Purpose Statement

The UNSW Developmental Wind Farm project aims to support UNSW's 2025 strategic goals by developing a sustainable energy solution that integrates teaching, research, and operations. The project will provide a platform for renewable energy research while reducing the university's carbon footprint. Additionally, it will incorporate commercial and educational integration, employee training, and advanced monitoring systems to ensure long-term sustainability and operational efficiency.

Scope Statement

The project scope covers the full lifecycle of developing UNSW's 30MW scalable wind farm, including strategic alignment, engineering design with future expansion capacity, regulatory-compliant construction, and operational integration with research systems. Core components:

- Scalable infrastructure for 8→10 turbine units
- Remote monitoring system integrated with campus
- Full compliance with NSW planning and heritage regulations
- Maintenance systems supporting 10-year operations
- Substation and energy storage design for grid integration
- Performance evaluation and sensor systems for data collection
- Road assessment and construction for site accessibility
- Stakeholder analysis to ensure alignment with community and institutional goals

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Key Deliverables

1. Strategic Alignment Report (UNSW 2025 Gap Analysis)
2. Scalable Turbine Layout Blueprint (10-unit capacity)
3. NSW Planning Portal Submission Package
4. As-built Drawings with Heritage Protection Notes
5. SCADA Integration Test Certificates
6. Annual Performance Report Template
7. Blade Recycling Protocol
8. Digital Twin Model (BIM Level 3)
9. Substation and Energy Storage Design Documentation
10. Performance Evaluation and Sensor System Reports
11. Road Assessment and Construction Plan
12. Stakeholder Engagement Strategy

Constraints

- **Budget**: Fixed at AUD $48M (designated for 8 turbines)
- **Duration**: Shortest feasible timeline (commissioning ≤24 months)
- **Regulatory**: Mandatory Aboriginal heritage surveys prior to earthworks
- **Technical**: Minimum 30MW electrical system capacity for future expansion
- **Social**: Ongoing wildlife impact monitoring during operations

- **Scope**: Post-project warranty period with additional costs for extended maintenance
- **Technical**: Integration of commercial and educational systems for research and training

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修改说明：

1. **Purpose Statement**：
   - 新增了 **商业与教育整合**、**员工培训** 和 **先进监控系统**，以体现 Shawn 和 Esther 提到的产学研结合和长期可持续性。
2. **Scope Statement**：
   - 新增了 **变电站和储能设计**、**绩效评估和传感器系统**、**道路评估与建设** 和 **利益相关者分析**，以涵盖 Shawn 提到的变电站、储能、传感器、道路评估和利益相关者解析。
3. **Key Deliverables**：
   - 新增了 **变电站和储能设计文档**、**绩效评估和传感器系统报告**、**道路评估与建设计划** 和 **利益相关者参与策略**，以反映新增的 Scope 内容。
4. **Constraints**：
   - 新增了 **范围约束**（项目结束后保修期及延长维护费用）和 **技术约束**（商业与教育系统整合），以涵盖 Esther 提到的保修范围和 Shawn 提到的产学研结合。

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graph TD
    %% 主项目结构
    A[UNSW Developmental Wind Farm WBS] --> B[1 Project Initiation] %% 1. 项目启动
    A --> C[2 Engineering Design] %% 2. 工程设计
    A --> D[3 Procurement & Bidding] %% 3. 招标采购
    A --> E[4 Construction] %% 4. 施工
    A --> F[5 Commissioning & Testing] %% 5. 调试测试
    A --> G[6 Project Management] %% 6. 项目管理
    A --> H[7 Compliance & Documentation] %% 7. 合规文档
    A --> I[8 Operations & Maintenance] %% 8. 运维

    %% 项目启动
    B[1 Project Initiation] --> B1[1.1 Strategic Alignment] %% 1.1 战略对齐
    B --> B2[1.2 Feasibility Study] %% 1.2 可行性研究

    %% 工程设计
    C[2 Engineering Design] --> C1[2.1 Conceptual Design] %% 2.1 概念设计
    C --> C2[2.2 Design Drawings and Document (Detailed Design)] %% 2.2 详细设计
    C --> C3[2.3 Substation Design] %% 2.3 变电站设计
    C --> C4[2.4 Energy Storage Design] %% 2.4 储能设计
    C --> C5[2.5 Sensor and Testing Equipment Design] %% 2.5 传感器和测试设备设计
    C --> C6[2.6 Performance Evaluation Equipment Design] %% 2.6 绩效评估设备设计
    C --> C7[2.7 Grid Connection Design] %% 2.7 电网连接设计

    %% 招标采购
    D[3 Procurement & Bidding] --> D1[3.1 Tender Process] %% 3.1 招标流程
    D --> D2[3.2 Contract Execution] %% 3.2 合同执行
    D --> D3[3.3 Stakeholder Analysis] %% 3.3 利益相关者分析

    %% 施工
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    E[4 Construction] --> E1[4.1 Site Works] %% 4.1 场地工程
    E --> E2[4.2 Foundation] %% 4.2 基础
    E --> E3[4.3 Electrical] %% 4.3 电气工程
    E --> E4[4.4 Substation Construction] %% 4.4 变电站建设
    E --> E5[4.5 Energy Storage Installation] %% 4.5 储能安装
    E --> E6[4.6 Road Assessment and Construction] %% 4.6 道路评估与建设

    %% 调试测试
    F[5 Commissioning & Testing] --> F1[5.1 Unit Testing] %% 5.1 单元测试
    F --> F2[5.2 System Testing] %% 5.2 系统测试
    F --> F3[5.3 Remote Systems] %% 5.3 远程系统
    F --> F4[5.4 Equipment and Material Testing] %% 5.4 设备材料测试
    F --> F5[5.5 Generator, Control, and Monitoring System Testing] %% 5.5 发电机、控制和监管
系统测试

    %% 项目管理
    G[6 Project Management] --> G1[6.1 Cost Control] %% 6.1 成本控制
    G --> G2[6.2 Risk Mgmt] %% 6.2 风险管理
    G --> G3[6.3 Digital Tools] %% 6.3 数字工具
    G --> G4[6.4 Employee Training] %% 6.4 员工培训
    G --> G5[6.5 Commercial and Educational Integration] %% 6.5 商业与教育整合

    %% 合规文档
    H[7 Compliance & Documentation] --> H1[7.1 Compliance Process (Approvals)] %% 7.1 合规审
批
    H --> H2[7.2 Deliverables] %% 7.2 交付物
    H --> H3[7.3 Warranty and Post-Project Scope] %% 7.3 保修及项目后范围

    %% 运维
    I[8 Operations & Maintenance] --> I1[8.1 Performance] %% 8.1 性能
    I --> I2[8.2 Sustainability] %% 8.2 可持续性
    I --> I3[8.3 Wildlife Monitoring] %% 8.3 野生动物监测
    I --> I4[8.4 Recycling Program] %% 8.4 回收计划

    %% 关键路径
    C1[2.1 Conceptual Design] -.->|Layout Finalized| D1[3.1 Tender Process] %% 布局确定
    D2[3.2 Contract Execution] -.->|Contract Signed| E1[4.1 Site Works] %% 合同签署
    E3[4.3 Electrical] -.->|Power Ready| F2[5.2 System Testing] %% 电力就绪
    F2[5.2 System Testing] -.->|Grid Approved| I1[8.1 Performance] %% 电网批准
    H1[7.1 Approvals] -.->|Permit Released| E1[4.1 Site Works] %% 许可发布

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    class H1,B1 critical
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