Develop policies and regulatory approaches for green ICTs and circularity of e-waste

ICTs, environment and circular economy in the Union of the Comoros

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Context and challenges

Digital technology: a driver of development, a source of environmental pressures

Energy and resources

Networks, technical sites and data centres: consume energy and fuel (generators, equipment transport).

Greenhouse gas emissions

Fuel combustion, air conditioning and travel : CO_2 emissions are among the most critical aspects of the practical case.

Electronic and hazardous waste

WEEE, batteries and used oils: growing flows that require appropriate collection, treatment and recovery channels.

62 Mt of e-waste generated worldwide in 2022, of which only 22.3 per cent was collected and recycled in a documented manner (Global E-waste Monitor 2024).

International framework and objective

Global references, national foundations, a challenge of articulation

International references

ITU-D Question 2/2 (2026-2029): ICTs for the environment. Baku Declaration: Environmental Sustainability: A Dimension of Digital Transformation.

Situation in Comoros

Legal foundations already exist: prevention, reuse, recycling and recovery of waste, environmental requirements in licences and specifications.

Challenges to be addressed

Articulate the environment, ICTs and waste frameworks; clarify the roles of the ministry responsible for ICTs and ANRTIC in WEEE governance.

The objective of the contribution is to show how existing regulatory instruments can be mobilized and strengthened for greener ICTs, better WEEE management and a true circular economy.

Three laws, one regulatory chain

Direct impacts of ICTs: energy, fuels, emissions, WEEE, batteries, oils

Framework environmental law

General principles: prevention, reuse, recycling, recovery, responsibility, environmental assessment.

Law on electronic communications

Sector levers: licences, specifications, monitoring, infrastructure sharing.

Framework law on waste

Management mechanisms and extended producer responsibility (EPR), including for WEEE.

Design › **Deployment** › **Operation** › **End of life**

The challenge is to move from a dispersed legal framework to a coherent regulatory chain.

The circular economy: the foundation

Framework environmental law – the foundation of circularity

Reference	Principle	Scope for ICTs
Art. 4	sober and responsible production and consumption; prevention, reuse, reuse, recycling, recovery	Explicit legal basis for applying circularity to ICTs equipment
Art. 4	Management: sorting, collection, transport, storage, treatment, recycling, disposal	Management chain for waste from equipment and infrastructure
Art. 90	Responsible producer or holder until disposal or recovery	Empowerment of actors in the chain
Art. 91	Reduce, sort, recycle, reuse	Direct link to circularity hierarchy
Art. 92–97	Control and authorization of hazardous waste	Batteries, oils and certain categories of WEEE

To remember: the framework law offers an explicit basis for applying circularity to ICTs, with particular vigilance on hazardous waste.

Environmental Assessment

Environment framework law: The gateway to ICTs infrastructure

Art. 45–49	Environmental assessment, environmental and social impact study, audit and public inquiry.
Art. 46	The impact study conditions the environmental authorization when the project is likely to have harmful effects.
Decree 01-052/SG	Its annexes submit production, transport and telecommunication plants to an impact study.
Consequence	Major projects for networks, technical sites and ICTs infrastructure must be linked to the general environmental regime.

Remember that the ICTs specifications should explicitly refer to the applicable environmental authorizations and obligations.

The levers of telecoms law

Loi on electronic communications what it already allows

Sector Leverage	References	Use for circularity
Policy and licensing	Arts. 15, 17, 18, 20	Include environmental commitments in licences
Terms of reference	Arts. 20 and 20-IV	Transforming environmental objectives into enforceable obligations
Health and environment	Arts. 20-IV and 20-XVIII	Environmental protection and exposure limitation
Pooling	Arts. 20-V, 58, 58-II, 58-III	Avoid duplication and optimize infrastructure
Less damaging deployment	Arts. 63, 64-I to IV	Reduce impacts during installation and operation
Renewal and compliance	Arts. 24 and 94	Gradually introducing new requirements

Licences and terms of reference are the most direct means of ensuring that environmental objectives are enforceable against operators.

