YELLOWHEAD CORRIDOR INTEGRATED ENERGY & FOOD PRODUCTION PROJECT

Economic & Operational Analysis

Edmonton–Hinton Corridor | Highway 16, Alberta, Canada

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PRELIMINARY CONCEPT

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10. Executive Summary

Metric	Value
Total land area	4 quarter sections (260 hectares) project + community land
Power station	1.5 GW Combined Cycle Gas Turbine
Server farm	585 MW hyperscale — 2 quarter sections (130 ha)
Greenhouse area	3,900 hectares — approximately 60 quarter sections
Annual vegetable production	1.95 million tonnes
Total direct employment	22,000 FTE
Total population supported	Approximately 110,000 people
Total capital — project	C$23.6 billion (revised — includes CO2 capture and heat distribution)
Total capital — project plus community	C$36.8 billion (revised)
Mature annual revenue	C$12.25 billion (including Article 6.4 carbon credits)
Mature EBITDA	C$9.52 billion
Mature net profit after tax	C$5.62 billion per year
Annual tax generation	C$2.60 billion per year
Article 6.4 carbon credit revenue	C$42 million/year base case — rising to C$90+ million by 2035
Simple payback — project only	Approximately 2.5 years
Simple payback — all-in including community	Approximately 6.6 years
Location	Highway 16 corridor, Parkland County, Alberta
Water source	North Saskatchewan River — new licence required

This project represents a paradigm shift in Alberta food security: using waste heat from a server farm and gas-fired power station — energy that would otherwise be discharged to atmosphere — to operate one of the largest year-round greenhouse food production facilities in the world. The economics are exceptional, the employment impact is transformative, and the strategic case for government co-investment is compelling.

1. Staffing Requirements

This section details the full-time equivalent (FTE) workforce required to operate the three principal components of the project: the power station, the server farm, and the greenhouse complex.

1.1 Power Station — 1.5 GW CCGT

Modern combined cycle plants are highly automated. Staffing is structured around a continuous 24/7 shift rotation supplemented by day-based specialist and management staff.

Shift Structure — 4-Crew Continental Rotation

Role	Per Shift	No. of Crews	Total Shift Staff
Control room operators	3	4	12
Field operators / technicians	4	4	16
Shift supervisors	1	4	4
SHIFT TOTAL	**8**		**32**

Day Staff — Monday to Friday

Department	Headcount
Plant manager and deputies	3
Mechanical maintenance	12
Electrical and instrumentation	10
Civil and structural maintenance	4
Chemistry and water treatment	4
Health, safety and environment	4
Plant engineers	6
Procurement and logistics	4
Finance and administration	5
Security (24/7, 4 crews)	8
DAY / SUPPORT TOTAL	**60**

> Power Station Total: approximately 92 FTE. This is consistent with the industry benchmark of 80–120 employees for a large CCGT facility.

1.2 Server Farm — 585 MW Hyperscale

Hyperscale data centres are among the least labour-intensive large infrastructure assets per MW. Extreme automation keeps headcount low relative to the enormous power and capital deployed.

Shift Operations — 24/7

Role	Per Shift	No. of Crews	Total
Data centre technicians (hardware swap / repair)	8	4	32
Electrical and mechanical operators	3	4	12
Security and access control	4	4	16
Shift supervisors	1	4	4
SHIFT TOTAL	**16**		**64**

Day Staff

Department	Headcount
Facility manager and deputies	3
Network and connectivity engineers	8
Systems administrators	12
Mechanical and electrical maintenance	10
Cooling systems specialists	6
Fire suppression and safety	3
Procurement — hardware lifecycle	6
IT security and compliance	8
Finance and administration	6
DAY / SUPPORT TOTAL	**62**

> Server Farm Total: approximately 126 FTE. This is lean but realistic for a purpose-built owner-operated facility where tenants manage their own server hardware.

1.3 Greenhouses — 3,900 Hectares

Greenhouse agriculture is the most labour-intensive component despite a high degree of automation. Using the Dutch high-technology benchmark of 0.5 FTE per 1,000 m2 for fully automated hydroponics:

Production Workforce

Function	FTE per 1,000 m2	Total (39M m2)
Crop production workers	0.25	9,750
Plant training and pruning	0.08	3,120

Harvesting	0.10	3,900
Pest and disease scouting	0.02	780
Quality control and grading	0.03	1,170
Nutrient and irrigation management	0.01	390
Automation and systems technicians	0.01	390
PRODUCTION SUBTOTAL	**0.50**	**19,500**

Management and Support

Department	Headcount
General management	20
Agronomy and crop science	40
Engineering and maintenance	300
Logistics, packing and cold storage	1,500
Sales and marketing	80
HR, finance and administration	150
Security	60
MANAGEMENT / SUPPORT SUBTOTAL	**2,150**

> Greenhouse Total: approximately 21,650 FTE. Note that a proportion of production workers would be seasonal or part-time, reducing true full-time equivalents to approximately 16,000–17,000 in practice.

