

Rethinking long-term economic development

Comparative pathways for Saudi Arabia and the United Arab Emirates

Fiscal resilience, clean power, industry and a differentiated just transition

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Executive Summary

The global energy landscape is changing, challenging long-standing assumptions that continued fossil fuel expansion offers hydrocarbon-dependent economies the most secure route to lasting prosperity. Within this context, Saudi Arabia and the United Arab Emirates face a strategic choice: deepen dependence on fossil fuels, or use today's resources to build prosperity that can endure beyond them. Hydrocarbon revenues have supported public services, infrastructure and economic development. But the conditions underpinning that model are changing. Competitive renewable electricity, advances in electrification and uncertainty over future fossil-fuel demand are reshaping the foundations of long-term economic security.

This report challenges the assumption that continued fossil-fuel expansion is necessary to finance diversification and the energy transition in Saudi Arabia and the UAE. Its findings strengthen the case for a different direction: halt further expansion and pursue a planned reduction in fossil-fuel dependence, supported by renewable energy, targeted electrification and durable alternative sources of public income. For Saudi Arabia and the UAE, this offers an opportunity to protect development gains while preparing their economies for a changing world.

Expansion cannot guarantee lasting prosperity

The report compares three illustrative development pathways: continued hydrocarbon expansion; a halt to new production expansion from 2026 followed by gradual decline; and a faster transition combining the same halt with steeper production decline, stronger renewable deployment, efficiency and diversification. Each is tested across seven economic environments at 2030, 2040 and 2050.

By 2040, the faster transition delivers a stronger annual fiscal balance than continued expansion in six of the seven environments tested, in both countries. Expansion retains a small advantage only in the high-price environment. These are scenario comparisons, not forecasts or probabilities.

The vulnerability of an expansion-led strategy is particularly clear under adverse market conditions. In the severe downside test, hydrocarbon government revenues under continued expansion fall from a calibrated 2025 baseline of approximately US$162 billion to US$85 billion in Saudi Arabia, and US$71 billion to US$37 billion in the UAE by 2030, despite higher assumed production. Producing more does not necessarily protect public revenues when market conditions deteriorate.

Fossil fuel expansion does deliver stronger annual budget outcomes in 2030 across all tested environments. Transition therefore requires early investment, careful financing and credible implementation. Later improvements depend on the full policy package, particularly stronger non-hydrocarbon revenues and expenditure discipline; reducing production alone does not deliver them. Stronger later annual balances also do not erase earlier borrowing or asset drawdowns.

The strategic implication is nevertheless clear: existing hydrocarbon revenues can help finance transformation, but this does not establish a need for further expansion. Committing additional resources to fossil-fuel dependence must be weighed against investments that build alternative income, productive capabilities and resilience.

Executive Summary

Renewable energy offers a competitive foundation for transformation

Both countries have opportunities to translate renewable resources into economic advantage. In the report's selected 2030 comparison, solar photovoltaic electricity has the lowest modelled new-build generation cost: approximately US$34/MWh in Saudi Arabia and US$31/MWh in the UAE, compared with approximately US$41/MWh for new gas generation in both countries.

These estimates include allowances for grids, balancing and curtailment. They do not establish identical reliability or replace the need for complete power-system planning. Realising the opportunity requires investment in grids, storage, flexibility and efficient energy use.

Targeted electrification can extend these benefits. Transport provides the strongest combined economic and emissions result among the applications screened, delivering positive annual net benefits and lower operational emissions in both countries at the representative deployment scales tested. Industrial opportunities require more selective assessment: renewable electricity can reduce emissions without immediately lowering costs, while process efficiency and material substitution offer additional gains.

Renewables, electrification and fossil-fuel phase-out should form one coordinated development strategy. Renewable deployment alongside continued fossil expansion does not, by itself, reduce dependence. Clean electricity must increasingly displace fossil-fuel use, while diversification builds public revenues and livelihoods that can endure as production declines.

A credible transition must protect people and reflect national circumstances

Saudi Arabia and the UAE have substantial financial and institutional capabilities, but different starting points. Saudi Arabia's greater hydrocarbon revenue dependence makes the sequencing of diversification and fiscal reform particularly consequential. The UAE's comparatively diversified commercial structure provides a different foundation, although diversification cannot be judged solely through non-oil activity while fossil exposure continues to grow.

