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CONCEPT FOR ARMENIA'S NATIONAL CHEMICAL CLUSTER

Vanadzor Nitrogen Chemicals Complex and the Yerevan New Nairit Polychloroprene Complex

Prepared as a concept project for further discussion, structuring and progression to Pre-FEED / FEED. This document presents a preliminary engineering and economic concept and is not a final investment memorandum or detailed engineering design.

The document brings together two interrelated initiatives: establishing a modern nitrogen chemicals hub in Vanadzor and re-establishing polychloroprene production in Yerevan on a new technological basis, drawing on Nairit's industrial heritage and expertise.

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1. EXECUTIVE SUMMARY

The project envisages an integrated national chemical cluster in Armenia with two core industrial centres: the Vanadzor Nitrogen Chemicals Complex and the Yerevan New Nairit Polychloroprene Complex. Both initiatives build on the country's industrial heritage, while being developed as modern, next-generation facilities aligned with global requirements for energy efficiency, safety, environmental performance and downstream processing.

The central idea is to move beyond restoring individual Soviet-era production facilities and establish a new industrial platform. Large-scale basic chemicals production would provide scale and export cash flow, while a centre for polymers and materials science would generate higher added value within Armenia.

- Vanadzor cluster: approximately 1 million tonnes of finished nitrogen fertilisers per year, including granular urea, urea ammonium nitrate (UAN) and calcium ammonium nitrate (CAN) / ammonium nitrate, together with higher-value downstream products: melamine, melamine resins, AdBlue and purified CO_2.
- Yerevan cluster: new polychloroprene rubber and latex production in two phases, with 45–50 thousand t/year in Phase 1 and up to 75 thousand t/year following Phase 2. A substantial share of the polymer output would be processed into adhesives, sealants, coatings, membranes, compounds and industrial rubber products.
- Preliminary base programme cost: approximately USD 4.15–4.5 billion, excluding financing costs. The indicative total financing package, including interest during construction, working capital and contingencies, is approximately USD 5–5.5 billion.
- The project should progress through successive stages: concept → Pre-FEED → FEED → financing and EPC tender → construction → commissioning → achievement of design capacity.

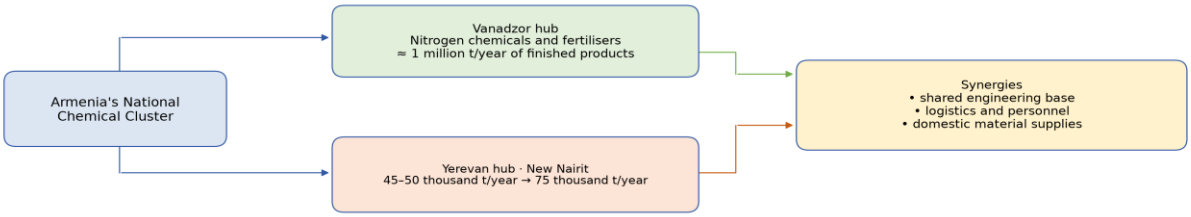


Fig. 1. Overall architecture of Armenia's National Chemical Cluster

The project involves more than industrial construction: it entails creating a new core of national manufacturing capacity. It requires coordinated development of energy, transport, logistics, water supply, engineering skills, research, laboratories and export channels.

2. STRATEGIC RATIONALE AND INDUSTRIAL BACKGROUND

During the Soviet period, Armenia had well-developed chemical industry centres, most notably the Yerevan cluster around Nairit and the Kirovakan / Vanadzor chemical complex. These centres operated in different but complementary segments: polymers, rubbers, latexes, plastics and industrial rubber products, as well as nitrogen chemicals, chemical fibres and related intermediates.

The current strategy does not envisage simply replicating the old plants. Instead, it proposes using the country's industrial expertise as a foundation for new facilities adapted to modern markets. Vanadzor

should focus on large-scale nitrogen chemicals and fertilisers, while Yerevan should focus on specialty polymer chemistry and higher-value downstream processing.

