From Community Waste to Community Fertilizer: A Sequential Execution Plan

The decision in plain language

Ronnie’s proposal is technically sound: use existing digesters to turn sewage and other organic waste into useful methane, make nitrogen fertilizer from that methane, and recover nutrients from the remaining liquids and solids. This advances *From Waste to Harvest* from explanation into execution. It retains Ronnie’s central safeguard: prevent pharmaceuticals, heavy metals and persistent chemicals from entering the loop wherever possible.

The strongest opening is probably not an ammonia factory at every sewer plant. It is a regional partnership: wastewater utilities recover nutrients and supply cleaned gas; experienced chemical operators make ammonia; farmer cooperatives distribute fertilizer. Compare that arrangement against a small on-site unit before choosing. Named organizations below are research candidates, not committed partners. Nobody was contacted.

Recommendation: screen Philadelphia Water Department (PWD), Philadelphia Gas Works (PGW) and Philadelphia Energy Authority (PEA) first; benchmark Newtown Creek’s operating renewable-natural-gas system; and use Ostara installations as a separate nutrient-recovery model. Protect sanitation first: fertilizer production must never compromise sewage treatment.

1. Two harvests, not one

New nitrogen fertilizer: clean biogas, reform methane with steam into hydrogen, remove carbon dioxide, and combine hydrogen with nitrogen separated from air to make ammonia. The nitrogen comes from air—not methane. Reforming is mature chemistry, but biogenic gas does not mean zero emissions.

Recovered nutrients: capture existing phosphorus and some nitrogen from digester liquids as struvite; consider ammonia stripping and acid absorption to produce ammonium salts. Use residual biosolids only where testing and law support it. Struvite recovery generally treats a concentrated sidestream, not every pound entering the sewer. Keep separate mass balances to avoid counting recovered nitrogen twice.

Gas needs removal of hydrogen sulfide, moisture, siloxanes and other contaminants. Methane enrichment and polishing depend on pipeline and reformer specifications; pipeline-quality gas may still require additional catalyst protection. Digesters also need heat: diverting their fuel without replacement would undermine operation. Gas-derived ammonia is a separate chemical product from sludge, but its purity still needs verification. Neither it nor recovered crystals should be presumed safe simply because the feedstock is renewable.

2. Sequential execution: six phases with decision gates

Timelines are planning estimates from authorization, not promises or published project schedules.

Phase 1 — Establish ownership and select sites: months 0–3

Goal: identify two or three credible sites without buying equipment.

Steps: appoint a municipal sponsor and a small group covering utilities, fertilizer operations, farmers and independent engineering. Obtain twelve months of gas production, methane concentration, heat use, flaring, downtime, nutrient loads, contamination results and sales contracts. Rank sites by genuinely available gas, clean feedstocks, farm access and operator capability. Include a “do not convert” option.

Who acts: utility boards, city procurement staff, agricultural extension and county conservation districts; PWD/PGW/PEA for a Philadelphia lead.

Decision gate: subtract committed gas, plant heat and existing energy value before selecting a lead. A large digester with no uncommitted gas is not automatically a good conversion.

Phase 2 — Prove safety and compare routes: months 3–9

Goal: choose the lowest-risk fertilizer pathway.

Steps: audit industrial sewer dischargers; establish PFAS, metals and pharmaceutical testing; identify disposal routes for rejected material. Compare nutrient recovery alone, RNG supplied to an existing ammonia producer, and modular on-site production. Obtain vendor quotations, preliminary permit opinions, lifecycle emissions models and crop-trial designs. Discuss odor, traffic and ammonia accidents with neighbors.

Who acts: utility pretreatment staff, accredited laboratories, independent process engineers, state environmental/agriculture departments and farmers.

Decision gate: an independently reviewed feasibility study with measured nutrient balances and viable economics under low-credit prices. Reject contaminated feedstock rather than dilute it.

Phase 3 — Secure contracts, permits and finance: months 9–18

Goal: make a pilot financeable without putting household sewer bills behind speculative technology.