Equity requires differentiated pathways consistent with Common but Differentiated Responsibilities and Respective Capabilities. Historically polluting Global North countries must lead through the fastest reductions and fulfil their climate-finance responsibilities. National circumstances must shape how Saudi Arabia and the UAE transition, while their substantial capabilities support meaningful action.

Greenpeace MENA calls on Saudi Arabia and the UAE to halt further fossil-fuel expansion, establish transparent and differentiated energy transition plans consistent with 1.5°C and equity, and redirect investment towards renewable energy, targeted electrification and diversification that protects people. Their development ambitions and investment capabilities create an opportunity to lead this transformation. The decisions taken today will determine whether those capabilities deepen fossil dependence or build lasting prosperity beyond it.

Three illustrative pathways and their production assumptions

The neutral labels below describe the pace of the economic scenarios. Neither Path B nor Path C has been validated as Paris-aligned, consistent with a national fair share, or socially just.

Path A – Hydrocarbon expansion: additional capacity and production remain central to fiscal and export income. Renewable energy and diversification continue.

Path B – Managed illustrative transition: no new production expansion from 2026, with a gradual decline in existing production.

Path C – Faster illustrative transition: the same halt, followed by a steeper decline and stronger assumed renewable deployment, efficiency, diversification and transition spending.
The production-linked revenue indices represent combined oil-and-gas exposure relative to 2025. They are not separate physical oil and gas extraction schedules. The values are author-selected scenario assumptions, not official forecasts, nationally determined contributions or phase-out benchmarks.

Assumed production-linked index reductions from 2025

Country / path	2030 cut	2040 cut	2050 cut
Saudi Arabia – B	4%	20%	40%
Saudi Arabia – C	10%	40%	70%
UAE – B	6%	25%	50%
UAE – C	15%	50%	80%

Path A assumes production-linked volumes at 110%, 118% and 125% of the 2025 base in 2030, 2040 and 2050 in both countries. For B and C, the table shows percentage reductions from that base, before stress overlays. Country-specific fiscal and delivery differences remain in the analysis.

The neutral labels identify relative pacing within the illustrative set. Faster than another modelled path does not establish sufficient climate ambition. A steeper fair-share pathway would require a new model run; these results must not be extrapolated to an untested decline rate.

Key Insights

The fiscal comparison distinguishes near-term cash flows from later resilience.

Expansion's early advantage does not persist across most of the environments tested.

1. Expansion retains an early annual fiscal advantage. In 2030, Path A records a stronger balance than either transition path in all seven environments in both countries. In the Reference case, Saudi balances are –8.0%, –9.3% and –10.0% of GDP for A, B and C. UAE balances are +2.8%, +1.4% and +0.6%. These are annual budget outcomes, not investment profits.

2. Path C improves the 2040 annual balance in six of seven environments in each country. Under the Severe Downside test, the C-minus-A advantage is 5.32 percentage points of GDP for Saudi Arabia and 5.12 for the UAE. Both still record deficits. The High-Price Upside case leaves A ahead by approximately 0.35 and 0.27 points, respectively.

3. Diversification and expenditure assumptions drive the later improvement. In the 2040 Reference comparison, the Saudi C-versus-A balance improves by US$17.1 billion, despite US$107.7 billion less hydrocarbon revenue. Higher non-hydrocarbon receipts and lower primary expenditure more than offset that loss after interest. The corresponding UAE improvement is US$8.8 billion.

4. Timing and financing matter. A better balance at one horizon does not erase previous borrowing or asset drawdowns. In the Reference case, UAE debt in 2040 is about 20.3% of GDP under C, compared with 17.6% under A, despite C's stronger annual balance. The assumed financing assets are not audited liquid sovereign wealth.

Path B offers a useful intermediate comparison. Its 2040 balance exceeds A in three of seven environments in both countries: Moderate Downside, Severe Downside and Technology Acceleration. By 2050 it exceeds A in all seven Saudi cases and six UAE cases. C exceeds A in all seven by 2050, within the same long-horizon assumptions.