The project is important for Armenia for several reasons:

- diversification of the country's industrial base and an increased share of manufacturing;
- creation of a major export-oriented industrial core;
- revival of chemical and materials science expertise on a modern basis;
- creation of thousands of skilled jobs and demand for engineering education;
- establishment of a domestic production base for chemical materials, adhesives, coatings, compounds, membranes and specialty products;
- greater technological independence and stronger export potential.

3. OVERALL ARCHITECTURE OF THE NATIONAL CHEMICAL CLUSTER

The proposed programme comprises two independent but interconnected projects. Each has its own production rationale, product portfolio and feedstock requirements. However, both projects should be linked through common engineering standards, logistics, workforce training and applied research and development (R&D).

Component	Primary function	Indicative scale
Vanadzor Nitrogen Chemicals Complex	Large-scale basic chemicals and fertiliser production	≈ 1 million t/year of finished products
Yerevan New Nairit Complex	Polychloroprene rubbers and latexes; downstream processing	45–50 thousand t/year → 75 thousand t/year
Shared research and engineering platform	Laboratories, quality, standards, R&D and staff training	Unified framework
Logistics and sales	Export channels, warehouses, rail and domestic supplies	Integrated framework

The cluster's underlying rationale is that Vanadzor provides industrial scale and a steady export flow, while Yerevan develops a more technology-intensive segment with advanced downstream processing. This structure helps reduce dependence on any single product or market.

For programme coordination, the cluster should be considered a single platform with a common management framework, rather than a collection of separate plants. This would encompass shared requirements for safety, digital production management, logistics, laboratory facilities, staff training and environmental monitoring.

4. VANADZOR NITROGEN CHEMICALS COMPLEX

4.1. Purpose and Product Strategy

The Vanadzor project is proposed as a modern integrated nitrogen chemicals complex producing 1 million tonnes of finished nitrogen fertilisers per year, together with high-margin associated products. Ammonia production forms the foundation of the complex, supporting subsequent development of urea, liquid fertilisers, nitrates and downstream products.

- granular urea: approximately 700 thousand t/year;
- UAN: approximately 200 thousand t/year;
- CAN or comparable nitrate products: approximately 100 thousand t/year;
- melamine: approximately 25–30 thousand t/year;
- AdBlue and industrial urea solutions;
- melamine-formaldehyde resins and related chemicals.

4.2. Preliminary Process Configuration

The process configuration centres on ammonia production from natural gas and integration of the principal downstream processes. This approach provides an established global technology base and substantial flexibility in the product portfolio.

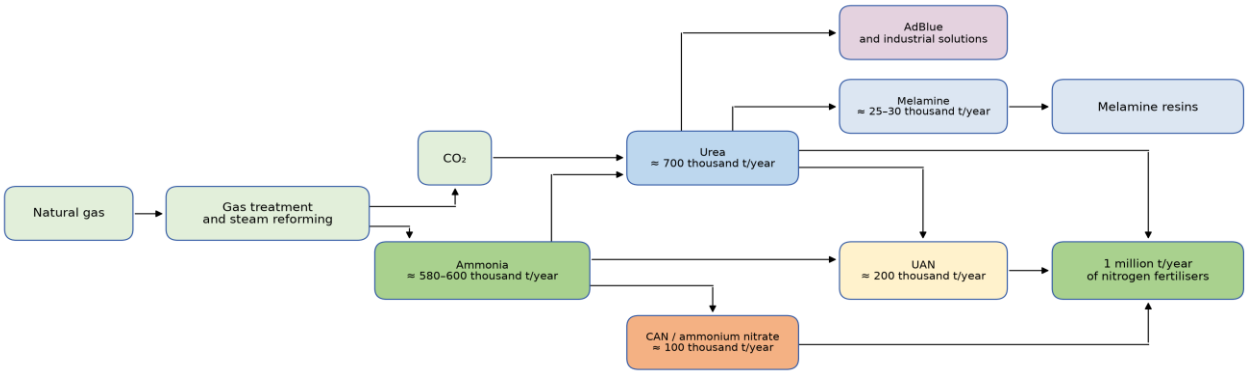


Fig. 2. Simplified block flow diagram of the Vanadzor Nitrogen Chemicals Complex

The main process flow is as follows: natural gas is treated and fed to steam reforming; after shift conversion and CO_2 separation, a hydrogen stream is obtained and used with nitrogen from air for ammonia synthesis. Ammonia and CO_2 are then sent to the urea plant. Part of the ammonia is routed to nitric acid / nitrate production and liquid nitrogen fertiliser production. Urea, in turn, serves as the feedstock for both merchant granular urea and melamine, AdBlue and other products.



