

Waste to Energy: Nepal's Path to a Circular and Energy- Secure Future

From household biogas to national fuel substitution — lessons from three decades of Nepal's bioenergy transition, and the case for BioCNG and RDF in strengthening energy security

Alternative Energy Promotion Centre (AEPC)
Government of Nepal

A Climate Risk — and a Missed Energy Opportunity

Nepal's waste systems remain largely linear, even as fossil fuel dependence keeps rising



6,613 TPD

Municipal solid waste generated nationally (2026)



62.3%

Collection efficiency — the rest is unmanaged, dumped or burned



57%

Share of organic waste in the mix — a ready energy feedstock, largely wasted



Climate & Health Risk

- Open dumping of organic waste generates methane, a potent greenhouse gas, while leachate contaminates groundwater in water-stressed areas.
- As urban waste volumes grow, these risks to climate, environment and urban resilience are intensifying across South Asia.



Forgone Energy Security

- Traditional biomass still meet a large share of Nepal's energy supply, alongside a growing and costly reliance on imported LPG, coal, diesel and petrol.
- Every tonne of organic waste left unmanaged is not just a climate liability — it is a domestic energy resource and a foreign-exchange saving left on the table.

Three Decades of Nepal's Biogas Journey

A gradual, deliberate shift from household energy to commercial and national-scale energy infrastructure



Nepal's NDC 3.0 keeps raising the bar

550 → 750

Large biogas plants targeted by 2030
→ 2035

500,000+

Households with biogas for cooking
by 2030

35%

Bioenergy share targeted in 2
cement industries, replacing coal

WHAT NEPAL HAS BUILT

Scale Achieved: Nepal's Bioenergy Footprint Today

From half a million household digesters to commercial gas, power and transport-fuel applications



456,000+

Household biogas plants

Foundation for public awareness, supply chains & local capability



500+

Medium-size plants (up to 100 m³)

A bridge to institutional and commercial applications



18

Large biogas plants operational

Municipal waste, commercial, pilot and ongoing projects

LARGE-SCALE END USES DELIVERED



1.6M+

LPG cylinders substituted by 11 high-pressure cylinder-filling projects over 9 years



4

Electrification projects generating power from biogas



2

Gas-grid projects delivering piped biogas



3

Automobile / transport-fuel projects



234,324+

Tonnes of organic fertilizer produced, cutting chemical-fertilizer imports

BioCNG and RDF: Displacing Imported Fossil Fuel

With LPG, coal, diesel and petrol dominating Nepal's fossil energy import bill, waste-derived fuels offer a direct, domestic substitute



BioCNG — transport & industrial fuel

- Upgraded from raw biogas (~50% methane) to ~95% methane, BioCNG substitutes directly for LPG, diesel and petrol in public transport, cooking and industry.
- If Terai's biogas potential is fully realised, Nepal could substitute up to 705 KTPA of LPG demand.
- That translates to an estimated FOREX saving of ~NPR 78 billion (~USD 0.55 billion) a year.



RDF — thermal fuel for industry

- Non-organic combustibles — plastics, textiles, wood — are baled into refuse-derived fuel (RDF) for thermal use in cement kilns, boilers and other industrial furnaces.
- NDC 3.0 already targets up to 35% bioenergy substitution for coal in two limestone-based cement industries by 2030.
- A single GCF-supported pilot programme is designed to recover 96 TPD of RDF and 9.8 TPD of BioCNG from just 860 TPD of collected waste.

705.3 KTPA

Potential LPG demand reduction

~NPR 78 B

Annual FOREX savings (~USD 0.55 B)

2.31 MMT CO₂e

Annual GHG emissions avoided

Why the Gap Persists: It's the Ecosystem, Not the Technology

A plant can be technically sound and still struggle if the market, finance and enabling institutions around it are weak



Policy & Supply Chain

- Poor waste segregation at source
- Biogas not recognised as a transport fuel
- No mandatory organic-fertilizer market
- Weak inter-agency policy coordination



Market

- Lack of assured gas buyers / off-takers
- Payment recovery difficulties
- Banks perceive the sector as high risk
- Limited industrial adoption; cost overruns from delays



Technology & O&M

- Shortage of local technical experts
- High maintenance & spare-part costs
- Irregular calibration and testing facilities
- Heavy dependence on imported components

Priorities for the Next Decade

Reliability, market creation and enabling policy — including a direct lever for energy security



Reliability

- Assured feedstock supply & source segregation
- Strong O&M, trained operators, local technical expertise
- Quality equipment, spare parts, timely maintenance



Market Creation

- Assured off-takers for BioCNG, RDF, electricity, fertilizer
- Results-based market incentives (e.g. NPR 15/kg for BioCNG, piloted under Nepal's GCF waste-to-energy programme)
- Stable demand from industry, hotels, agro-processing, transport



Enabling Policy

- National targets for large biogas, BioCNG & waste-to-energy
- Mandate replacement of coal / diesel / petrol with gas for select industries
- Predictable subsidies, tax incentives, and clear energy-market access

KEY TAKEAWAY FOR THE DIALOGUE

From Waste Challenge to Climate-Smart, Investable Pipelines



Reframe waste as a resource

Nepal's 30-year biogas experience shows organic waste can deliver clean cooking fuel, transport fuel, power and fertilizer — not just disposal.



Prioritise BioCNG & RDF for energy security

With LPG, coal, diesel and petrol imports weighing on the economy, waste-derived fuels are a direct, domestic substitute.



Build the ecosystem, not just the plant

Bankable pipelines need assured off-takers, risk-sharing finance and coherent policy — the same ingredients GCF concept notes should test for.

Thank you — I look forward to the discussion

Alternative Energy Promotion Centre (AEPC) · Government of Nepal