Waste law: the end of life

The link that completes the regulatory chain

Theme	Provision	Contribution for ICTs
Circular economy	Art. 39	Explicit legal definition
Prevention, reuse, recycling, recovery	Arts. 3, 7, 39	Established principles
Product durability	Art. 8	Reduction of waste and its harmfulness in the life cycle
Responsibility of the producer	Art. 6	Responsibility until final disposal or recovery
REP	Arts. 19–20	Producers, importers, distributors; Possible specific regime
WEEE	Art. 20	Specifically targeted e-waste
Recycling and recovery	Arts. 11, 20, 25	Explicit legal bases

Remember: the waste law provides the end-of-life link: producer's responsibility, EPR and WEEE are expressly targeted.

Cross-reading of the three laws

Complementarity at every stage of the life cycle

Life cycle stage	Environmental law	Law on electronic communications	Waste law
Design / planning	Prevention + Assessment	Technical requirements	Sustainability / prevention
Deployment	ESIA - Environmental and Social Impact Assessment / Authorisation	Licences, specifications, mutualization	Waste prevention
Operation	Environmental responsibility	ANRTIC control + operator obligations	Sorting/Collection/Traceability
Renewal	Audit / Compliance	Amendment of licences and terms of reference	EPR / Valorisation
End of life	Producer/holder responsibility	**Sector role to be clarified**	WEEE + recycling + recovery

Remember: each stage is covered by at least one law; only the sectoral role ICTs at the end of life remains to be specified (yellow box).

Observation: a role for ICTs to be clarified

WEEE governance: identified actors, coordination to be organized

What exists

The ministry responsible for ICTs defines sector policy, regulations and issues licences.
ANRTIC is responsible for regulation, investigation, control and follow-up. The law on electronic communications is a gateway to integrating circularity.

What's missing

No article of the Waste Act identifies ANRTIC as the WEEE governance institution. This does not mean that there is no legal basis: it is a need to clarify intersectoral responsibilities.

Ministry of ICTs | **ANRTIC** | **Ministry of Environment** | **Waste stakeholders** | **Operators / importers**

Initiative under way: ANRTIC's Development Projects Department is beginning to identify and harmonize WEEE analyses among operators (indicators to be entered into the digital observatory).

Licences and terms of reference

The operating lever for imposing environmental commitments

Terms of reference can convert circularity principles into measurable obligations :

- **WEEE and battery management**
- **Reuse, repair, refurbishment when relevant**
- **Sorting, storage, traceability, approved channels**
- **Infrastructure sharing**
- **Reduced energy consumption and CO2 emissions**
- **Compliance with ESIA and environmental protection requirements**

To remember: the renewal and compliance of licences and authorizations are a window to gradually tighten these prescriptions.

Practical case: operators' specifications

Environmental obligations already present in the specifications

Operator / document	Enhanced environmental commitment	Education
Comoros Telecom specifications, Art. 18.1	Compliance with environmental standards and the timetable for bringing them up to standard (Appendix 6)	An environmental obligation already exists in the regulatory contract
Comores Telecom – Art. 18.2	Respect for land-use planning and environmental protection when deploying infrastructure	Deployment is already linked to environmental protection
TELMA (YAS) – Statement of Reference, Art. 18	Environmental provision identified in the study	Possibility of harmonizing requirements between operators
Comoros Cables – Terms of Reference, Art. 16	Environmental Disposition Identified	The logic can extend to connectivity infrastructure

To remember, there is a contractual basis for harmonizing it between operators and making it measurable.

Proposed regulatory framework

An implementation framework for ANRTIC

Level	Proposed Action	Possible indicators
Policy	Common framework for ICTs – Environment – Waste	Adopted reference framework / coordination protocol
Licenses	Minimum circularity clauses	% of licenses with environmental clauses
Terms of reference	WEEE obligations, batteries, pooling, reporting	WEEE quantities; recovery rate; Shared sites
Control	Annual Environmental Compliance Grid	Number of checks, deviations, corrective actions
Data	Environmental indicators integrated into the observatory	Operator data: availability, quality, frequency
Partnerships	Approved supply chains + Ministry of the Environment + importers	Number of agreements / compliant providers