Fig. 2A. Conceptual visualisation of the Vanadzor Nitrogen Chemicals Complex: large-scale production, tank farm and industrial logistics infrastructure.

4.3. Process Units

- natural gas treatment, steam reforming and synthesis gas production;
- ammonia production with an indicative capacity of 580–600 thousand t/year;
- urea production and granulation;
- UAN production;
- CAN / nitrate production;
- melamine production;
- melamine resin production;
- CO_2 purification and compression systems;
- AdBlue and industrial solution production;
- plant-wide utilities and infrastructure: steam, water, cooling, power supply, storage, internal rail logistics, effluent treatment and flare systems.

4.4. Preliminary Capacities

Parameter	Indicative value
Ammonia	≈ 580–600 thousand t/year
Granular urea	≈ 700 thousand t/year
UAN	≈ 200 thousand t/year
CAN / nitrate products	≈ 100 thousand t/year
Melamine	≈ 25–30 thousand t/year
Total nitrogen fertilisers	≈ 1 million t/year
Natural gas	approximately 0.50–0.60 billion m^3/year

These figures are indicative and subject to confirmation during Pre-FEED. At this stage, it is particularly important to establish the overall configuration and economic rationale of the complex, rather than treat individual product figures as definitive.

4.5. Feedstock and Infrastructure Requirements

Natural gas is the principal driver of the Vanadzor project's economics. A long-term gas pricing formula, guaranteed supply volumes and reliable logistics are critical. In addition to gas, the complex will require substantial quantities of water, electricity and steam, together with extensive storage and rail facilities.

- natural gas as the key feedstock and energy source;
- access to water and water treatment facilities;
- reliable power supply and backup capacity;
- rail infrastructure for product dispatch;
- warehouses, tanks and loading / unloading systems;
- effluent treatment facilities and environmental monitoring systems.

4.6. Preliminary Cost of the Vanadzor Project

Project component	Cost range, USD million
Ammonia production	650–850
Urea and granulation	400–550
Nitric acid, nitrates, UAN/CAN	250–400
Melamine, resins, AdBlue, CO_2	150–250
Utilities, offsites and effluent treatment	250–400
Warehouses, tanks, rail and loading facilities	150–250
Engineering, licences, management and commissioning	150–220
Contingency and unforeseen costs	250–350
TOTAL	≈ 2 300–3 100

Approximately USD 2.7 billion may be used as the working base estimate for further planning. The final cost will depend on technology selection, the downstream product portfolio, the extent of local participation in construction, the condition of external infrastructure and equipment supply terms.

Vanadzor provides the main industrial scale and serves as the anchor export project for the entire programme. With the right configuration, it can generate a stable revenue stream, strengthening the economic resilience of the whole cluster and increasing Armenia's investment appeal as a location for modern chemical production.

5. YEREVAN NEW NAIRIT POLYCHLOROPRENE COMPLEX

5.1. Project Concept

The Yerevan project involves establishing a new, modern polychloroprene complex that draws on Nairit's historical expertise while being built as a technologically new facility. Its purpose is not simply to produce merchant rubber, but to develop a broad range of specialty products through further downstream processing.

Rather than focusing on bulk commodity rubbers, the project targets segments where formulations, consistent quality, engineering support and specialised material properties are more important. This enables higher added value per tonne of output and reduces reliance on competition based purely on price.