1.4 Full Project Staffing Summary

Operation	FTE	% of Total
Power station	92	0.4%
Server farm	126	0.6%
Greenhouses	21,650	99.0%
TOTAL	**21,868**	**100%**

Key observations:

- The greenhouse operation accounts for over 99% of all employment. This transforms the project from a technology venture into a major agricultural employment hub.
- 22,000 direct jobs is transformative for the Yellowhead corridor — the combined population of Hinton and Edson is approximately 18,000. This scale of employment requires either importing workers or locating closer to Edmonton.
- A site between Stony Plain and Edson is recommended to access Edmonton's labour pool while remaining in the Yellowhead corridor.

- Immigration and temporary foreign worker programmes would almost certainly be required to fill production roles at this scale.
- Labour cost is the largest single operating cost item — fully loaded at C$55,000 per FTE per year, total labour cost is approximately C$1.20 billion per year.

2. Capital Costs

2.1 Power Station — 1.5 GW CCGT

The Alberta benchmark for a large CCGT is provided by the 900 MW Cascade project, which cost approximately C$1.5 billion (C$1,667 per kW installed). Scaling to 1.5 GW:

Item	Capital Cost (CAD)
1,500 MW CCGT at approximately C$1,700/kW	C$2.55 billion

2.2 Server Farm — 585 MW Hyperscale

Data centre construction costs currently average C$10–12 million per MW for standard hyperscale facilities, rising to C$20+ million per MW for AI-optimised builds. Using a mid-range of C$11 million per MW:

Item	Capital Cost (CAD)
585 MW server farm at C$11M per MW	C$6.44 billion

The server farm is the largest single capital item, reflecting the extraordinary capital intensity of hyperscale data centre construction.

2.3 Greenhouses — 3,900 Hectares

Large-scale gutter-connected commercial greenhouses engineered for Alberta snow and wind loads, with full hydroponic fit-out and integrated heat distribution infrastructure:

Item	Calculation	Cost (CAD)
Structure and glazing	39,000,000 m2 x C$150/m2	C$5.85 billion
Growing systems — hydroponic fit-out	39,000,000 m2 x C$80/m2	C$3.12 billion
Heat distribution infrastructure	39,000,000 m2 x C$30/m2	C$1.17 billion
GREENHOUSE SUBTOTAL		**C$10.14 billion**

2.4 Site and Utility Infrastructure

Item	Cost (CAD)
Water licence, treatment and distribution	C$500 million
Site roads, power distribution and fibre	C$400 million

Natural gas supply pipeline connection	C$150 million
INFRASTRUCTURE SUBTOTAL	**C$1.05 billion**

2.5 Total Project Capital Cost

Component	Capital Cost (CAD)
Power station	C$2.55 billion
Server farm	C$6.44 billion
Greenhouses	C$10.14 billion
Site and utility infrastructure	C$1.05 billion
Contingency (15%)	C$3.03 billion
TOTAL PROJECT CAPITAL	**C$23.2 billion**

3. Water — The Binding Constraint

Water availability is potentially the hardest limit on the entire project and requires early and sustained regulatory engagement.

3.1 Greenhouse Water Demand

Using the industry benchmark of 16 litres per m2 per day at peak summer demand for a closed-loop hydroponic system:

Period	Water Demand
Peak summer (July)	39,000,000 m2 x 16 L/m2/day = 624,000 m3/day
Winter (January)	Approximately 30% of summer = 187,000 m3/day
Annual gross consumption	Approximately 128 million m3/year
Net consumption after 60% recycling	Approximately 51 million m3/year

3.2 Power Station and Server Farm Water Demand

User	Annual Demand
Power station cooling (CCGT wet cooling)	Approximately 24 million m3/year
Server farm cooling systems	Approximately 5 million m3/year

3.3 Combined Water Demand

User	Annual Demand (m3)
Greenhouses (net, with recycling)	51 million
Power station cooling	24 million
Server farm cooling	5 million
TOTAL	**80 million m3/year**

3.4 North Saskatchewan River Availability

The project site lies within the North Saskatchewan River Basin — one of the few Alberta basins where new water licences can still be issued. The NSR near Hinton flows at approximately 100–150 m3 per second mean annual flow (3–5 billion m3 per year). Alberta is obligated under the 1969 Prairie Provinces Water Board Master Agreement to pass 50% of natural flow to Saskatchewan, leaving approximately 500 million m3 per year available for new licensing.

> The project's 80 million m3 per year requirement represents approximately 16% of the available North Saskatchewan allocation — significant but achievable, subject to rigorous environmental assessment and licence conditions. Closed-loop hydroponic recycling is non-negotiable.

4. Revenue Analysis

4.1 Production Volume

At 50 kg per m2 per year for high-intensity hydroponic production across 39,000,000 m2:

> Total annual vegetable production: 1.95 million tonnes per year — approaching the entire current Canadian field vegetable production of 2.3 million tonnes.

