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Manning Book Proposal
Machine Learning for Power & Utilities

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Book Title

Machine Learning for Power & Utilities

Name of Author(s)

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1 Tell us about yourself

What are your qualifications for writing this book?

I have extensive hands-on experience applying machine learning to electric utility operations, including load forecasting, predictive maintenance, outage prediction, and grid optimization. I've worked directly with utilities to deploy ML models into production, integrating them with SCADA, GIS, and asset management systems. My background combines deep technical expertise in machine learning with practical understanding of utility operations, regulatory requirements, and the unique challenges of critical infrastructure.

Do you have any unique characteristics or experiences that will make you stand out as the author?

I've seen firsthand the gap between ML research and utility operations—the "pilot purgatory" where models never make it to production. This book is written from the perspective of someone who has deployed ML in control rooms, worked with operators and engineers, and understands both the technical requirements and the business constraints. I've worked with real utility data (eGrid, SCADA, smart meters) and understand the data quality, integration, and regulatory challenges that other ML books ignore. The book includes production-ready code examples that demonstrate enterprise integration patterns, not just toy datasets.

2 Tell us about the book's topic

What is the technology or idea that you're writing about?

This book teaches machine learning and AI applications specifically for electric power utilities. It covers forecasting (load, renewable generation), predictive maintenance, outage prediction, com-

puter vision for asset inspection, NLP for maintenance logs, LLMs for operational support, cybersecurity analytics, and MLOps for production deployment. The focus is on practical, production-ready implementations that integrate with existing utility systems (SCADA, GIS, EAM).

Why is it important now?

Electric utilities face unprecedented challenges: aging infrastructure, electrification-driven demand growth, distributed energy resources creating grid variability, extreme weather increasing outages, and regulatory pressure for better reliability and transparency. Traditional deterministic models and manual processes cannot keep up. Meanwhile, utilities generate massive amounts of data (SCADA, smart meters, PMUs, asset records) that sits unused in silos. Machine learning can unlock this data to enable predictive operations, but there's a critical gap: most ML resources are generic and don't address utility-specific challenges like regulatory compliance, integration with legacy systems, or the need for explainability in critical infrastructure.

In a couple sentences, tell us roughly how it works or what makes it different from its alternatives?

This book bridges the gap between ML theory and utility operations. Unlike generic ML books, it addresses utility-specific challenges: integrating with SCADA and GIS systems, handling regulatory requirements for model auditability, working with real utility data formats, and deploying models that operators and engineers can trust. Each chapter starts with a business problem, shows how ML solves it, and provides production-ready Python code that demonstrates enterprise integration patterns. The book progresses from foundational analytics (forecasting, classification) to advanced topics (LLMs, computer vision) while maintaining focus on operational deployment.

3 Tell us about the book you plan to write

What will the reader be able to do after reading this book?

After reading this book, the reader will be able to:

- Build production-ready ML models for utility use cases: load forecasting, predictive maintenance, outage prediction, renewable generation forecasting, and customer analytics

- Integrate ML models with existing utility systems (SCADA, GIS, EAM, customer systems) using APIs, databases, and message queues

- Apply computer vision to automate asset inspections using drone imagery and pole-mounted cameras

- Use NLP to extract insights from maintenance logs, work orders, and regulatory documents

- Deploy LLMs for operational support, including summarization, entity extraction, and multimodal AI for field operations

- Implement MLOps workflows using MLflow for model tracking, automated retraining, and production deployment

- Build feature engineering pipelines for utility data, including temporal features, geospatial features, and grid topology features

- Apply causal inference methods to evaluate policy impacts and program effectiveness

- Use multi-task learning to simultaneously predict multiple related outcomes (e.g., CO2, NOx, SO2 emissions)

- Measure ROI of ML initiatives using frameworks like CPMAI

- Ensure models meet regulatory requirements for explainability, fairness, and auditability

- Deploy real-time analytics pipelines for control room integration

- Build enterprise-scale ML platforms that support multiple use cases across the utility

Is your book designed to teach a topic or to be used as a reference?

The book is designed primarily to teach, with a progressive structure that builds from fundamentals to advanced topics. Each chapter includes hands-on Python examples that readers can run and modify. However, the code examples and integration patterns are also designed to serve as reference material for practitioners implementing similar solutions.

Does this book fall into a Manning series such as In Action, In Practice, Month of Lunches, or Grokking?

This book fits best in the "In Action" series, as it provides comprehensive, practical coverage of ML applications in utilities with real-world examples and production-ready code.

Are there any unique characteristics of the proposed book, such as a distinctive visual style, questions and exercises, supplementary online materials like video, etc?

The book includes:

- Production-ready Python code examples for each use case (33+ code files)

- Real utility data examples (eGrid power plant data, SCADA simulations, smart meter data)

- Integration patterns showing how ML connects to enterprise systems

- Business context for each technique, explaining why it matters operationally

- Regulatory and compliance considerations throughout

- Case studies from real utility deployments

- Minimalist, clean visualizations (no chart junk)

- Code that follows PEP 8 and production best practices

4 Q&A

What are the three or four most commonly-asked questions about this technology?