5.2. Implementation Phases

Phase	Capacity	Scope
Phase 1	45–50 thousand t/year	Start-up of core polychloroprene rubber and latex production, together with initial downstream processing capacity
Phase 2	up to 75 thousand t/year	Production expansion and a higher share of domestic processing into high-value products

5.3. Process Rationale

A modern butadiene-based route is proposed: butadiene and chlorine are used to produce chloroprene, which is then polymerised into polychloroprene rubbers and latexes. An on-site membrane chlor-alkali plant is envisaged to supply chlorine, caustic soda and hydrogen.

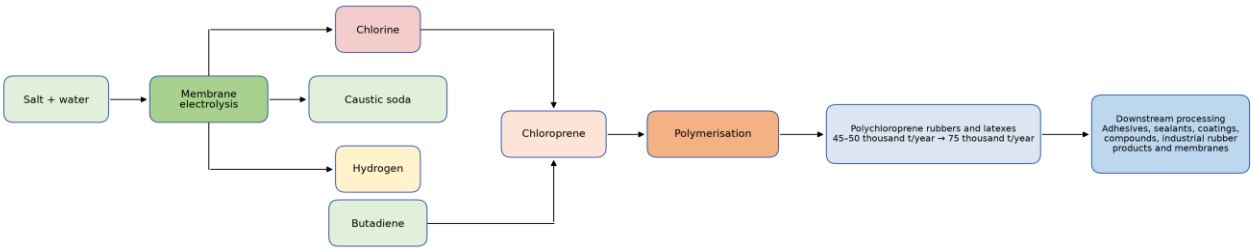


Fig. 3. Simplified block flow diagram of the New Nairit Complex

This route is more modern and energy-efficient than the historical acetylene-based process. It provides greater flexibility in the polymer product range, better production cost control and lower energy and gas consumption.



Fig. 3A. Conceptual visualisation of the Yerevan New Nairit Complex: a modern specialty chemicals and polymers site with production buildings and utility networks.

5.4. Main Process Units

- brine preparation and membrane electrolysis;
- chlorine, caustic soda and hydrogen production;
- chloroprene synthesis from butadiene and chlorine;
- polymerisation and production of solid rubbers and latexes;
- coagulation, drying, packaging and storage units;
- production of adhesives, sealants and coatings;
- production of specialty compounds;
- initial and subsequent phases of industrial rubber product manufacturing;
- environmental facilities: gas treatment, treatment of chlorinated organic streams, wastewater treatment and industrial safety systems.

5.5. Product Portfolio

Phase 1 should combine merchant rubber and latex production with the launch of on-site downstream processing. At full capacity, a substantial share of the polymer output should be processed within Armenia.

Product category	Phase 1	After Phase 2
Merchant polychloroprene rubbers and latexes	≈ 25–28 thousand t of polymer base	≈ 25–30 thousand t of polymer base
Adhesives, sealants and coatings	≈ 7–9 thousand t of polymer base	≈ 15–18 thousand t of polymer base
Specialty compounds	≈ 7–8 thousand t of polymer base	≈ 12–15 thousand t of polymer base
Industrial rubber products and membranes	≈ 6–7 thousand t of polymer base	≈ 15–18 thousand t of polymer base
TOTAL dry polymer capacity	≈ 45–50 thousand t/year	≈ 75 thousand t/year

The final mass of saleable products may exceed the mass of the polymer base because of solvents, water, resins, fillers, textile substrates, reinforcement and other components. Consequently, with 75 thousand t/year of polymer base, total finished output from further downstream processing may be substantially higher.

5.6. Potential Finished Product Range

- adhesives for the footwear, furniture, construction and transport industries;
- sealants and sealing materials;
- protective and corrosion-resistant coatings;
- waterproofing membranes;
- cable materials and flame-resistant compounds;
- industrial hoses, flexible tubing, belts and conveyor belts;
- specialty industrial sheeting and industrial rubber products;
- latex formulations for specialised applications.

5.7. Feedstock, Energy and Site

The key resources are butadiene, salt, water and electricity. As chlor-alkali production is energy-intensive, power reliability and price will be major determinants of the complex's competitiveness. The site's environmental condition, sanitary protection zones, logistics access and the ability to locate chemical units safely will also be particularly important.