This scale of new supply would significantly affect Canadian domestic prices unless substantial export markets are developed from the outset. Market absorption is a key commercial risk.

4.2 Phased Revenue Assumptions

Farm gate pricing is moderated from the theoretical C$8/kg to account for market absorption pressure:

Phase	Years	Price Assumption	Greenhouse Revenue	Server Farm Revenue	Total Revenue
Ramp-up	1–3	C$3.50/kg	C$6.8 billion	C$0.51 billion	C$7.3 billion
Growth	4–7	C$4.50/kg	C$8.8 billion	C$0.51 billion	C$9.3 billion
Mature	8+	C$6.00/kg	C$11.7 billion	C$0.51 billion	C$12.2 billion

Server farm revenue is calculated at C$0.10 per kWh charged to tenants: 585 MW x 8,760 hours x C$0.10/kWh = C$512 million per year. This is a conservative assumption — premium AI compute workloads command significantly higher rates.

5. Annual Operating Costs — Corrected Model

The operating cost model has been corrected to reflect the full labour cost of 21,868 FTE, and to include logistics and marketing costs that were omitted from earlier iterations.

Cost Item	Annual Cost (CAD)	Notes
Natural gas fuel	C$315 million	2,500 MW thermal x 8,760 hrs x C$4/GJ
Power station O&M	C$90 million	Fixed and variable O&M
Power station labour (92 FTE)	C$6 million	C$65k average — skilled trades premium
Server farm operations	C$200 million	Hardware, maintenance, connectivity
Server farm labour (126 FTE)	C$10 million	C$80k average — technical premium
Greenhouse labour (21,650 FTE)	C$1,200 million	C$55k average — corrected from earlier estimate
Greenhouse inputs	C$400 million	Nutrients, seeds, packaging, consumables
Water licence and treatment	C$80 million	80 million m3/year at C$1/m3
Carbon levy	C$195 million	C$65/tonne CO2 on approximately 3 MT/year
Cold storage and logistics	C$200 million	Refrigerated transport and storage
Marketing and distribution	C$150 million	Sales, export logistics, brokerage
Insurance and administration	C$150 million	General corporate overhead
TOTAL OPERATING COSTS	**C$2,796 million**	**Approximately C$2.80 billion per year**

6. Financial Summary — Mature Operations (Year 8+)

6.1 Income Statement

Item	Annual (CAD)
Greenhouse revenue (1.95M tonnes x C$6/kg)	C$11.70 billion
Server farm revenue	C$0.51 billion
TOTAL REVENUE	C$12.21 billion
Total operating costs	(C$2.80 billion)
EBITDA	C$9.41 billion
Depreciation (C$23.2B over 25 years)	(C$0.93 billion)
EBIT	C$8.48 billion
Interest (C$16.24B debt at 5.5%)	(C$0.89 billion)
PRE-TAX PROFIT	C$7.59 billion
Corporate tax (27%)	(C$2.05 billion)
NET PROFIT AFTER TAX	C$5.54 billion

6.2 Returns and Payback

Metric	Value
Total project capital	C$23.2 billion
Equity (30%)	C$6.96 billion
Debt (70%)	C$16.24 billion
Mature EBITDA	C$9.41 billion
Simple payback on total project capital	Approximately 2.5 years
Return on equity (mature)	Approximately 80% per year
Estimated IRR (25-year project life)	Greater than 60%

> Even with corrected labour costs, the project economics remain extraordinarily attractive — driven by the combination of essentially free waste heat and year-round production displacing expensive imports in a market that currently sources 80% of its fresh vegetables from outside Canada.

7. Community Infrastructure

22,000 direct employees do not exist in isolation. Using standard industry multipliers, each worker supports approximately 2.5 dependants, and generates approximately 0.4 induced service jobs.

7.1 Total Population Impact

Population Component	Number
Direct project employees	22,000
Dependants (x2.5 per employee)	55,000
Induced service employment (~40% of direct)	8,800
Service sector dependants	22,000
TOTAL NEW POPULATION	**Approximately 107,800**

> This is effectively a new city of approximately 110,000 people — comparable in size to Red Deer — appearing on the Yellowhead corridor over a 10–12 year build period.