The screens identify specific opportunities rather than a uniform cost advantage from electrification. The quoted application results use Path A, 2030, Severe Downside and administered gas unless an A-to-C comparison is stated.

5. Solar PV is the lowest-cost new-build power option in the selected screen. System-adjusted costs are about US$33.9/MWh in Saudi Arabia and US$30.7/MWh in the UAE, compared with US$40.7 and US$41.0 for combined-cycle gas generation. Grid, balancing and curtailment allowances are included. Average energy cost does not establish identical reliability or a complete power-system design.

Key Insights

6. Gas value and financing change the comparison. Solar plus battery storage reaches cost parity with new combined-cycle gas at about US$5.19/MMBtu in Saudi Arabia and US$4.70/MMBtu in the UAE. The gas values are analytical cases, not current spot prices or export netbacks. Higher financing costs can erode technology-cost gains.

7. Transport provides the strongest combined application result in the selected screen. Representative annual net benefits are approximately US$111 million in Saudi Arabia and US$87 million in the UAE, with operational CO_2 reductions of 7.21 and 4.51 million tonnes. These reflect assumed project scales and uptake, not national transport-sector forecasts. The model annualises application and grid investment.

8. More renewable electricity reduces operational emissions in several industrial applications, but does not automatically lower energy costs. In the selected 2030 A-to-C comparison, five electricity-using applications show lower emissions and higher energy costs. Gas-based ammonia is unchanged because its reference process has no material purchased-electricity input.

9. Process efficiency and materials also matter. The separate cement option lowers the clinker ratio from 0.71 to 0.57 and reduces screened emissions by about 18.6% in Saudi Arabia and 18.5% in the UAE. Improving data-centre power usage effectiveness from 1.4 to 1.2 reduces electricity per unit of IT service by 14.3%. Neither screen includes a complete commercial investment case.

The study tests the economic case for fossil expansion, not whether the modelled pathways meet 1.5°C or fair-share requirements.

By 2040, Path B assumes production reductions of 20% in Saudi Arabia and 25% in the UAE, compared with 40% and 50% under Path C. These are illustrative indices, not emissions budgets or optimal phase-down rates. Fiscal outcomes under faster reductions remain untested and sensitive to hydrocarbon prices, growth, spending and transition costs.

Just-transition outcomes also remain unverified. The support allocations in Paths B and C are illustrative, not costed protection programmes. All seven safeguards covering workers, households, participation and environmental protection remain unassessed in both countries.

The 2024-25 baseline does not fully capture the effects of the 2026 conflict, reconstruction or overseas investments. Overseas fossil investment does not demonstrate reduced fossil exposure, nor does aggregate inward FDI establish non-fossil diversification.

The central finding is that continued expansion is not consistently the stronger long-term fiscal strategy under the tested conditions. Diversification, renewables and efficiency offer alternatives, but climate alignment and social justice require separate evidence. The study does not endorse nuclear energy, carbon capture, offsets or further fossil expansion.

Introduction

This report examines whether continued fossil-fuel expansion offers Saudi Arabia and the United Arab Emirates a stronger long-term development pathway than a planned reduction in hydrocarbon dependence.

Hydrocarbon revenues have financed public services, infrastructure and industrial development in both countries. The relevant question now is how to sustain prosperity as energy technologies, market conditions and climate constraints change. Additional production can generate receipts, but receipts alone do not establish a durable fiscal strategy or the best use of investment capital.

The comparison follows three illustrative packages of production, revenue diversification, public spending and energy-system assumptions. Path A continues production expansion. Path B stops new expansion from 2026 and assumes a managed decline in existing production. Path C also stops expansion and assumes a faster decline, alongside stronger renewable deployment, efficiency and diversification. These are analytical choices, not descriptions of policies already adopted.

The central finding concerns public finances: expansion has an early annual fiscal advantage, but the faster illustrative transition produces a stronger annual fiscal balance by 2040 in six of the seven tested environments in each country. This challenges the claim that further expansion is economically necessary for resilience. It does not establish project-level returns, an optimal phase-out speed or a climate-aligned national pathway.