5.8. Preliminary Cost of the Yerevan Project

Project component	Phase 1, USD million	Phase 2, USD million
Chlor-alkali production	120–180	40–60
Chloroprene production	220–300	90–120
Polymerisation, rubbers and latexes	170–230	80–100
Adhesives, coatings and compounds	80–130	70–90
Industrial rubber products and membranes	70–120	70–100
Utilities, environmental facilities, storage and safety	100–160	40–60
Engineering, licences, commissioning and contingency	120–180	50–70
TOTAL	≈ 800–1 100	≈ 400–600

The total cost of the Yerevan cluster following both phases is provisionally estimated at USD 1.2–1.7 billion. Approximately USD 1.45 billion may be used as the working base estimate for further conceptual planning.

This project represents both a production investment and the return of sophisticated chemical industry to Armenia in a modern form. Its distinctive feature is the combination of a historic industrial brand with a focus on contemporary niches in materials and specialty chemicals.

6. SYNERGIES BETWEEN THE TWO CLUSTERS

Although Vanadzor and Yerevan are independent industrial sites, combining them within one programme creates additional advantages. Synergies arise in material flows, organisation and shared expertise.

- a unified national programme for chemicals and advanced materials;
- a shared engineering, laboratory and workforce base;
- domestic demand for industrial materials, coatings and specialty products;
- common standards for safety, quality and digital production management;
- a shared export strategy and coordinated logistics;
- a stronger position in securing international financing.

In particular, the Yerevan complex can supply Vanadzor with chemically resistant seals, hoses, conveyor belts, protective coatings and specialty materials. Vanadzor, in turn, can supply some chemical feedstocks for downstream products, while providing an industrial base and cash flow that improve the resilience of the entire programme.

7. INFRASTRUCTURE, RESOURCES AND SITE REQUIREMENTS

Both projects require substantial site preparation and external infrastructure. At the concept stage, it is essential to recognise that a chemical facility of this scale is developed as part of a wider industrial system.

- energy: reliable power supply, substations, backup capacity and, where necessary, on-site generation or cogeneration;
- gas: guaranteed volumes, a long-term pricing formula, transportation and supply redundancy for Vanadzor;

- water: abstraction, treatment, recirculating systems, effluent treatment and environmental monitoring;
- logistics: rail, road access, warehouse complexes, containerisation and export routes;
- environment: sanitary protection zones, waste management, monitoring systems, treatment facilities and emergency preparedness;



Fig. 4A. Conceptual visualisation of the cluster's industrial logistics infrastructure: integration of chemical production, storage facilities and transport flows.

- safety: modern emergency shutdown (ESD) systems, gas detection, firefighting, protective barriers, physical security and cybersecurity.

Particular attention must be paid to the environmental assessment and suitability of the Yerevan project site. The location decision should follow a comprehensive site investigation, as chlorinated organic chemical production imposes substantially stricter safety and environmental requirements than conventional mechanical manufacturing.