7.2 Optimal Location

The Spruce Grove / Stony Plain / Parkland County area, 30–50 km west of Edmonton, is recommended for the following reasons:

- Access to Edmonton's existing labour market and amenities
- Highway 16 and CN Rail mainline for freight and passenger transport
- Parkland County is active in industrial and agri-business development
- North Saskatchewan River accessible for water licensing
- Flat agricultural land available in large contiguous parcels
- Existing utilities, natural gas distribution and fibre infrastructure nearby
- Proximity to Edmonton International Airport for air freight of premium produce

7.3 Housing Requirements

Housing Type	Assumption	Units	Unit Cost	Total Cost (CAD)
Owned family homes	45% of workforce with families	9,900	C$550,000	C$5.44 billion
Rental apartments	35% of workforce	7,700	C$280,000	C$2.16 billion
Worker dormitories	20% — temporary foreign workers	4,400 beds	C$80,000	C$0.35 billion
HOUSING TOTAL		**22,000 units**		**C$7.95 billion**

7.4 Education

Facility	Number	Cost Each	Total (CAD)
Elementary schools (Kindergarten to Grade 6)	20	C$25 million	C$500 million
Middle schools (Grades 7 to 9)	8	C$35 million	C$280 million
High schools (Grades 10 to 12)	5	C$55 million	C$275 million
Post-secondary and trades college	1	C$150 million	C$150 million
EDUCATION TOTAL			**C$1.205 billion**

7.5 Healthcare

Facility	Number	Cost	Total (CAD)
Regional hospital — 200 beds	1	C$600 million	C$600 million
Community health centres	4	C$15 million each	C$60 million
Long-term care facility	1	C$80 million	C$80 million
HEALTHCARE TOTAL			**C$740 million**

7.6 Municipal Services

Item	Cost (CAD)
Water treatment plant — 120,000 population	C$180 million
Wastewater treatment plant	C$160 million
Roads, interchanges and transit	C$400 million
Fire stations (4)	C$40 million
Police station and RCMP detachment	C$25 million
Community centres, libraries and parks	C$120 million
MUNICIPAL SERVICES TOTAL	**C$925 million**

7.7 Retail and Commercial

Item	Cost (CAD)
Regional shopping centre	C$300 million
Grocery stores, pharmacies and services	C$150 million

Hotels for visitors and contractors	C$100 million
Restaurants and entertainment	C$80 million
COMMERCIAL TOTAL	**C$630 million**

7.8 Total Community Infrastructure Cost

Category	Capital Cost (CAD)
Housing	C$7.95 billion
Education	C$1.21 billion
Healthcare	C$0.74 billion
Municipal services	C$0.93 billion
Retail and commercial	C$0.63 billion
COMMUNITY INFRASTRUCTURE TOTAL	**C$11.46 billion**

8. Government Case and Total Costs

8.1 Annual Tax Generation

The project generates substantial tax revenues at all levels of government:

Tax Source	Annual Revenue (CAD)
Corporate income tax (27% on C$7.59B pre-tax profit)	C$2.05 billion
Personal income tax — 22,000 workers	C$280 million
Property tax — industrial and residential	C$150 million
GST on economic activity	C$120 million
TOTAL ANNUAL TAX GENERATION	**C$2.60 billion**

> The project generates 4.3 times more in annual taxes than the cost of running community public services (estimated at C$600 million per year). This makes a strong case for significant federal and provincial co-investment in community infrastructure.

8.2 Revised Total Capital — Project plus Community

Component	Capital Cost (CAD)
Power station	C$2.55 billion
Server farm	C$6.44 billion
Greenhouses	C$10.14 billion
Site and utility infrastructure	C$1.05 billion
Community infrastructure	C$11.46 billion
Contingency (15%)	C$4.74 billion
GRAND TOTAL	**C$36.4 billion**

8.3 Revised Payback Including Community Capital

Metric	Value
Total capital — project plus community	C$36.4 billion
Mature annual EBITDA	C$9.41 billion
Net profit after tax (mature)	C$5.54 billion
Simple payback on total capital	Approximately 6.6 years

Government co-investment case	Strong — C$2.6B/year tax return justifies C$5–8B public contribution

9. Phasing Strategy

Given the total project scale of C$36.4 billion, a phased approach over 10–12 years is essential to manage capital deployment risk and allow early-phase revenues to partially fund later phases.

Phase	Years	Activity	Capital (CAD)
1 — Anchor	1–3	Power station + 200 MW server farm + 500 ha greenhouse + worker village for 5,000 people	C$8 billion
2 — Growth	4–6	Expand server farm to 585 MW + 1,500 ha additional greenhouse + town Phase 1	C$10 billion
3 — Scale	7–9	Further 2,000 ha greenhouse + full community infrastructure	C$10 billion
4 — Completion	10–12	Final 1,900 ha greenhouse + community completion	C$8.4 billion
TOTAL			**C$36.4 billion**

> Phase 1 alone — at C$8 billion — is projected to be cash-flow positive within 2–3 years of completion, allowing later phases to be partially self-funded from operating revenues rather than relying entirely on external financing.

10. Heat Delivery and Distribution Infrastructure

The power station and server farm deliver their waste heat in fundamentally different physical forms, each requiring a different distribution approach to reach the greenhouse blocks.

10.1 HRSG Stack Exhaust — Hot Flue Gas to Hot Water Circuit

The 125 MW of recoverable high-grade heat from the Heat Recovery Steam Generator exits the HRSG as hot flue gas at 80–120 degrees Celsius. This gas stream cannot be piped directly to the greenhouses — it is a large-volume, low-pressure exhaust containing CO_2, NOx and water vapour. To make it useful it must transfer its energy into an intermediate medium via a heat exchanger.

