ADS ECO Eco-Industrial Complex
Technology Overview
Advanced Circular Economy & Industrial Infrastructure Systems
Armenia

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1. Executive Technology Summary

ADS ECO is a next-generation eco-industrial infrastructure platform integrating advanced waste processing, material recovery, renewable energy generation, industrial recycling, and smart operational technologies.

The Project combines multiple interconnected technology systems into a unified circular economy infrastructure ecosystem.

The technological architecture is designed to:

- Maximize resource recovery
- Reduce landfill dependency
- Generate renewable energy
- Improve industrial efficiency
- Reduce environmental impact
- Enable digital operational transparency
- Support institutional ESG reporting

ADS ECO integrates industrial automation, artificial intelligence, smart monitoring systems, renewable energy infrastructure, and advanced thermal conversion technologies.

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2. Technology Architecture Philosophy

The ADS ECO technology platform is based on four core principles:

2.1 Circular Resource Recovery

Maximizing material recovery from municipal and industrial waste streams through advanced sorting and industrial recycling technologies.

2.2 Energy Recovery & Optimization

Converting non-recyclable waste fractions into renewable energy and industrial energy carriers.

2.3 Smart Digital Infrastructure

Integrating SCADA, AI analytics, automation systems, and real-time monitoring for operational optimization.

2.4 ESG & Environmental Integration

Embedding environmental monitoring, emissions management, and sustainability reporting into operational systems.

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3. Waste Reception & Logistics Technologies

3.1 Intelligent Waste Intake Systems

ADS ECO integrates smart waste intake infrastructure for controlled waste reception and operational efficiency.

Core Systems

- Automated weighing systems
- Vehicle identification systems
- Smart logistics routing
- Digital waste registration systems
- Automated checkpoint controls
- Industrial logistics analytics

3.2 Safety & Detection Technologies

Integrated Detection Systems

- Radiation detection systems
- Gas monitoring systems
- Hazardous material identification
- Fire detection systems
- Environmental safety sensors

These systems improve:

- Operational safety
- Environmental protection
- Regulatory compliance
- Risk management capability

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4. AI Sorting & Material Recovery Technologies

4.1 AI/NIR/VIS Optical Sorting Systems

The Material Recovery Facility (MRF) utilizes advanced optical sorting technologies.

Core Technologies

- AI-powered recognition systems
- Near Infrared (NIR) sorting
- Visual spectrum (VIS) identification
- Smart sensor arrays
- Machine learning classification systems
- Automated robotic sorting systems

4.2 Material Identification Technologies

The sorting infrastructure identifies and separates:

- Plastics by polymer type
- Ferrous metals
- Non-ferrous metals
- Glass fractions
- Paper & cardboard
- RDF feedstock fractions
- Organic materials

4.3 Conveyor & Automation Infrastructure

Automation Systems

- Smart conveyor systems
- Automated material routing
- Industrial robotics integration
- Sensor-based quality control
- Digital sorting optimization

These technologies improve:

- Recovery efficiency
- Material purity
- Operational speed
- Labor optimization
- Industrial consistency

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5. Recycling & Industrial Processing Technologies

5.1 Plastic Recycling Technologies

Core Systems

- Plastic shredding systems
- Washing and decontamination lines
- Separation systems

- Pelletizing technologies
- Extrusion systems

Outputs

- Recycled polymer pellets
- Industrial plastic feedstock
- Circular manufacturing materials

5.2 Paper & Cardboard Recycling Technologies

Systems

- Fiber recovery systems
- Industrial pulping technologies
- Separation systems
- Moisture control infrastructure

Outputs

- Recycled paper feedstock
- Industrial cardboard materials
- Circular packaging materials

5.3 Glass Recycling Technologies

Systems

- Glass crushing technologies
- Optical impurity separation
- Particle sizing systems
- Purification systems