- How do I get started with ML in utilities if I don't have a data science background?

- How do I integrate ML models with existing SCADA, GIS, and asset management systems?

- What are the regulatory requirements for deploying ML in critical infrastructure, and how do I ensure models are explainable and auditable?

- How do I measure ROI and justify ML investments to utility leadership?

- What's the difference between a pilot project and production deployment, and how do I bridge that gap?

- How do I handle the data quality and integration challenges when working with utility data from multiple siloed systems?

5 Tell us about your readers

Your book will teach your readers how to accomplish the objectives you've established for the book. It's critical to be clear about the minimum qualifications you're assuming of your reader and what you'll need to teach them.

What skills do you expect the minimally-qualified reader to already have? Be specific.

- Intermediate Python programming skills (comfortable with pandas, numpy, basic object-oriented programming)

- Basic understanding of machine learning concepts (supervised vs unsupervised learning, training vs testing)

- Familiarity with utility operations (understanding of load forecasting, asset management, or grid operations)

- Basic knowledge of data analysis (working with CSV files, understanding data types, basic statistics)

- No deep expertise in specific ML algorithms required (we teach the algorithms as needed)

- No prior experience with utility-specific ML applications required

What are the typical job roles for the primary reader? Be specific:

- Data scientists or analysts working in utilities or energy companies (2-5 years experience)

- Utility engineers or operations staff looking to add ML capabilities to their skill set

- Software engineers building analytics platforms for utilities

- Consultants working with utility clients on ML projects

- Graduate students or researchers focusing on energy systems and ML

What will motivate the reader to learn this topic?

Readers are motivated by the urgent need to modernize utility operations in the face of aging infrastructure, electrification, and renewable integration. They see the potential of ML but struggle with the gap between generic ML tutorials and utility-specific requirements. They need practical, production-ready examples that show how to integrate ML with existing systems and meet regulatory requirements. They want to move beyond pilot projects to operational deployment that delivers measurable business value.

6 Tell us about the competition and the ecosystem

What are the best books available on this topic and how does the proposed book compare to them?

Most ML books are generic and don't address utility-specific challenges. "Hands-On Machine Learning" by Aurélien Géron is excellent for ML fundamentals but doesn't cover utility use cases or integration patterns. "Applied Machine Learning" by David Forsyth covers applications but not utilities. There are academic texts on power systems and ML, but they lack practical implementation details. This book is unique in providing production-ready code for utility-specific ML applications with enterprise integration patterns.

What are the best videos available on this topic and how does the proposed book compare to them?

Online courses (Coursera, edX) cover ML fundamentals but not utility applications. YouTube has scattered tutorials on load forecasting or predictive maintenance, but nothing comprehensive. This book provides a structured, comprehensive curriculum with hands-on code examples that videos cannot match.

What other resources would you recommend to someone wanting to learn this subject?

IEEE Power & Energy Society publications, EPRI reports, utility industry conferences (DistribuTECH, IEEE PES), and open-source projects like GridLAB-D. This book complements these resources by providing practical implementation guidance.

What are the most important web sites and companies?

EPRI (Electric Power Research Institute), IEEE Power & Energy Society, NREL (National Renewable Energy Laboratory), utility industry publications (Utility Dive, Energy Central), and ML platforms (Databricks, AWS, Azure) with utility-specific solutions.

Where do others interested in this topic gather?

IEEE PES conferences, DistribuTECH, utility industry forums, LinkedIn groups for utility data science, and professional associations like the Association of Energy Engineers.

7   Book size and illustrations

Please estimate:

The approximate number of published pages to within a 50-page range

Approximately 200-250 published pages (current manuscript is approximately 210 pages, with 28 chapters plus appendices)

The approximate number of diagrams and other graphics

Approximately 40-60 diagrams and graphics, including:

- Architecture diagrams showing ML integration with utility systems

- Flowcharts for ML workflows

- Visualizations of model outputs (forecasts, predictions, anomaly detections)

- Code execution results and data visualizations

- System integration diagrams

The approximate number of code listings

Approximately 100-150 code listings, including:

- 33+ complete Python scripts (one per chapter)

- Code snippets demonstrating specific techniques

- Configuration files (YAML, JSON)

- API integration examples

- Database queries and data processing pipelines

8   Schedule

To write and revise a chapter, most authors require 2-4 weeks. Please estimate your writing schedule

Chapter 1: We typically expect the first chapter in about 1 month
February 2026
    1/3 manuscript:
[May 2026 - approximately 3-4 months after Chapter 1]
    2/3 manuscript:
[September 2026 - approximately 6-8 months after Chapter 1]
    3/3 manuscript:
[December 2026 - approximately 9-12 months after Chapter 1]

Are there any critical deadlines for the completion of this book? New software versions? Known competition? Technical conferences?