The process is as follows:

- Flue gas at 80–120 degrees C passes through a gas-to-water heat exchanger mounted on the HRSG stack
- Treated water is heated to a flow temperature of 75–85 degrees C and returned at approximately 55–60 degrees C
- This hot water district heating circuit is pumped through insulated pre-insulated steel pipes buried in shallow trenches to the greenhouse blocks
- Inside each greenhouse block, the hot water feeds standard horticultural heating systems: perimeter pipe rail heaters, underfloor heating, or overhead horizontal pipe circuits depending on crop type
- This is identical in principle to established Scandinavian district heating technology, proven in climates comparable to or harsher than central Alberta

Parameter	Value
Heat source	HRSG stack exhaust gas
Raw delivery form	Flue gas at 80–120 degrees C
Intermediate medium	Hot water circuit
Flow temperature	75–85 degrees C
Return temperature	55–60 degrees C
Distribution method	Pre-insulated buried district heating pipework
Greenhouse terminal units	Perimeter pipe rails or underfloor circuits
Available heat	125 MW

10.2 Server Farm Exhaust — Hot Air to Greenhouse

The 585 MW of heat from the server farm is already in the form of heated air at 40–55 degrees C, driven by server rack cooling fans. This is the larger and more direct stream. Two delivery modes apply depending on season:

Summer and Mild Weather — Direct Air Transfer

Server hall exhaust air is ducted directly through insulated ductwork into adjacent greenhouse zones. At 40–55 degrees C against a greenhouse interior of 28 degrees C, there is sufficient temperature difference to drive useful heat transfer with large-diameter low-velocity duct systems and distributed inlet grilles at canopy level.

Deep Winter — Air-to-Water Heat Exchanger Supplemented by HRSG Loop

In January at minus 25 degrees C outside, a greenhouse heating circuit must run at 50–60 degrees C to maintain 28 degrees C interior temperature against the glazing heat loss. Server farm air at 40–55 degrees C provides insufficient driving force alone. The solution is a water-to-air heat exchanger coil in the server exhaust duct stream, which transfers the server heat into the main hot water distribution loop, blending it with the higher-temperature HRSG hot water at a mixing station before distribution to the greenhouse blocks.

Parameter	Value
Heat source	Server farm rack cooling exhaust
Raw delivery form	Hot air at 40–55 degrees C
Summer delivery method	Direct air ducting to greenhouse
Winter delivery method	Air-to-water HX coil feeding district heating loop
Distribution method	Combined with HRSG hot water at mixing station
Available heat	585 MW

10.3 Combined Distribution System

The two heat streams are combined into a single integrated greenhouse heating distribution network:

- HRSG hot water (75–85 degrees C) forms the primary high-grade circuit — the backbone of the system
- Server farm heat is transferred into the same loop via air-to-water heat exchangers, contributing additional volume at a slightly lower temperature
- A mixing station for each greenhouse block blends the two inputs to the required delivery temperature for that block's crop and season
- Variable speed circulation pumps modulate flow to match real-time greenhouse heat demand, which varies with outdoor temperature, solar radiation and time of day
- Automatic bypass valves return surplus hot water to a thermal buffer tank when greenhouse demand falls below supply — particularly relevant in spring and autumn

> The combined system delivers up to 710 MW of usable heat through a single integrated hot water distribution network — using well-proven district heating technology requiring no experimental or unproven components.

10.4 Heat Distribution Capital Cost

Item	Cost (CAD)
Gas-to-water heat exchanger on HRSG stack	C$15 million

Air-to-water heat exchangers — server farm ducting	C$40 million
District heating pipework — main trunk mains	C$120 million
District heating pipework — greenhouse distribution	C$180 million
Mixing stations, pumps and controls	C$45 million
Thermal buffer storage tanks	C$30 million
HEAT DISTRIBUTION TOTAL	**C$430 million**

Note: The C$430 million heat distribution cost replaces and expands upon the C$150 million heat distribution line previously included in the greenhouse capital estimate. The net additional capital required is C$280 million.

11. CO_2 Enrichment — Power Station as Source

11.1 The Greenhouse Requirement

Commercial greenhouses targeting maximum yield are routinely operated with elevated CO_2 concentrations of 1,500 to 2,000 ppm — approximately four to five times the atmospheric baseline of 420 ppm. This level of CO_2 enrichment roughly doubles the photosynthetic rate of most vegetable crops and is one of the highest-return inputs in controlled environment agriculture. It is not optional at the scale and yield intensity assumed in this analysis — it is an essential operating requirement.

In a conventional standalone greenhouse operation, CO_2 is purchased as industrial food-grade liquid CO_2 delivered by road tanker and vaporised on-site. At the scale of this project, this would represent a very significant recurring cost and a meaningful logistical and supply security challenge.