Steps: negotiate gas supply, waste delivery, fertilizer purchasing, maintenance and environmental-attribute ownership. Complete design and safety studies. Separate wastewater infrastructure costs from chemical-manufacturing costs. Seek eligible water-infrastructure loans, demonstration support and private risk capital. Obtain permits before irreversible construction commitments.

Who acts: municipal bond counsel, lenders, developers, cooperative leaders and state funding administrators.

Decision gate: signed agreements, funded contingency, clear liability allocation and a downside case covering essential costs. Do not rush unsafe construction simply to meet a tax deadline.

Phase 4 — Build and independently measure: months 18–36

Goal: demonstrate safe, reliable production through a full operating year.

Steps: install nutrient recovery first where independently useful. Add a limited gas-to-fertilizer demonstration or contracted ammonia production. Meter leakage, usable nutrient output, energy use, uptime and rejected material. Test product batches under a release procedure. Maintain backup digester heating and gas handling.

Who acts: qualified suppliers and chemical operators, utility staff, laboratories and extension agronomists.

Decision gate: a full year of reliable performance, farmer acceptance and audited cost per pound of usable nutrient—not simply a successful opening ceremony.

Phase 5 — Expand proven production: years 3–5

Goal: grow only what works.

Steps: expand recovery, aggregate additional clean food waste where capacity permits, and contract with a regional ammonia producer or warranted modular supplier. Arrange storage for seasonal demand and farmer nutrient-management support. Do not encourage overapplication to increase sales.

Who acts: utility consortium, cooperative/distributor, lenders and regional planners.

Decision gate: secure buyers, performance guarantees, affordable debt service and unchanged contamination standards.

Phase 6 — Replicate a regional network: years 5–8

Goal: connect communities without rebuilding everything at each plant.

Steps: standardize testing and contracts; aggregate qualified gas; share processing and distribution hubs. Consider source-separated toilet systems mainly in new development, rather than replacing existing sewers wholesale. Any public communication requires separate approval.

Who acts: regional utilities, states, cooperatives and experienced infrastructure operators.

Decision gate: evidence that replication lowers cost and genuinely displaces fossil fertilizer production.

3. Existing entities worth evaluating

Municipal anchors

Philadelphia Northeast WPCP—PWD, PGW and PEA: first local screening choice. PEA's 2023 information request identifies eight digesters, approximately 450,000–510,000 thousand cubic feet of annual biogas, and 5.6 MW cogeneration using biogas plus natural gas. A later solicitation seeks enhanced biogas monetization with PGW, beginning at Northeast and potentially extending to Southwest. Existing digestion, gas expertise and procurement make this practical. Its spring-2026 construction target is a schedule—not proof construction occurred; confirm current project status and contracts. [1–2]

Newtown Creek—NYC DEP and National Grid: strongest measured RNG benchmark. DEP reports nearly 286,000 MMBtu of RNG during June 2025–May 2026, with 85% system uptime. More than 54,000 wet tons of food scraps were co-digested alongside sludge. Existing upgrading and pipeline injection favor a fertilizer supply agreement, but gas already serving another market is not automatically available. [3]

DC Water Blue Plains/Bailey Bioenergy Facility: operating and training partner. Thermal hydrolysis and digestion support up to 10 MW of electricity, approximately one-third of plant demand, plus Class A biosolids. Sophisticated operations make it a useful partner. Its gas already has a valuable job: target surplus or additional recovery rather than sacrifice dependable power and heat. It is not an existing methane-to-ammonia installation. [4]

Madison Metropolitan Sewerage District, Nine Springs, with Ostara: nutrient-recovery reference. Its documented 2014 installation combines digestion improvements with phosphorus/nitrogen recovery into Crystal Green. Two systems had stated annual capacity of 1,300 tons of fertilizer. The reported $3 million recovery-system cost is historical, not a 2026 quotation. This models the second harvest, not ammonia synthesis from methane. [5]