8. ECONOMICS AND PRELIMINARY COST ESTIMATE

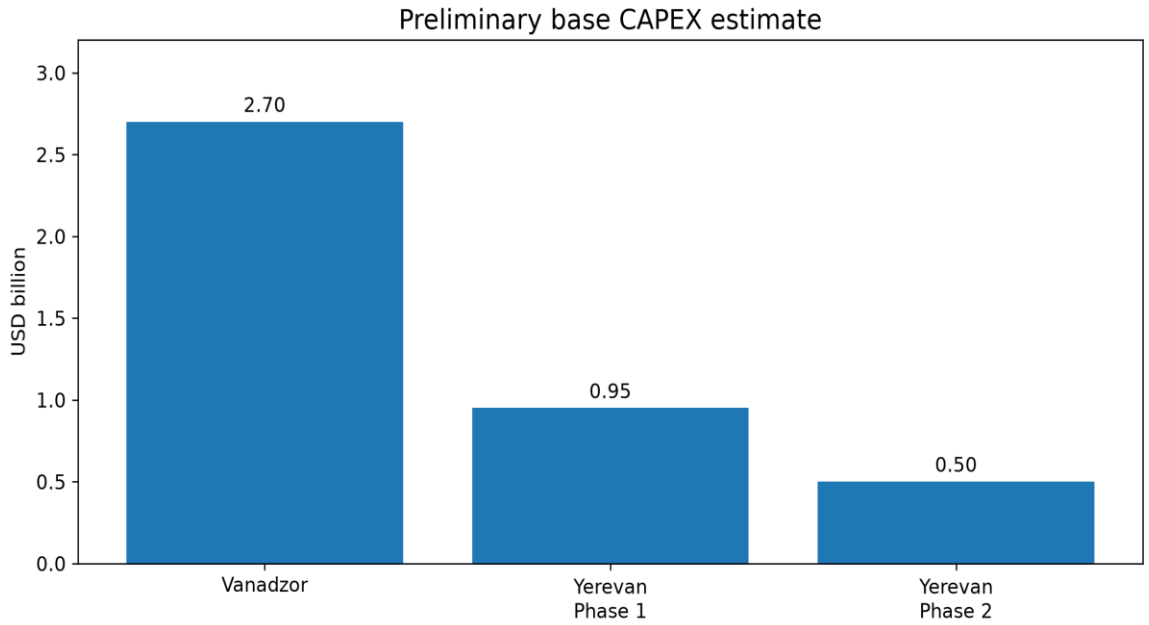


Fig. 4. Preliminary base CAPEX estimate for the main programme components

Project	Low estimate, USD billion	Base estimate, USD billion	High estimate, USD billion
Vanadzor cluster	2.3	2.7	3.1
Yerevan, Phase 1	0.8	0.95	1.1
Yerevan, Phase 2	0.4	0.5	0.6
TOTAL excluding financing costs	3.5	4.15	4.8
Total financing package including IDC, WC and contingencies	≈ 4.5	≈ 5.0	≈ 5.5

All estimates at this stage are conceptual. Their purpose is to establish the order of magnitude of the programme's capital requirements and provide a basis for progression to Pre-FEED and financing structuring. For chemical projects of this type, estimates are normally revised after engineering development, clarification of external infrastructure and selection of technology packages.

Project cost is determined not only by process units, but also by external infrastructure, environmental requirements, logistics, owner's contingencies, financing costs during construction and the working capital required.

9. ENVIRONMENTAL AND INDUSTRIAL REQUIREMENTS

Both chemical projects involve operations with significant safety responsibilities. Industrial safety and environmental protection must therefore be fundamental to the design from the earliest stages, rather than treated as supporting functions.

- design in accordance with international process safety management practice;
- a multi-level HAZID / HAZOP / SIL framework and functional safety;

- modern leak detection and automatic shutdown systems;
- treatment of process emissions and wastewater;
- management of solid, liquid and hazardous waste;
- protective barriers, emergency preparedness, spill containment and fire protection;
- digital monitoring of production and environmental parameters.

This is particularly relevant to the Yerevan project, where chlor-alkali and chlorinated organic production must be designed with the highest degree of conservatism and engineering discipline. The Vanadzor project, in turn, requires rigorous safety in handling ammonia, nitrate chemistry, high pressures and large-scale chemical flows.