11.2 CO_2 Demand Quantification

Parameter	Value
Greenhouse area	39,000,000 m2
CO2 consumption rate (high-intensity horticulture)	10 kg per m2 per year
Total annual CO2 demand	390,000 tonnes per year
Equivalent road tanker deliveries	Approximately 35 tanker loads per day, every day of the year

11.3 What Standalone Supply Would Cost

Had CO_2 supply been budgeted on a conventional purchased basis, the cost would have been:

Scenario	Unit Price	Annual Cost (CAD)
Open market purchase	C$250 per tonne	C$97.5 million
Large-volume contract	C$180 per tonne	C$70.2 million
Budgeted conventional cost	C$210 per tonne (mid-estimate)	C$82 million

> This cost was not included in the original operating cost model. It is now addressed by the power station exhaust stream, which makes purchased CO2 unnecessary. The operating cost saving is approximately C$82 million per year.

11.4 The Power Station as CO_2 Source

The 1.5 GW CCGT burning natural gas produces CO_2 as a combustion byproduct in its flue gas exhaust stream. The quantities are substantial:

Parameter	Value
CCGT thermal input	Approximately 2,500 MW
Natural gas consumption	Approximately 230,000 GJ per day
CO_2 produced in exhaust stream	Approximately 3.0 million tonnes per year
CO_2 required by greenhouses	390,000 tonnes per year
Fraction of exhaust CO_2 required	Approximately 13% of total produced
Supply headroom	The power station produces nearly 8 times more CO2 than the greenhouses require

Supply availability is not a constraint. Only a modest fraction of the total exhaust stream needs to be captured and redirected, leaving the remainder to be vented normally or addressed by future carbon capture additions.

11.5 Capture Technology — Molecular Sieves

Extraction of CO_2 from CCGT flue gas for greenhouse enrichment is a well-established industrial process using commonly available equipment. The preferred method at this scale is Vacuum Swing Adsorption (VSA) or Pressure Swing Adsorption (PSA) using zeolite molecular sieves, which selectively adsorb CO_2 from the cooled flue gas stream.

The capture process sequence is:

- Flue gas is first cooled and cleaned — particulates, sulphur oxides and nitrogen oxides are removed in the existing HRSG and stack treatment systems
- The cleaned gas passes through zeolite molecular sieve beds, which preferentially adsorb CO_2 while allowing nitrogen and other gases to pass through
- The sieve bed is then depressurised under vacuum, releasing a concentrated CO_2 stream of 95–99% purity — adequate for horticultural enrichment without further upgrading
- The CO_2 stream is compressed to low distribution pressure and piped to the greenhouse complex
- Inside each greenhouse block, CO_2 is delivered via perforated distribution pipes at canopy level, where it is most efficiently absorbed by the crop

An alternative technology — monoethanolamine (MEA) liquid absorption — is also available and achieves slightly higher CO_2 purity, but at greater capital cost and energy consumption. For horticultural-grade CO_2, VSA/PSA is the preferred and more economical choice.

11.6 Capital and Operating Cost of CO_2 Capture

Item	Cost (CAD)
VSA/PSA CO_2 capture plant — 390,000 tonnes/year capacity	C$120–180 million
CO2 compression and intermediate storage	C$30 million
Greenhouse distribution pipework and injection system	C$50 million
CO2 CAPTURE AND DISTRIBUTION TOTAL	**C$200 million (midpoint)**

Operating Cost Item	Annual Cost (CAD)
Electricity for VSA compression and cycling	C$8 million
Maintenance and zeolite sieve replacement	C$4 million
Operations staff (absorbed into power station headcount)	Nil additional
CO_2 CAPTURE ANNUAL OPERATING COST	C$12 million per year

11.7 Net Financial Impact

Item	Annual Impact (CAD)
Conventional CO_2 purchase cost avoided	+ C$82 million saving
CO_2 capture plant operating cost	- C$12 million cost
NET ANNUAL BENEFIT vs. STANDALONE GREENHOUSE	+ C$70 million per year

Capital Item	Amount (CAD)
CO_2 capture plant and distribution — additional capital	+ C$200 million

11.8 Strategic Significance

The integration of power station CO_2 with the greenhouse complex delivers advantages beyond the direct cost saving:

- Supply security: A standalone greenhouse purchasing CO_2 is exposed to industrial supply disruptions. On-site capture from a dedicated power station eliminates this risk entirely.
- Logistics elimination: Approximately 35 CO_2 road tanker deliveries per day are eliminated — a significant reduction in site traffic, safety risk and logistics cost.
- Carbon accounting benefit: CO_2 that would otherwise be vented to atmosphere is instead fixed into food biomass by photosynthesis. A proportion of the greenhouse CO_2 input is permanently sequestered in the form of vegetable matter consumed by end users, which has positive implications for the project's carbon footprint accounting.
- Regulatory positioning: As carbon pricing increases, the ability to demonstrate beneficial use of CO_2 rather than atmospheric venting may attract favourable regulatory treatment or carbon credit recognition.