The opening summary introduces the method and pathways before the findings. Chapter 1 compares starting conditions. Chapter 2 explains the analytical choices. Chapters 3-5 examine fiscal, power and industrial results. Chapter 6 sets out the climate-justice requirements and the evidence still needed to assess them.

The 2026 context and the limits of the scenarios

The 2024-25 calibration is a historical starting point. The study does not represent the full economic effects of the 2026 conflict, reconstruction spending, disrupted shipping or new overseas fossil-fuel investments.

The context has changed. The UAE announced withdrawal from OPEC and OPEC+ effective 1 May 2026. The IMF's July 2026 assessment describes disruption to Saudi trade and activity, rerouting of oil exports and higher oil receipts. Such developments can affect fiscal revenues, infrastructure costs, insurance, logistics and investment timing in different directions. The model has not been recalibrated to quantify all these effects, and the study does not estimate the complete quarterly output losses or project-spending response.

The High-Price Upside case tests more favourable hydrocarbon prices, while the Financing Stress and Implementation Stress tests examine selected borrowing and delivery constraints. These cases illuminate relevant channels; they are not event-specific war scenarios. A prolonged conflict with persistently higher prices and substantial reconstruction or bypass-infrastructure expenditure would require a new, explicitly costed case. Higher gross oil revenues cannot be treated as net investment returns without those costs.

Overseas investment needs the same discipline. Moving an investment abroad does not diversify the underlying economic exposure if it remains tied to oil, gas or petrochemicals. The baseline FDI indicator measures aggregate inward flows, not outward sovereign investment and not specifically investment in non-fossil activities. The model does not separately trace the sector composition or fiscal exposure of overseas portfolios.

The analysis therefore preserves its original calibration and reports the seven defined tests transparently. Its findings should inform scrutiny of expansion claims, rather than serve as a forecast of conflict outcomes or a comprehensive assessment of current national investment plans.

1

Starting conditions for Saudi Arabia and the UAE

Saudi Arabia and the UAE share a development challenge: converting the capabilities created by hydrocarbon wealth into prosperity that can withstand changing energy markets. Their different fiscal, industrial and institutional positions shape the practical conditions of transition.

Hydrocarbon exports have supported public revenue, infrastructure, industrialisation and rising living standards in the Gulf for decades. The economic logic was reinforced by growing global energy demand, comparatively low production costs and the ability of national oil companies to generate foreign exchange and fiscal transfers. Saudi Arabia and the United Arab Emirates used this resource base to build transport, power, water, education, health and industrial systems and to accumulate domestic and external assets. Any credible transition assessment must begin by recognising this contribution.

1.1 Hydrocarbon dependence has several distinct measures

Saudi Arabia is more exposed through public revenue and merchandise exports in the supplied baseline. The UAE's trading structure is more diversified, but re-exports and different reporting boundaries limit direct comparisons.

In 2025, hydrocarbon receipts account for about 54.6% of Saudi central-government revenue and 44.0% of UAE general-government revenue in the comparative baseline. The fiscal scenario calibration uses an unrounded UAE share of 44.06%, shown as 44.1% where that series is discussed. The small difference reflects rounding and calibration, not a substantive change in the revenue structure. [1, 2]

Trade shares require particular care. The Saudi hydrocarbon-export observation is for 2025, whereas the non-oil export observation is for 2024. They should not sum to 100%. The UAE series also includes re-exports, so the headline non-oil share cannot be read as domestically manufactured value added. The table states the periods instead of forcing unlike series into a common total. [3, 4]

Table 1.1 [1, 2, 3, 4, 5, 6, 7, 8]

Indicator and source period	Saudi Arabia	UAE
Hydrocarbon public revenue, 2025	54.6%	44.0%
Hydrocarbon merchandise exports, KSA 2025 / UAE 2024	67.5%	26.2%
Non-oil merchandise exports, 2024	23.0%	73.9%
Fiscal balance, KSA 2025 / UAE 2024	−5.8% of GDP	+6.4% of GDP
Renewable installed-capacity share, 2025	12.2%	15.3%
Grid-average emissions, 2024	0.57 tCO_2/MWh	0.34 tCO_2/MWh
Aggregate inward FDI / GDP, source five-year average	1.6%	5.0%

Crude-extraction shares and non-oil GDP shares in the workbook use different years or activity boundaries and have not been reconciled into a common accounting series. They are not used here to rank overall physical dependence. Fiscal, trade and energy indicators should each be read within their own denominator.