The utility industry is rapidly adopting ML, and there's growing competition from consulting firms and platform vendors. The book should be completed before major industry conferences (DistribuTECH typically in February/March) to maximize impact. There are no critical software version dependencies, as the book uses stable, widely-adopted libraries (scikit-learn, pandas, TensorFlow, etc.).

9 Table of Contents

The table of contents is your plan for teaching your intended readers the skills they need to accomplish the objectives you've established for the book. While every Table of Contents is different, there are a few common best practices for a typical In Action book.

Part 1: Foundations

1. Introduction to Machine Learning in Power and Utilities

    (a) The Three Forces Disrupting Utilities
    (b) Why Machine Learning Matters
    (c) Data as a Strategic Asset
    (d) A Simple Example: Temperature-to-Load Forecasting
    (e) What This Book Covers
    (f) Summary

2. Data Sources and Integration Patterns

    (a) Utility Data Landscape
    (b) SCADA and Real-Time Telemetry
    (c) Advanced Metering Infrastructure (AMI)
    (d) Asset Management Systems (EAM)
    (e) Geographic Information Systems (GIS)
    (f) External Data Sources (Weather, Markets)
    (g) Data Integration Patterns
    (h) Summary

3. Machine Learning Fundamentals

    (a) Regression for Continuous Predictions
    (b) Classification for Categorical Outcomes
    (c) Clustering for Pattern Discovery
    (d) Model Evaluation Metrics
    (e) Utility Use Case Mapping
    (f) Summary

Part 2: Core Applications

4. Load Forecasting and Demand Analytics

   (a) The Business Problem: Balancing Supply and Demand
   (b) Time Series Fundamentals: ARIMA Models
   (c) Weather-Driven Features
   (d) LSTM Neural Networks for Load Forecasting
   (e) Ensemble Methods
   (f) Production-Grade Forecasting: Feature Engineering and Multi-Tier Models
   (g) Forecast Accuracy Metrics and Operational Impact
   (h) Summary

5. Predictive Maintenance for Grid Assets

   (a) The Cost of Unplanned Failures
   (b) Classification Models for Failure Prediction
   (c) Anomaly Detection for Condition Monitoring
   (d) Handling Class Imbalance
   (e) Risk Scoring and Prioritization
   (f) Integration with Asset Management Systems
   (g) Summary

6. Outage Prediction and Storm Response

   (a) The Business Problem: Proactive Outage Management
   (b) Weather Data Integration
   (c) Feeder-Level Outage Risk Models
   (d) Vegetation and Asset Condition Features
   (e) Crew Staging Optimization
   (f) Real-Time Storm Analytics
   (g) Summary

7. Grid Optimization and Operations

   (a) Voltage Optimization
   (b) Feeder Reconfiguration
   (c) Demand Response Optimization
   (d) Reinforcement Learning for Grid Control
   (e) Summary

8. Renewable Integration and DER Forecasting

   (a) The Challenge of Variable Generation
   (b) Solar Generation Forecasting

Part 3: Advanced Techniques

Part 4: Enterprise Integration and Operations

13. Enterprise Integration Patterns

    (a) API-Based Integration
    (b) Database Replication and ETL
    (c) Message Queues and Streaming
    (d) GIS Integration
    (e) SCADA Integration
    (f) Summary

14. MLOps for Utilities

    (a) The Pilot Purgatory Problem
    (b) Experiment Tracking with MLflow
    (c) Model Versioning and Registry
    (d) Automated Retraining Pipelines
    (e) Model Deployment as APIs
    (f) Model Monitoring and Drift Detection
    (g) Regulatory Compliance and Auditability
    (h) Summary

15. Orchestration and Workflow Management

    (a) Task Orchestration with Prefect
    (b) Scheduling and Dependencies
    (c) Error Handling and Retries
    (d) State Management
    (e) Summary

16. Platform Deployment and Architecture

    (a) Cloud vs On-Premise Considerations
    (b) Containerization and Kubernetes
    (c) Data Lake Architecture
    (d) Security and Access Control
    (e) Summary

Part 5: Specialized Topics

17. Cybersecurity Analytics

    (a) Anomaly Detection for Network Security
    (b) Supervised Learning for Threat Detection
    (c) False Positive Management

Appendices

A Installation and Setup

    (a) Python Environment Setup

    (b) Required Libraries

    (c) Data Access

    (d) Summary

B Datasets and Data Sources

    (a) Public Datasets

    (b) Utility Data Formats

    (c) Data Quality Considerations

    (d) Summary

C Troubleshooting Common Issues

    (a) Data Integration Challenges

    (b) Model Performance Issues

    (c) Deployment Problems

    (d) Summary

D Regulatory Framework Overview

    (a) NERC CIP

    (b) State PUC Requirements

    (c) FERC Regulations

    (d) Summary