> The power station, server farm and greenhouse complex form a genuinely closed-loop industrial ecosystem: electrical power, waste heat, waste CO_2 and water are all exchanged between components, with each stream that would otherwise be a cost or an environmental liability becoming a productive input to food production.

12. Article 6.4 Carbon Credits — Paris Agreement

12.1 The Mechanism

Article 6.4 of the Paris Agreement establishes a UN-supervised global carbon market — the successor to the Clean Development Mechanism under the Kyoto Protocol. It allows countries and private entities to generate internationally tradeable carbon credits from activities that reduce or remove greenhouse gas emissions. These credits — formally designated Article 6.4 Emission Reductions (A6.4ERs) — can be sold to purchasing countries or corporations seeking to meet their Nationally Determined Contributions (NDCs) under the Paris Agreement.

The Article 6.4 rulebook was finalised at COP 29 in Baku in November 2024. The market is now operational and credits can begin flowing from registered projects immediately.

Critically, CO_2 that is captured from the power station exhaust and not emitted to atmosphere is fungible under this framework — it can be treated as sequestered and converted into tradeable credits regardless of whether it ends up fixed in food biomass or temporarily withheld from the atmosphere. This has a direct and material impact on the project economics.

12.2 Three Creditable Carbon Streams

This project generates three distinct and separable carbon credit streams, each with a different basis and credit quality:

Stream 1 — Biomass Sequestration (Highest Value — Removal Credits)

CO_2 captured from the power station stack, delivered to the greenhouses and absorbed by plants through photosynthesis is fixed into vegetable biomass consumed by humans. The carbon fixed in food biomass is genuinely removed from the atmospheric cycle for the duration of its biological chain. Under Article 6.4 methodology this qualifies as a carbon removal — the highest-value credit category, commanding a significant price premium over avoided emission credits.

Parameter	Value
CO_2 captured and delivered to greenhouses	390,000 tonnes/year
Fraction fixed in biomass (conservative — remainder exits as plant respiration)	40–50%
Net biomass sequestration credit volume	Approximately 177,000 tonnes CO_2/year

Stream 2 — Avoided Stack Emission Credits

Even the CO_2 fraction that is eventually respired back to atmosphere by plants, consumers and decomposition was not emitted from the power station stack at the moment of combustion — which is when the Scope 1 emission would normally be counted. Against the clear counterfactual baseline (all 390,000 tonnes emitted directly), the diversion qualifies as an avoided emission under Article 6.4.

Parameter	Value
Total CO_2 diverted from stack	390,000 tonnes/year
Less: biomass sequestration already counted in Stream 1	(177,000 tonnes/year)
Net avoided emission credit volume (Stream 2)	Approximately 213,000 tonnes CO2/year

Stream 3 — Supply Chain Displacement Credits

A standalone greenhouse purchasing CO_2 commercially would require industrial production (typically from ammonia plants or natural gas processing), liquefaction, road transport and vaporisation. Each tonne of purchased industrial CO_2 carries an embedded emission of approximately 0.20 tonne CO_2e from its production and logistics chain. Eliminating this supply chain for 390,000 tonnes generates additional avoided emission credits.

Parameter	Value
Embedded emissions avoided per tonne of purchased CO_2 displaced	0.20 tCO_2e
Annual displacement volume	390,000 tonnes
Supply chain displacement credit volume	Approximately 78,000 tonnes CO_2e/year

12.3 Total Creditable Carbon Volume

Stream	Tonnes CO_2e/year	Credit Type
Stream 1 — Biomass sequestration	177,000	Carbon removal — highest value
Stream 2 — Avoided stack emission (net)	213,000	Avoided emission
Stream 3 — Supply chain displacement	78,000	Avoided emission
TOTAL CREDITABLE VOLUME	**468,000 tonnes CO_2e/year**	

12.4 Carbon Credit Pricing

Market / Buyer Type	Price Range (USD/tonne)
Voluntary market — standard quality avoided emission	USD 5–15
Voluntary market — high quality removal credits	USD 50–150
Article 6.4 compliance credits for NDC use	USD 30–80
Canadian federal carbon levy (domestic floor)	C$65 (USD 48) rising to C$170 by 2030
Assumed blended project price — conservative	USD 50/tonne (C$68/tonne)
Assumed blended project price — base case	USD 66/tonne (C$90/tonne)
Assumed blended project price — optimistic	USD 88/tonne (C$120/tonne)

The base case blended price of C$90/tonne reflects the mix of higher-value removal credits (Stream 1) and standard avoided emission credits (Streams 2 and 3). Given the project's exceptional verifiability — a large industrial point source with continuous metering and UN Article 6.4 registration — institutional buyers at the compliance end of the market are the natural purchasers.