Analysis of the practical case

Simplified reading of criticality levels: Low · Moderate · High





OPERATOR GENERATOR SETS OUT OF SERVICE



WASTE EQUIPMENT FROM PYLON OPERATORS



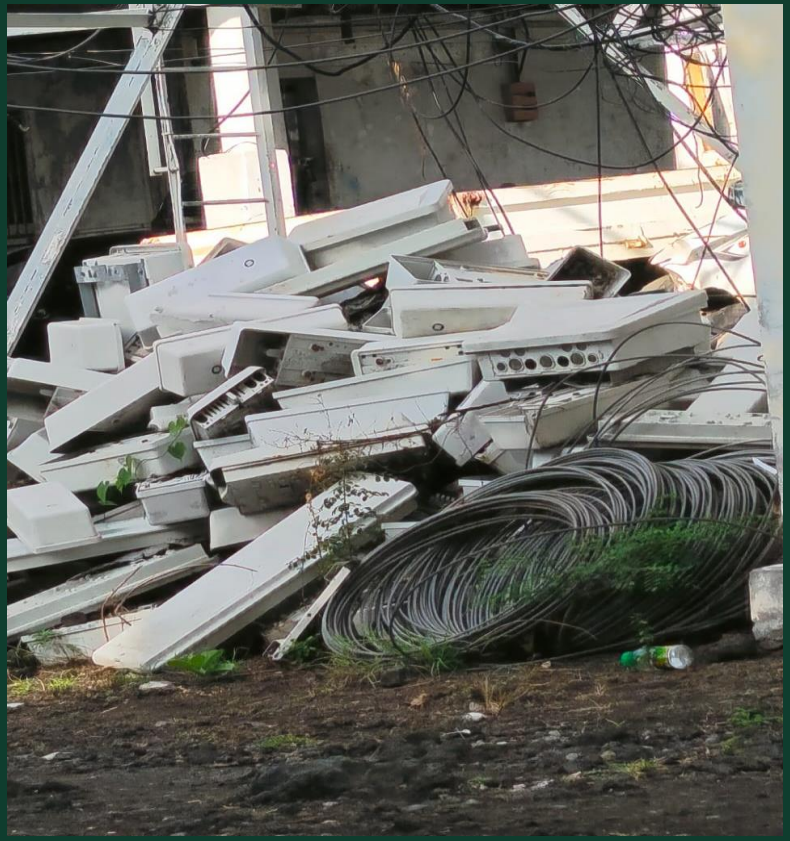
CABLES FOR OUT-OF-SERVICE OPERATOR NETWORKS



USED OIL TANK OPERATORS



DISH ANTENNAS OUT OF SERVICE



OUT-OF-SERVICE BTS ANTENNAS

Method and colour codes

Criticality = Severity (g) × Probability (p)

F — **Low impact – score 1 to 6**
NOT SIGNIFICANT

M — **Moderate impact – score 8 to 12**
SIGNIFICANT

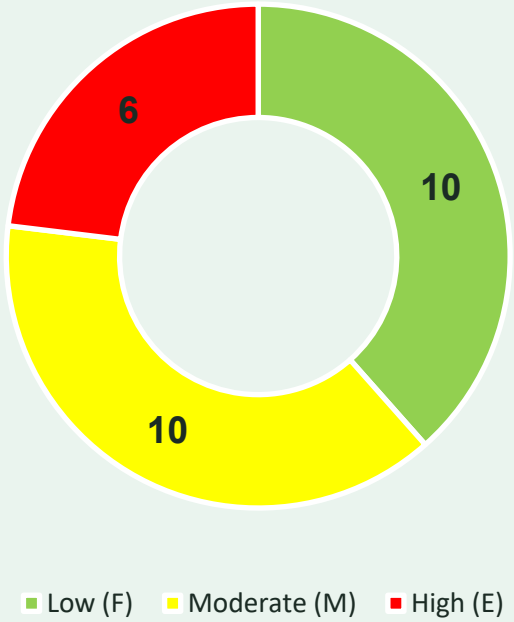
E — **High impact – score 15 to 25**
VERY SIGNIFICANT

G \ P	1 – Rare	2 – Improbable	3 – Possible	4 – Probable	5 – Almost certain
5 – Very serious	F5	U10	E15	E20	E25
4 – Bass	F4	M8	U12	E16	E20
3 – Average	F3	F6	M9	U12	E15
2 – Low	F2	F4	F6	M8	U10
1 – Very low	F1	F2	F3	F4	F5

Reading: cross the Severity (rows) and the Probability (columns) to obtain the code, e.g. G4 × P3 = M12.

