

# Zhengzhou Hengling New Energy - Solution

## Smart City Solution

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### 1. REQUIREMENT ANALYSIS & INVESTIGATION

#### 1.1 Project Background

Smart city initiatives require integrated lighting infrastructure that serves as: - The backbone for IoT sensor deployment - A platform for multiple city services convergence - An energy efficiency and carbon reduction driver - A public safety and security enhancement tool - A foundation for data-driven urban management

#### 1.2 Stakeholder Requirements

- **Municipal Government:** Energy savings, OPEX reduction, carbon neutrality
- **Public Safety:** Enhanced surveillance, emergency response, crime deterrence
- **Traffic Management:** Adaptive signaling, incident detection, flow optimization
- **Environmental Agency:** Air quality monitoring, noise pollution tracking
- **Citizens:** Improved safety, better services, transparent governance

#### 1.3 City Scale Parameters

- Coverage area: 10km<sup>2</sup> to 500km<sup>2</sup> urban areas
  - Lighting nodes: 5,000 to 200,000+ poles
  - Integration systems: Traffic, security, environmental, utility networks
  - Communication infrastructure: Fiber, 4G/5G, LoRaWAN, NB-IoT
  - Data center requirements: Edge + cloud hybrid architecture
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### 2. SOLUTION DESIGN

#### 2.1 Multi-Service Smart Pole Architecture

**Converged Services on Single Infrastructure:** - **Lighting Services:** Adaptive LED lighting, dimming, scheduling - **Security Services:** CCTV cameras, emergency call buttons, public address - **Traffic Services:** Traffic sensors, parking guidance, V2X communication - **Environmental Services:** Air quality, noise, temperature, humidity monitoring - **Connectivity Services:** 5G small cells, WiFi hotspots, IoT gateways - **Information Services:** Digital signage, public announcements

## 2.2 Core Technologies

- **Edge Computing:** Distributed intelligence for low-latency applications
- **Digital Twin:** City-wide 3D modeling and simulation
- **AI Analytics:** Predictive maintenance, anomaly detection, pattern recognition
- **5G Integration:** High-bandwidth, low-latency communication
- **Blockchain:** Secure data sharing and transaction integrity

## 2.3 Smart Pole Specifications

Component	Specification
Pole Structure	8m-12m height, aluminum alloy, wind load 55m/s
Lighting Module	100W-200W LED, 170lm/W, 0-10V dimming
Camera Module	4K UHD, 360° PTZ, AI analytics, low-light performance
Sensor Suite	PM2.5/PM10, NOx, SOx, CO, noise, temperature, humidity
Communication	5G small cell, WiFi 6, LoRaWAN gateway, V2X
Power System	Grid + solar hybrid, UPS backup, smart metering
User Interface	Emergency button, digital display, speaker/microphone

## 2.4 Central Management Platform

- Unified dashboard for all city services
  - GIS mapping with real-time node status
  - Big data analytics and visualization
  - API gateway for third-party integration
  - Multi-department role-based access
  - Automated reporting and compliance
  - Cybersecurity and data privacy protection
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# 3. PRODUCT CUSTOMIZATION

## 3.1 Infrastructure Customization

- Pole design matching city aesthetic standards
- Height and loading capacity for specific equipment
- Color and finish matching urban design guidelines
- Equipment mounting positions optimized for coverage
- Foundation design for local soil and wind conditions

## 3.2 Service Package Customization

- Modular service selection based on city priorities

- Phased deployment roadmap (lighting first, then add services)
- Integration with existing city systems (SCADA, TMS, CCTV)
- Data sharing protocols with municipal departments
- Custom KPI dashboards for each stakeholder

### 3.3 Business Model Customization

- CAPEX model: direct municipal procurement
- OPEX model: Energy Performance Contracting (EPC)
- PPP model: Public-Private Partnership
- Revenue sharing: Advertising, data services, connectivity
- As-a-Service: Lighting-as-a-Service (LaaS) subscription model