1.2 Fiscal resilience and sovereign capacity

The UAE's stronger recent fiscal-flow position gives it more near-term flexibility. Saudi Arabia's revenue concentration and deficit make the timing of adjustment more demanding. Neither country's sovereign wealth should be treated automatically as liquid budget finance.

The baseline records a Saudi fiscal deficit of about 5.8% of GDP in 2025 and a UAE general-government surplus of 6.4% in 2024. The observations differ in year and institutional coverage. They describe starting conditions, whereas the scenario model uses a 2025 calibration with a UAE surplus of approximately 5.1% of GDP. The two UAE figures must not be interchanged. [1, 2, 9, 10]

The reported non-oil primary deficits are about 23.3% of non-oil GDP for Saudi Arabia in 2025 and 17.1% for the UAE in 2024. These indicate continued dependence on income beyond the non-oil revenue base. They use a different denominator from the simplified scenario measure in Chapter 3, which divides by total GDP. [1, 2]

Both countries have substantial sovereign investment institutions. The assets they hold differ in ownership, liquidity and purpose, however, and may be committed to long-term or domestic development projects. Broad sovereign wealth is therefore distinct from resources a government could draw upon to finance a deficit or a transition programme. [11, 12]

Public debt adds another dimension. Baseline debt is about 31.8% of GDP in Saudi Arabia in 2025 and 34.9% in the UAE in 2024. The fiscal model's UAE 2025 calibration is 34.5%. Debt-service costs, investment commitments and usable financial assets affect resilience alongside the headline debt ratio. [1, 2]

These differences explain why similar transition ambitions can create different financing pressures. Chapter 3 follows annual balances, accumulated borrowing and assumed financial-asset drawdowns separately. It does not infer fiscal capacity from total sovereign assets or from a single year's budget result.

1.3 Diversification requires productive domestic capabilities

Commercial diversification can reduce some exposure to hydrocarbons without eliminating fiscal or industrial dependence. The relevant test is whether alternative activities generate durable public income, productive employment and competitive domestic value added.

The supplied trade data show a much larger non-oil merchandise-export share for the UAE than for Saudi Arabia in 2024. Part of the difference reflects the UAE's re-export and logistics role. A higher non-oil export share is therefore informative about commercial structure, but is not equivalent to a larger domestic manufacturing contribution. [3, 13]

Aggregate inward FDI averages about 1.6% of GDP in Saudi Arabia and 5.0% in the UAE over the source's five-year window. Those flows can include fossil-related activities. They do not describe outward sovereign investment or demonstrate that investment is moving into non-fossil sectors. Overseas oil, gas or petrochemical assets can retain the same market exposure as domestic fossil investment. [4, 14]

The workbook also records non-oil GDP shares, crude-extraction shares and manufacturing indicators with different accounting boundaries. The unreconciled 75.5% versus 75.0% non-oil GDP comparison is omitted from the publication rather than presented as a verified cross-country ranking. This does not change the fiscal scenario calculations, which use separate baseline revenues, spending and nominal GDP. [5, 6, 15]

The industrial question is consequently broader than the label "non-oil". Resource-based manufacturing can remain dependent on fossil feedstocks, cheap gas or hydrocarbon-funded domestic demand. Trade concentration, the source of fiscal revenue, product sophistication and energy use need to be considered together.

Renewable electricity, efficient production and changes in industrial processes may strengthen alternative sources of value. Chapter 5 tests representative energy and emissions effects, while retaining the limits of an application screen: it does not establish national investment returns, employment outcomes or a complete industrial-competitiveness ranking. [16]

1.4 Power systems and transition readiness

Both countries are expanding renewable electricity. Installed capacity, actual generation, historical grid emissions and the power available to an individual facility are different measures of progress.