Outputs

- Glass cullet
- Industrial glass materials
- Secondary raw materials

5.4 Metal Recovery Technologies

Technologies

- Magnetic separation systems
- Eddy current separation
- Non-ferrous metal recovery
- Industrial metal preparation systems

Outputs

- Ferrous scrap products
- Aluminum recovery
- Copper recovery
- Industrial metal feedstock

5.5 Textile, Wood & Tire Processing Technologies

Additional Circular Processing Systems

- Textile shredding systems
- Wood processing systems
- Tire granulation technologies
- Rubber recovery systems
- Industrial material stabilization

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6. RDF Production Technologies

Refuse Derived Fuel (RDF) Systems

ADS ECO integrates RDF preparation infrastructure to convert combustible non-recyclable fractions into industrial fuel products.

RDF Systems Include

- Material drying systems
- Size reduction technologies
- Fuel homogenization systems
- Industrial baling systems
- Storage and logistics infrastructure

RDF Applications

- Cement industry fuel
- Industrial thermal energy applications
- Alternative fuel systems

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7. Pyrolysis Technologies

7.1 Pyrolysis Conversion Systems

Pyrolysis systems convert waste fractions into energy carriers through controlled thermal decomposition in low-oxygen environments.

Core Pyrolysis Components

- Thermal reactor systems
- Feedstock preparation systems
- Temperature control infrastructure
- Gas recovery systems
- Oil recovery systems
- Carbon residue handling systems

7.2 Pyrolysis Outputs

Energy & Material Outputs

- Syngas
- Pyrolysis oil
- Carbon products
- Thermal energy

Technology Benefits

- Landfill reduction
- Energy recovery
- Reduced environmental burden
- Industrial energy production

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8. Plasma Gasification Technologies

8.1 Plasma Reactor Infrastructure

ADS ECO incorporates advanced plasma thermal conversion technologies.

Plasma Systems Include

- High-temperature plasma reactors
- Thermal conversion chambers
- Syngas generation systems
- Inorganic vitrification systems
- Emissions management infrastructure

8.2 Plasma Technology Advantages

Operational Benefits

- High destruction efficiency
- Hazardous fraction stabilization
- Reduced residual waste

- Advanced thermal conversion capability
- High-temperature processing control

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9. Syngas Management Technologies

Syngas Processing Infrastructure

ADS ECO integrates advanced syngas handling systems.

Core Infrastructure

- Syngas cooling systems
- Gas cleaning technologies
- Filtration systems
- Compression systems
- High-pressure storage systems

Operational Objectives

- Gas purification
- Energy optimization
- Emissions reduction
- Energy generation support

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10. Renewable Energy Technologies

10.1 Gas Turbine Systems

Infrastructure

- Industrial gas turbines
- Energy recovery systems
- Power optimization technologies
- Smart grid integration

Functions

- Electricity generation
- Internal energy supply
- Grid export capability

10.2 ORC Secondary Turbine Systems

Organic Rankine Cycle (ORC) systems recover residual thermal energy.

Benefits

- Waste heat recovery
- Increased energy efficiency
- Improved energy optimization
- Reduced energy loss

10.3 Solar Power Systems

Solar Infrastructure

- 5–6 MW photovoltaic systems
- Smart inverter infrastructure
- Renewable grid integration
- Energy balancing systems

10.4 Battery Energy Storage Systems (BESS)

BESS Functions

- Energy balancing
- Peak load optimization
- Grid stabilization
- Emergency backup capability
- Renewable energy integration support

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11. Hydrogen Production Technologies

Hydrogen Module Potential

ADS ECO incorporates future-ready hydrogen production infrastructure concepts.

Potential Functions

- Hydrogen production
- Industrial gas integration
- Renewable energy storage applications
- Long-term energy diversification

The hydrogen component strengthens future scalability and energy innovation positioning.