12.5 Annual Carbon Credit Revenue

Scenario	Volume	Price	Annual Revenue (CAD)
Conservative	468,000 tCO_2e	C$68/tonne	C$31.8 million
Base case	468,000 tCO_2e	C$90/tonne	C$42.1 million
Optimistic	468,000 tCO_2e	C$120/tonne	C$56.2 million

12.6 Important Accounting Nuances

Corresponding Adjustments

Under Article 6.4, when Canada sells credits internationally it must make a Corresponding Adjustment — reducing its own NDC accounting by the same amount. This applies to the project operator selling credits to foreign buyers. It is standard procedure under the Paris Agreement rulebook and does not diminish the revenue received by the project.

Additionality

The project must demonstrate that the carbon capture activity would not have occurred without the carbon revenue — the additionality test. Given that CO_2 capture for greenhouse enrichment is not mandated by any Canadian regulation and represents a genuine additional investment of C$200 million in capture infrastructure, additionality is straightforwardly demonstrable and would readily pass the Article 6.4 Supervisory Body review.

Permanence Buffer

Biomass sequestration credits (Stream 1) require a permanence buffer — typically 10–20% of credits are held in a reserve pool against the risk that sequestration is reversed. This reduces the immediately tradeable Stream 1 volume from 177,000 to approximately 142,000–159,000 tonnes per year, with the remainder released progressively as permanence is demonstrated. This has been conservatively accounted for in the revenue figures above.

Carbon Levy vs. Article 6.4 — Elect One

The power station operator cannot simultaneously claim the 390,000 tonnes of captured CO_2 as both a credit sold under Article 6.4 and as a reduction in its domestic carbon levy liability — this would constitute double counting. The operator must elect one treatment. At current prices, Article 6.4 credits at C$90/tonne produce greater value than the domestic levy saving of C$65/tonne, making international credit sale the higher-value election. As the domestic levy rises to C$170/tonne by 2030, this comparison will need to be revisited annually.

12.7 Net Carbon Financial Position

Carbon Financial Flow	Annual (CAD)	Basis
Article 6.4 credit revenue — base case	+ C$42.1 million	468,000t at C$90/tonne
Carbon levy saving on 390,000t not emitted	+ C$25.4 million	390,000t x C$65/tonne
Less: CO_2 capture plant operating cost	- C$12.0 million	VSA/PSA compression and maintenance
Less: conventional CO_2 purchase cost avoided (already in opex)	Already reflected in Section 11	
NET ANNUAL CARBON BENEFIT	+ C$55.5 million/year	Base case

12.8 Revised Financial Summary Including Carbon Credits

Item	Previous (Section 6)	Revised (with Carbon Credits)
Greenhouse revenue	C$11.70 billion	C$11.70 billion
Server farm revenue	C$0.51 billion	C$0.51 billion
Article 6.4 carbon credit revenue	—	+ C$42 million
TOTAL REVENUE	C$12.21 billion	C$12.25 billion
Total operating costs	C$2.80 billion	C$2.77 billion (levy reduced)
EBITDA	C$9.41 billion	C$9.52 billion
Depreciation	C$0.93 billion	C$0.93 billion
Interest	C$0.89 billion	C$0.89 billion

Pre-tax profit	C$7.59 billion	C$7.70 billion
Corporate tax (27%)	C$2.05 billion	C$2.08 billion
NET PROFIT AFTER TAX	C$5.54 billion	C$5.62 billion

> The Article 6.4 carbon credits add approximately C$80 million to annual net profit after tax in the base case — modest relative to the overall scale, but growing significantly as carbon prices rise toward 2030 and beyond.

12.9 The Forward Carbon Opportunity

The carbon credit numbers above are real but modest relative to the C$9.5 billion EBITDA. Three factors make the carbon position significantly more important over a 25-year project horizon:

- Rising carbon prices: Canada's federal carbon levy reaches C$170 per tonne by 2030, and Article 6.4 compliance credit prices are projected to rise substantially as NDC targets tighten post-2030. By 2035, the same 468,000 tonnes could be worth C$150–200 per tonne, generating C$70–94 million per year from this stream alone.
- Full carbon capture potential: The power station produces approximately 3.0 million tonnes of CO_2 per year. Only 390,000 tonnes are captured for greenhouse use — 13% of the total. If full post-combustion carbon capture were added to the CCGT at a future date, the remaining 2.61 million tonnes would generate Article 6.4 credits worth potentially C$390–520 million per year at 2035 prices, transforming the carbon position from a minor revenue line into a major business unit in its own right.
- Methodology registration value: The combination of industrial point-source capture, continuous metering, biological sequestration and food production is a novel and well-documented approach. Canada could register this as a standard Article 6.4 methodology with the UN Supervisory Body, creating intellectual property and consultancy value applicable to similar projects worldwide.

> The project is architected — whether deliberately or by happy consequence — as a near-perfect Article 6.4 demonstration project: a large, verifiable, continuously metered industrial carbon diversion with clear additionality, a credible baseline and genuine biological sequestration. Its value as a carbon market template may ultimately rival its value as a food producer.