Overview: 26 aspects assessed

Breakdown by criticality level



10 **Level F – 38%**
Not significant

10 **M level – 38%**
Significant

6 **E level – 23%**
Very significant

16 of 26 (62%)
significant or very significant aspects (M + E levels)

High (E) – very significant

6 aspects: score from 15 to 25 – priority for action

Environmental aspect	Main impact	G × P	Code
CO_2 emissions from generator sets (GEs)	Air pollution	4 × 4	**E16**
CO_2 emissions from trucks (on-site transport)	Air pollution	4 × 4	**E16**
Fuel consumption (vehicles and motorcycles)	Resource depletion / oil price	4 × 5	**E20**
E-waste (D3E)	Air, water and soil pollution	4 × 4	**E16**
Hazardous waste hydrocarbons (GE maintenance)	Air, water and soil pollution	4 × 5	**E20**
Used batteries	Air, water and soil pollution	4 × 4	**E16**

Moderate level (m) – significant

10 aspects: score from 8 to 12 – mastery to be strengthened

Process	Environmental aspect	Impact	G × P	Code
Purchasing & Logistics	**CO_2 emissions from vehicles**	Air pollution	3 × 3	**M9**
Energy	**Fuel consumption (GE)**	Resource depletion	4 × 3	**U12**
Energy	**Oil spill (GE maintenance)**	Soil / Groundwater Pollution	4 × 3	**U12**
HSSES control (AESS)	**Dumping of waste oil (storage)**	Soil / Groundwater Pollution	4 × 3	**U12**
Purchasing & Logistics	**Oil spill (storage)**	Soil / Groundwater Pollution	4 × 3	**U12**
Deployment	**Biodiversity loss (sites, FO poles)**	Impact on biodiversity	3 × 3	**M9**
Deployment / Energy	**GE gases and dusts**	Air pollution, inconvenience to local residents	4 × 2	**M8**
Information system	**Ink consumption**	Resource depletion	3 × 4	**U12**
HSSES control (AESS)	**Air conditioning**	Ozone layer, warming	3 × 4	**U12**
All processes	**Fire**	Soil and air pollution	4 × 2	**M8**

Low (F) – Not significant

10 aspects: score from 1 to 6 – common follow-up

F6	**Water consumption** Procurement & Logistics / Deployment	F4	**Non-basic waste (paper, packaging)** HSSES Steering
F3	**Medical waste (infirmary)** HSSES (Health, Health, Safety, Safety and Environment) management	F6	**Noise pollution from EHs** Energy
F2	**Inert waste (new sites)** Deployment	F6	**Solid waste from new projects** Deployment
F4	**Dust emissions** Deployment	F3	**Crusher noise and equipment** Energy / Deployment
F4	**Used wooden poles** Deployment	F2	**Waste fibres and cables** Deployment

Synthesis and points of attention

Fuel and CO_2

3 out of 6 high aspects: generators, trucks, vehicles and motorcycles. The fuel oil reached the maximum observed score (E20).

Hazardous waste

Hydrocarbons, WEEE and used batteries are at high levels; oil and fuel spills are in M12.

Points of vigilance

Two scores (E20*, F3*) do not correspond to the G × P calculation: to be checked. Aspects F remain under ongoing monitoring.

Priority: action plan on the 6 E aspects, then control of the risk of spillage (M12).

Conclusion: towards ICTs truly circular regulation

An existing framework

The foundations of the circular economy are already there: prevention, reuse, recycling, recovery, responsibility, WEEE.

A sectoral lever

Electronic communication law allows for the implementation of licences, specifications, control and sharing.

Clear priorities

6 very significant aspects out of 26: fuel, CO_2, hydrocarbons, WEEE and used batteries.

Possible role of ANRTIC is to gradually integrate circularity into specifications, operator control and the digital observatory, in coordination with environmental authorities.

The legal framework exists; The challenge now is to articulate it, make it operational and measure its results.