10. IMPLEMENTATION APPROACH AND PHASING

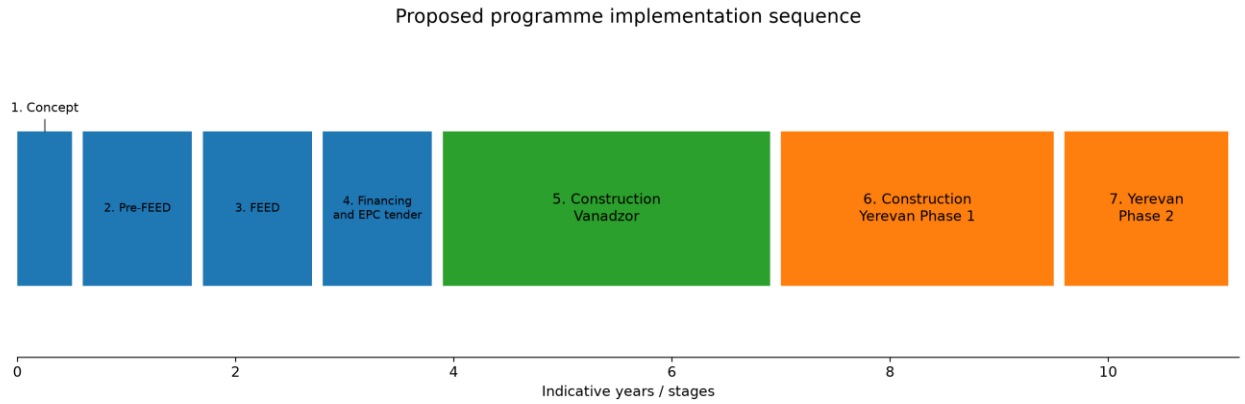


Fig. 5. Proposed programme implementation sequence

Given the programme's scale and complexity, a phased approach appears optimal. It reduces the risk of design errors, enables more orderly financing structuring and helps avoid changes to the project's technical scope during EPC negotiations.

1. Prepare and approve the project concept.
2. Develop Pre-FEED and a bankable feasibility study.
3. Proceed to FEED, refining technologies, balances, sites and external infrastructure.
4. Prepare the financing package and conduct EPC tendering on a common technical basis.
5. Construct the Vanadzor complex and Phase 1 of the Yerevan complex.
6. Commission the facilities, achieve design capacity and proceed to construction of Phase 2 of the Yerevan cluster.

The key implementation principle is to define clearly what is to be built, its parameters and the limits of supply before selecting a contractor and entering into contracts. This reduces the risk of uncontrolled schedule and cost escalation.

11. SOCIOECONOMIC IMPACT FOR ARMENIA

The two-cluster chemical programme can have a systemic impact on Armenia's economy. Its reach extends well beyond the two industrial sites and can establish a new foundation for industrial growth.

- new jobs in industry, logistics, construction, laboratories and engineering;
- growth in the tax base and export earnings;
- return and training of engineering professionals;
- new areas of R&D and applied science;
- development of related industries: steel structures, machinery, packaging, transport, services and maintenance;
- development of Armenia's reputation as a location for advanced industry and materials science.

Over the long term, the programme can become a platform for a broader range of specialty chemicals and materials, including new polymer systems, composites, membranes, industrial reagents and other high-technology fields.

12. CONCLUSION

The proposed concept for Armenia's National Chemical Cluster combines industrial realism with strategic ambition. It is a programme to establish modern, next-generation facilities drawing on Armenia's industrial expertise, rather than an attempt simply to recreate the Soviet past.

The Vanadzor Nitrogen Chemicals Complex should become the large-scale industrial core and foundation for export scale. The Yerevan New Nairit Complex should become the centre for specialty polymer chemistry and higher-value downstream processing. Together, these projects create a strong, complementary and strategically resilient industrial platform.

Following approval of this concept, the next practical step should be to prepare structured terms of reference for Pre-FEED/FEED. These should cover confirmation of the product portfolio, feedstock and energy balances, site requirements, external infrastructure, environmental constraints and the financing approach.

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APPENDIX A. SUMMARY TABLES

Project	Key capacity	Base CAPEX estimate
Vanadzor	1 million t/year of fertilisers; 580–600 thousand t/year of ammonia	≈ USD 2.7 billion
Yerevan, Phase 1	45–50 thousand t/year of polychloroprene and latexes	≈ USD 0.95 billion
Yerevan, Phase 2	Expansion to 75 thousand t/year	≈ USD 0.5 billion
Entire programme	Two clusters + shared infrastructure and synergies	≈ USD 4.15–4.5 billion

APPENDIX B. KEY CONCEPT ASSUMPTIONS

- All quantitative figures in this document are preliminary and intended for concept-level use.
- The product portfolio may be adjusted following Pre-FEED and market analysis.
- Cost estimates are not tied to a specific EPC contractor or named technology licensors.
- Individual environmental, site, logistics and infrastructure solutions require specialist studies.
- The final project configuration must be confirmed following engineering development and economic modelling.

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