Farm, food-waste and RNG partners

Vanguard Renewables/TotalEnergies: River Falls and Eden, Wisconsin, and Amelia Court House, Virginia, facilities were reported completed in April 2026, with combined RNG capacity near 870,000 MMBtu annually. They integrate farm digestion, food-waste handling, upgrading and committed purchasing. Their announced gas customer is AstraZeneca: evaluate them as developers or expansion partners, not a pool of unclaimed gas. [6]

Divert, Longview, Washington: reporting on its 2026 opening describes food-waste depackaging, capacity for 100,000 tons annually, pipeline injection and expected digestate fertilizer. Separately collected food offers an alternative to sewage, though plastics and cleaning chemicals still require control. Evaluate new capacity rather than assume existing sales can be redirected. [7]

Fertilizer producers and modular comparators

Yara, Cubatão, Brazil: closest verified chemical precedent. Yara announced first biomethane-based ammonia deliveries in December 2024 using purified gas from sugarcane waste, claiming greenhouse-emissions reductions up to 75%. This proves substitution in existing ammonia infrastructure—not that every small digester can cheaply copy it. Verify company emissions claims independently. [8]

Fertiberia, Puertollano, Spain: renewable-hydrogen integration began in 2022; thyssenkrupp Uhde describes further conversion of an existing 600-tonne/day ammonia unit. This uses electrolysis, not sewage methane. The useful lesson is preserving industrial equipment while replacing part of its feedstock. [9]

TalusAg, Kenya Nut Company and Landus cooperative: TalusAg documents a roughly one-tonne/day solar-powered Kenya deployment and a 15-year purchase agreement. Its partner page identifies work with Iowa's farmer-owned Landus on a U.S. installation. These demonstrate modular and cooperative

approaches; the page is not U.S. commissioning confirmation. Neither establishes sewage-biomethane reformer performance. [10]

4. Scale: substantial, but not unlimited

Worked estimate using Newtown Creek's measured RNG—not a Philadelphia forecast:

1. DEP reports approximately **286,000 MMBtu/year** of RNG. This reflects actual downtime and excludes gas retained for some on-site heating. It includes food-waste co-digestion, so it is not a human-waste-only yield. [3]

2. Assuming pipeline energy is reported at higher heating value, convert to lower heating value: **286,000 × 1.055 GJ/MMBtu × 0.90 ≈ 272,000 GJ/year**. The 0.90 adjustment is an engineering approximation; verify billing basis.

3. IEA gives **28 GJ/tonne ammonia** for best-available natural-gas production. The energy-equivalent benchmark is **272,000 ÷ 28 ≈ 9,700 tonnes/year**—not a small-plant guarantee. [11]

4. Assuming **32–40 GJ/tonne** for a less efficient installation gives **6,800–8,500 tonnes ammonia/year**. This is a planning sensitivity, not vendor performance. Engineering must account for auxiliary electricity and all losses.

5. Ammonia is **14/17 nitrogen by mass**: approximately **5,600–7,000 tonnes nitrogen**, or **12.3–15.4 million pounds** annually.

6. At an **illustrative 150 pounds of purchased nitrogen per acre**, that serves about **82,000–103,000 acres**. Actual rates depend on crop, yield, soil, rotation and manure credits; 150 is an assumption, not a recommendation.

For a nearby agricultural comparison, USDA's Lancaster County 2022 profile search result reports **95,549 acres of grain corn**. At the illustrative rate those acres require 14.3 million pounds: a Newtown-sized plant supplies approximately **86–108% of that one crop's assumed demand**, not all Lancaster agriculture. Direct retrieval of the USDA PDF failed, so confirm that acreage before investment decisions. Across a million-acre regional crop base at the same assumed rate, coverage falls to **8–10%**. This illustrates scale, not a proposal to haul New York fertilizer to Lancaster. [12]

The calculation assumes all reported RNG could be reassigned. Contracts may make that impossible; using only 10% produces only 10% of these quantities. Nutrient recovery adds value but needs its own measured balance. A city's sewage alone does not guarantee regional fertilizer self-sufficiency.