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12. Smart Grid & Energy Management Technologies

12.1 Smart Grid Infrastructure

Core Systems

- MV/HV substations

- Smart energy routing
- Grid synchronization systems
- Automated load balancing

12.2 Energy Management Systems (EMS)

EMS Functions

- Real-time energy optimization
- Energy demand balancing
- Operational energy analytics
- Renewable integration management

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13. SCADA & Digital Control Technologies

13.1 Centralized SCADA Infrastructure

ADS ECO integrates centralized digital operational management systems.

SCADA Functions

- Real-time operations monitoring
- Equipment performance analytics
- Process automation
- Environmental monitoring
- Energy management integration
- Alarm and incident management

13.2 MOCC Digital Control Center

Mission Operations & Control Center (MOCC) functions include:

- Integrated infrastructure oversight
- Multi-system operational control
- Data analytics management
- ESG reporting integration
- Smart infrastructure optimization

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14. ESG & Environmental Monitoring Technologies

Environmental Monitoring Systems

Monitoring Infrastructure

- Air emissions sensors
- Water quality systems

- Gas monitoring systems
- Environmental analytics systems
- Continuous emissions tracking

ESG Reporting Systems

Digital ESG Architecture

- KPI reporting systems
- ESG analytics dashboards
- Sustainability data management
- Institutional reporting integration

These systems support:

- ESG transparency
- Institutional reporting readiness
- Regulatory compliance
- Environmental accountability

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15. Wastewater Treatment Technologies

Wastewater Treatment Plant (WWTP)

ADS ECO integrates industrial wastewater management systems.

WWTP Components

- Mechanical treatment systems
- Biological treatment systems
- Filtration infrastructure
- Water reuse integration
- Industrial discharge management

Objectives

- Water conservation
- Environmental protection
- Industrial reuse optimization
- Regulatory compliance

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16. Fire Protection & Industrial Safety Technologies

Safety Infrastructure

Systems Include

- Automated fire suppression systems
- Industrial fire monitoring
- Emergency shutdown systems
- Hazardous material controls
- Worker safety monitoring systems

Safety Objectives

- Industrial risk reduction
- Environmental protection
- Infrastructure resilience
- Operational continuity

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17. Laboratory & Quality Control Technologies

Laboratory Infrastructure

ADS ECO integrates industrial laboratory systems.

Laboratory Functions

- Waste characterization
- Material quality testing
- Environmental analysis
- Industrial process monitoring
- Operational quality assurance

Technology Benefits

- Material consistency
- Operational optimization
- Environmental compliance
- Product quality assurance

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18. Digital Integration & Smart Infrastructure

Smart Infrastructure Ecosystem

ADS ECO integrates all technology systems into a unified digital operational ecosystem.

Integrated Systems

- AI analytics
- SCADA infrastructure
- Smart logistics systems
- ESG reporting platforms

- Energy management systems
- Industrial automation architecture

Benefits

- Operational transparency
- Real-time optimization
- Predictive maintenance capability
- Institutional reporting readiness
- Infrastructure scalability

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19. Technology Scalability & Replication

The ADS ECO technology architecture is designed for modular expansion.

Scalability Features

- Modular MRF systems
- Expandable energy blocks
- Replicable recycling modules
- Flexible utility integration
- Smart infrastructure scalability

Regional Replication Potential

Potential future replication:

- Lori Region
- Armavir Region
- Kotayk Region

The modular design enables phased deployment based on regional waste volumes and infrastructure demand.

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20. Strategic Technology Conclusion

ADS ECO integrates advanced industrial, renewable energy, digital, and environmental technologies into a unified circular economy infrastructure platform.

The technology ecosystem combines:

- Artificial intelligence
- Smart industrial automation
- Advanced thermal conversion
- Renewable energy systems
- ESG monitoring infrastructure

- Smart operational analytics
- Circular manufacturing technologies

ADS ECO is positioned as:

- Advanced eco-industrial infrastructure
- Climate-aligned technology platform
- Smart circular economy ecosystem
- Institutional-grade sustainable infrastructure

The technological architecture establishes a scalable foundation for Armenia's next-generation environmental and industrial modernization.

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