The workbook's 2025 capacity indicators record renewable shares of approximately 12.2% for Saudi Arabia and 15.3% for the UAE. Annual additions relative to peak demand are about 7.0% and 2.2%, respectively. These figures describe different indicators: the stock of installed capacity and one year's deployment relative to demand. Neither establishes the share of electricity generated from renewables. [8, 17, 18, 19, 20, 21]

The historical grid-average emissions factors are approximately 0.57 tCO ₂/MWh for Saudi Arabia and 0.34 tCO ₂/MWh for the UAE in 2024. They reflect the complete observed generation mixes. They are descriptive baseline measures, not renewable-only factors, endorsements of particular technologies or evidence of the procurement mix available to every industrial user. [7, 22]

The economic value of new renewable capacity depends on output, grid connection, storage, flexible demand and the fossil generation it displaces. Saudi Arabia's recent capacity additions therefore need to be read alongside delivery and system-integration requirements. The same requirements apply to the UAE as renewable deployment expands. [23, 24]

The scenario power and industrial calculations use their own generation and procurement assumptions. Historical electricity emissions should not be substituted for those scenario-specific factors. Chapters 4 and 5 state the relevant pathway, horizon and stress case when reporting the results.

The publication focuses on renewable electricity, efficiency and electrification. It does not propose nuclear deployment or carbon capture as transition solutions. The cost comparisons also do not demonstrate the hourly adequacy of a renewable power system; that requires separate engineering analysis. [25, 26]

1.5 Institutions, finance and implementation capability

Financial strength can enable transition but cannot substitute for institutional coordination, skills, transparent information and implementation capacity. The study's financing, delivery and monitoring rubrics are analyst assessments, while published governance, human-capital and innovation indicators use different vintages.

Both countries possess substantial institutional and financial capabilities, although differences in innovation, skills and implementation readiness may influence the effectiveness of transition delivery. Institutional capability is a critical determinant of the transition's feasibility. Large-scale energy and industrial transformation requires coordination across public finance, energy regulation, industrial policy, infrastructure delivery and private investment. Strong institutions can reduce implementation delays, mobilise finance and coordinate decisions across sectors. Saudi Arabia and the UAE have both demonstrated substantial capacity to mobilise investment and implement national development programmes.

The model's qualitative assessment gives Saudi Arabia and the UAE scores of 4.7 and 4.9 out of 5, respectively, for access to finance and sovereign investment capacity. Policy implementation capability is assessed at 4.4 for Saudi Arabia and 4.8 for the UAE. These values reflect the study's defined analytical rubrics and should not be presented as externally published institutional ratings.

Published indicators provide additional evidence of differences in innovation and human capital. In the 2025 Global Innovation Index, the UAE recorded a score of approximately 44.2, compared with 36.0 for Saudi Arabia. The World Bank's 2020 Human Capital Index also recorded higher values for the UAE (0.673) than Saudi Arabia (0.580). These differences provide useful context, but neither indicator directly measures the availability of workers with the specific skills needed for an energy transition. [27, 28, 29]

The assessment also identifies areas of institutional strength in Saudi Arabia, including a slightly higher analyst-assessed data transparency and monitoring readiness score of 4.2, compared with 4.0 for the UAE. Both countries are therefore well positioned to mobilise resources and establish programmes, but the effectiveness of implementation will depend on more than capital availability or the ability to deliver projects. For both countries, the main institutional challenge is to translate financial resources and delivery capability into measurable economic, environmental and social outcomes.

1.6 What the starting positions imply for the comparison

The countries face a shared transition question with different fiscal and commercial starting points. Those differences inform the interpretation of the scenarios; they do not assign either country an exemption from fossil-fuel phase-out.

Saudi Arabia : greater fiscal and export exposure. Hydrocarbon revenue concentration and the baseline deficit make the growth of alternative public income and the timing of expenditure central to the fiscal results. Its large industrial and domestic markets also create opportunities for renewable procurement and efficiency, subject to investment and delivery conditions. [1, 2, 3]

United Arab Emirates : commercial diversity with continuing fossil exposure. The UAE's stronger recent fiscal-flow position and trading networks provide different capabilities. Re-exports and aggregate inward FDI do not, however, prove that domestic production or overseas portfolios are independent of hydrocarbons. Nor does a more diversified trade profile establish that the country's physical fossil-fuel dependence is lower on every measure. [4, 14]

The crude-oil and gas GDP observations use different years and national-account boundaries. They are not used to infer a single physical-dependence ranking, and they should not be treated as the complements of the non-oil GDP series. The model's fiscal findings rely on the separate revenue and expenditure calibration described in Chapter 3.