5. Costs and the biggest hurdle

The chemistry works. **The hardest commercial obstacle is competing with inexpensive fossil ammonia while surrendering existing gas, heat and renewable-fuel-credit revenue.**

Illustrative feedstock sensitivity—not current market quotations: at 32 GJ/tonne ammonia, gas at $4/GJ contributes **$128/tonne**; RNG at $15/GJ contributes **$480**; RNG at $25/GJ contributes **$800**. Labor,

maintenance, financing, nitrogen separation, polishing, electricity, storage and transport come on top. A small unit can lose money before financing begins.

IEA's 2021 roadmap estimated emerging near-zero-emission routes at 10–100% above conventional production, depending on energy and location. That is historical technology context, not a November 2026 price forecast. Obtain matched delivered-cost bids for fossil ammonia, certified biomethane-based ammonia and modular production. [11]

Require guarantees for annual output, uptime, gas specifications, catalyst life and energy use. Modules reduce transport dependence but generally sacrifice industrial economies of scale. Direct nutrient recovery may beat synthesizing new ammonia; buying processing services may beat owning a chemical plant. No defensible site-specific capital cost can be established without engineering and quotations.

6. Government support, with 2026 limitations

Federal

Water infrastructure: EPA's Clean Water State Revolving Fund supports eligible treatment-plant energy conservation, including methane capture, co-digestion and conversion. Evaluate WIFIA for larger eligible water projects. Separate treatment infrastructure from merchant fertilizer manufacturing: whole-project eligibility is not automatic. [13]

45V hydrogen: Public Law 119-21 moved the construction deadline to **before January 1, 2028**. Qualifying production receives ten years of credits. The often-quoted maximum is $3/kg before inflation adjustment, requiring the highest emissions tier and labor compliance; biomethane alone does not guarantee qualification. [14]

Final methane rules use a **flaring baseline for wastewater methane**, not automatic credit for preventing atmospheric release. In 2026, RNG use generally requires direct connection or other documented exclusive physical delivery. Certificate-based treatment awaits a Treasury registry determination that cannot occur before 2027. Ordinary pipeline certificates should not be assumed sufficient for 45V today. [15]

45Z and RFS: 45Z was extended through 2029 for qualifying transportation fuel—not fertilizer. September 2026 IRS guidance addresses manure-specific emissions and revised rules. EPA's RFS similarly rewards approved transport pathways, including qualifying biogas-derived CNG/LNG. Gas redirected into fertilizer does not automatically retain these benefits. Model opportunity costs and prevent double claims. [16–17]

Section 48: the legacy qualified-biogas investment credit generally requires construction to have begun by **December 31, 2024**. Do not promise an automatic 30% IRA credit for a new 2026 digester. Hydrogen investment-credit elections have separate requirements and interact with production credits. [18]

USDA: REAP can support eligible rural producers/businesses, but its reviewed program page says grant applications are not being accepted. More importantly, USDA extended the RBCS biodigester loan-guarantee pause through **December 31, 2026, or further guidance**, withdrawing pending applications. Its

announcement cites 28% delinquency in the reviewed biodigester portfolio—not all U.S. digesters. Fertilizer Production Expansion Program is a precedent to investigate, not confirmed open funding. [19–20]

Most-needed federal support: independent demonstrations, contaminant research, performance-based financing and incentives rewarding verified low-carbon fertilizer rather than only transport fuels. These are recommendations, not current entitlements.

State, municipal and international

Pennsylvania: seek PENNVEST/DEP review for eligible wastewater and nutrient-removal investments; FY2026 revolving-fund plans exist. Philadelphia's GESA solicitation requires guaranteed savings above project and financing costs. It is a contracting mechanism, not a grant. [2,21]

Leading fuel-credit states: California's LCFS, Oregon's Clean Fuels Program and Washington's Clean Fuel Standard illustrate transportation-carbon markets. They may improve RNG economics but do not automatically subsidize fertilizer. California's amended rules limit some future biomethane/avoided-methane crediting periods; do not model indefinite credits. [22]

Local requirements: pretreatment controls, wastewater permit changes, reformer air permits, gas interconnection, zoning, fire codes, worker training and ammonia storage/transport safety. Federal process-safety and risk-management applicability depends on quantities and configuration. State fertilizer registration, nutrient guarantees, labels and contaminant specifications require review; wastewater permits are not fertilizer certification.

