# Metering Fundamentals in Electrical Utilities

Turning Data Into Decisions—*One Meter at a Time*

## About Me – Benjamin Manning

- PhD in Electrical & Computer Engineering with research in renewable energy and power systems
- Over 15 years of experience in electrical systems, grid integration, and energy analytics
- Led smart grid analytics and renewable integration projects for utilities and energy providers
- Developed automated power distribution, load balancing, and predictive maintenance systems
- Passionate about combining education, accessibility, and real-world applications with technology

How many marbles can a 12-ounce jar hold?

# What Is Metering?

- Measures energy consumption (typically in kWh)
- Tracks usage for billing, monitoring, and planning
- Installed at customer premises, substations, and feeders
- Essential for utility revenue and system

# Common Types of Meters

- Electromechanical Meters – Traditional spinning-disk meters
- Digital (Electronic) Meters – More accurate, with displays
- Smart Meters – Two-way communication, remote read capability



# Basic Metering Principles

***Real-world analogy:***
You're not just measuring how fast a car is moving (current), but also the size of the engine (voltage) and whether it's driving uphill or wasting gas (power factor).

kW is how fast you're burning fuel, and kWh is how much fuel you used over a period of time.

- Measures voltage, current, and power factor
- Calculates real power (kW) and energy (kWh)
- Advanced meters also measure reactive power (kVAR) and demand*
- Communicates data via wired or wireless networks

** Why utilities care:* Two buildings might use the same amount of energy in a day, but if one spikes power all at once, it strains the system more — that's what demand metering captures. (Reactive power (kVAR))

# Why Is Metering Important?

- Ensures accurate billing
- Supports grid reliability and load forecasting
- Enables outage detection and demand response
- Empowers customer energy management

**Effective usable jar volume =** 355 mL × 0.64 ≈ **227 mL**

**Number of marbles =** 227 mL ÷ 2.1 mL ≈ **108 marbles**

*A **standard marble** is ~16 mm in diameter

- Volume of one marble ≈ **2.1 mL**
- Assume a **packing efficiency of ~64%**

## What Happens If We Don’t Meter Properly?

- Revenue Loss
- Grid Instability
- Missed Maintenance & Fault Detection
- Overproduction

# Thank You!


*"The way to get started is to quit talking and begin doing."*