For both countries, diversification is stronger when it builds public revenue, productive capabilities and employment while fossil-fuel production and consumption decline. Diversifying commercial activities alone can leave exposure in government income, industrial feedstocks or overseas assets. [30, 31]

Chapter 2 translates these starting conditions into transparent comparative assumptions. The purpose is to test the economic narrative supporting further expansion, not to derive a national phase-out date from an aggregate score or to describe current government policy priorities.

2

Comparing three development pathways

The comparison separates starting conditions, hypotheses, analyst-defined pathways and conditional outcomes. Three pathways are tested at 2030, 2040 and 2050 under seven common environments. This produces comparative evidence rather than forecasts or verified climate-aligned national plans.

Saudi Arabia and the United Arab Emirates face different choices about how quickly to reduce hydrocarbon dependence, how to finance economic transformation and how to manage the risks associated with changing global energy markets.

The transition away from fossil fuels is not a single development trajectory. Its economic consequences depend on the pace of change, the availability of alternative revenues, the costs of renewable-energy technologies and the ability of governments and industries to implement new investments.

2.1 The linked analytical framework

The research connects starting conditions, explicit scenario assumptions and sector-level results. Its final step interprets the findings and their limits; it does not convert a model score into an approved national policy roadmap.

Exhibit 2.1

Stage	Purpose and boundary
1. Diagnose	Compare fiscal, trade, energy and institutional starting conditions.
2. Test	Set A, B and C assumptions at 2030, 2040 and 2050 under seven common environments.
3. Quantify	Compare public finances, new-build power costs, electrification and industrial applications.
4. Assess justice	Examine responsibility, capacity, dependence and seven safeguards without certifying outcomes.
5. Interpret	State supported findings, assumptions and evidence gaps. Distinguish comparative findings from national policy prescriptions.

The six hypotheses organise the evidence rather than predetermine it. Fiscal outcomes compare the whole assumed pathway package. Power and application screens use narrower cost and emissions boundaries, while the justice assessment identifies evidence requirements that cannot be replaced by economic scores. [1, 2, 16, 23, 30, 32].

Detailed methods, assumptions and supporting calculations remain in the technical evidence base. This publication concentrates on the economic comparison and the conditions needed to interpret it. The framework interprets economic trade-offs and evidence gaps rather than prescribing detailed national programmes.

2.2 The six hypotheses

The hypotheses test claims about expansion and the opportunities offered by alternative development choices. Each is presented consistently as a question; the evidence assessment follows in Section 2.6.

Table 2.1

Hypothesis	Question tested
H1. Fiscal resilience	Does additional fossil-fuel expansion strengthen long-term public finances?
H2. Transition finance	Is new expansion a necessary or superior way to finance transformation?
H3. Renewable energy	Can renewable electricity and electrification improve costs and emissions?
H4. Complementarity	Can diversification, renewable deployment and phase-down reinforce one another?
H5. Industry	What changes in unit energy costs and operational emissions?
H6. Differentiation	How do country circumstances shape implementation and support?

The assessment distinguishes support within a specified screen from proof of a broader investment or policy claim. For example, a lower generation cost does not establish identical reliability, and higher assumed non-hydrocarbon growth cannot independently prove that production decline causes fiscal improvement. [23, 24]