Biosolids/PFAS: Class A addresses pathogens, not absence of PFAS, metals or drugs. Part 503 remains foundational alongside stricter state rules. EPA's July 2026 PFAS biosolids guidance remains draft on the reviewed page; comments ended October 5. Its earlier risk assessment identified risks in some modeled scenarios at 1 ppb PFOA/PFOS—not a universal legal limit. Maine's land-application restrictions demonstrate why a disposal fallback matters. [23–24]

Support Ronnie's source-control principle with industrial inventories, enforceable discharge limits where authorized, medicine take-back, safer procurement and upstream PFAS reduction. Take-back addresses unused drugs, not medicines excreted after legitimate treatment. Digestion does not reliably eliminate these contaminants; test products and residuals separately.

Internationally, Yara's Brazil operation and Spain's retrofit demonstrate industrial routes. The EU's May 2026 Fertiliser Action Plan identifies Innovation Fund and European Hydrogen Bank support for decarbonisation. March 2026 RENURE rules allow member states, with safeguards, to exempt specified manure-recovered ammonium salts, concentrates and struvite from the manure nitrogen application limit. An October proposal to extend flexibility to certain liquid digestates is not yet adopted. These rules concern manure, not blanket authorization for sewage products. EU fertilizer conformity and waste-derived-input rules still require specialist review. Adopt engineering lessons, not assumptions that foreign subsidies transfer to U.S. projects. [27]

7. Public funding through markets

Municipal/green bonds: finance proven treatment assets against established utility repayment capacity, with independent reporting of proceeds. DC Water's $350 million 2014 green century bonds financed Clean Rivers—not ammonia—but demonstrate public-market access. Green labels do not eliminate debt or engineering risk. Tax-exempt financing can reduce 45V credits under applicable rules. [14,25]

Community investment: eligible companies can use Regulation Crowdfunding up to **$5 million in twelve months**, through a registered intermediary. Regulation A permits **$20 million Tier 1/$75 million Tier 2**, with substantial compliance. These are fundraising ceilings, not grants or guaranteed demand. Do not shift experimental losses to residents unable to bear them. [26]

Cooperatives and offtake: farmer equity can align production with actual demand. TalusAg's Kenya agreement and Landus relationship are relevant precedents. Negotiate multi-year purchasing with price floors, volume bands and quality conditions; farmers should never be obliged to buy unusable product. [10]

Public-private partnerships: utilities can retain sanitation assets while specialists accept defined operating and equipment risks. Vanguard/TotalEnergies and AstraZeneca demonstrate private capital plus committed demand, although not a municipal fertilizer partnership. Require open-book costs, guarantees and clear gas, nutrient and credit ownership. [6]

Environmental markets: carbon credits may support verified additional methane reductions; nutrient credits depend on watershed rules. Existing capture is not automatically additional. Never sell the same emissions benefit under incompatible fuel-credit, offset and fertilizer claims. Treat volatile or unapproved credits as upside, not the basis of debt repayment.

First practical decision

Prepare a small feasibility brief: Philadelphia as lead, Newtown Creek as benchmark, direct nutrient recovery as the lower-risk first investment, and an existing ammonia producer versus modular production as competing options. Ronnie's circle is achievable in pieces. Measure safety, recovery, farmer needs and affordability—then expand only what works.

Sources and verification notes

Checked November 8, 2026, ET. Company statements are not independent certification. Estimates are labeled. Sources 13 and 23 were available through search, but direct fetches timed out; source 12 PDF retrieval failed. No outreach, application, or investment solicitation occurred.

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