## 4. PROJECT IMPLEMENTATION

### 4.1 Phased Deployment Strategy

Phase	Duration	Scope
Phase 1: Pilot	3-6 months	50-200 poles, core lighting + security services
Phase 2: District	6-12 months	1,000-5,000 poles, full service suite
Phase 3: City-wide	12-24 months	10,000+ poles, city-wide integration
Phase 4: Expansion	Ongoing	New services, technology upgrades

### 4.2 Implementation Methodology

- **Minimal Disruption:** Night work, traffic management plans
- **Network Readiness:** Fiber and power infrastructure pre-deployment
- **Stakeholder Coordination:** Utility companies, traffic police, residents
- **Quality Assurance:** Stage-gate approvals, independent testing
- **Knowledge Transfer:** Parallel training during deployment

### 4.3 Standards Compliance

- ITU-T Smart City standards
- ISO 37120 Sustainable Development Indicators
- IEC 61850 Smart Grid integration
- NIST Cybersecurity Framework
- GDPR / local data privacy regulations
- CENELEC EN 50174 Smart City infrastructure

## 5. SYSTEM COMMISSIONING & TESTING

### 5.1 Integration Testing

- Cross-service communication verification
- Third-party system API integration
- Data synchronization between edge and cloud
- Failover and redundancy mechanism testing
- Cybersecurity penetration testing

### 5.2 Performance Testing

- Network latency and bandwidth testing
- Sensor accuracy calibration and verification
- AI analytics accuracy and false positive rate
- System capacity under peak load conditions
- 30-day continuous operation stress test

### 5.3 Acceptance Process

- Department-specific acceptance testing
  - Independent third-party performance audit
  - Energy savings verification vs. baseline
  - Citizen satisfaction survey
  - Formal handover and sign-off
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## 6. PROJECT DELIVERY

### 6.1 Deliverables Package

- Smart pole hardware and installation
- Central management platform and licenses
- Integration with existing city systems
- Data center and network infrastructure
- Complete documentation and training
- Operations and maintenance setup

### 6.2 Documentation Package

- As-built drawings and BIM models
- System architecture and network diagrams
- API documentation for developers
- Operation and maintenance manuals
- Emergency response procedures
- Compliance certificates and test reports

### 6.3 Capacity Building

- **IT Department:** Platform administration, cybersecurity
- **Street Lighting Department:** Operations, maintenance, troubleshooting

- **Public Safety:** Video surveillance, emergency response
  - **Traffic Department:** Traffic analytics, incident management
  - **Executive Management:** KPI reporting, strategic decision making
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## 7. OPERATION & MAINTENANCE

### 7.1 Smart Maintenance Operations

Activity	Approach
Monitoring	24/7 NOC with automated alerting
Predictive	AI-based failure prediction 2-4 weeks in advance
Preventive	Scheduled maintenance based on usage patterns
Corrective	Field service dispatch with mobile app
Optimization	Continuous performance improvement

### 7.2 Lifecycle Management

- **Years 1-5:** Warranty coverage, regular maintenance, software updates
- **Years 6-10:** Component replacement planning, technology refresh evaluation
- **Years 11-15:** System upgrade assessment, service expansion planning
- **End-of-Life:** Environmentally responsible recycling, technology migration

### 7.3 Continuous Improvement

- Monthly performance review meetings
- Quarterly KPI reporting to stakeholders
- Annual technology roadmap updates
- Citizen feedback integration
- Benchmarking against other smart cities

### 7.4 Outcome Metrics

- Energy consumption reduction (target: 70%+)
  - Maintenance cost reduction (target: 50%+)
  - Crime rate reduction in lit areas (target: 20%+)
  - Emergency response time improvement (target: 30%+)
  - Carbon emissions reduction (metric tons CO2/year)
  - ROI achievement (target: 3-5 year payback)
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