlight before vs after baseline utilities, sensor deployment, analytics, outcome.
- Show lessons learned.

15. Summary & Call to Action

- Recap major points: location selection → planning → sensor network → analytics → action
- Key message: Smart building analytics is not just "install sensors" but integrate data, build analytics, drive actions and monitor benefits.
- Call to action for participants:
  - Evaluate your building/portfolio: do you have the data?
  - Define objectives (energy, water, maintenance, occupant comfort)
  - Start small with a pilot
  - Monitor & scale

Thank you & Q&A