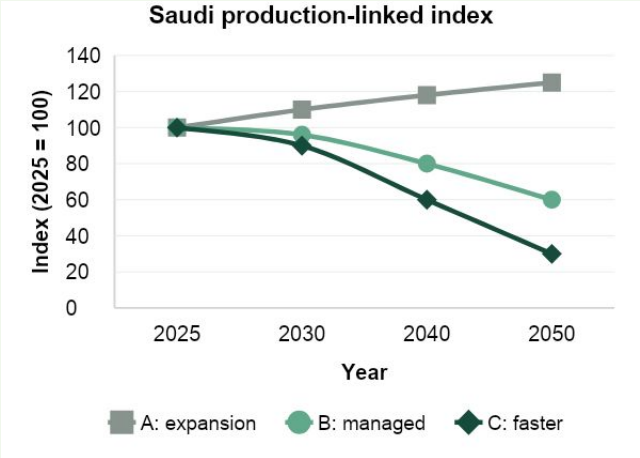
2.3 Production and renewable-generation assumptions

The charts show author-selected, unstressed assumptions. The production-linked revenue index combines oil-and-gas exposure with 2025 = 100. Renewable shares refer to electricity generation, exclude other technologies, and begin at the first modelled horizon in 2030. [1, 2, 16].

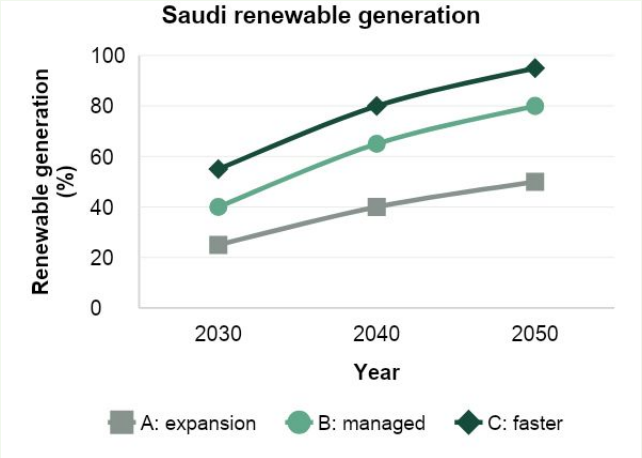
Exhibit 2.2

Saudi Arabia

Production-linked index (2025 = 100)

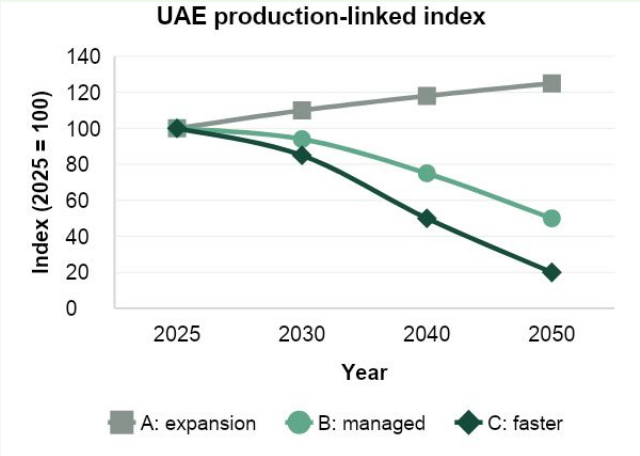


Renewable generation (% of electricity)

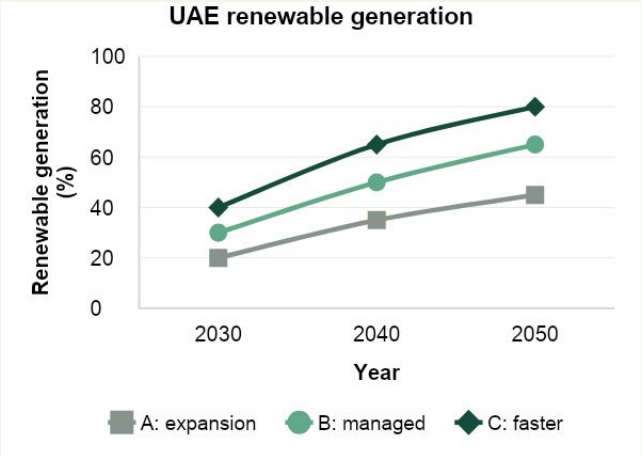


UAE

Production-linked index (2025 = 100)



Renewable generation (% of electricity)



A: expansion. B: managed illustrative transition. C: faster illustrative transition. These are not forecasts or verified climate-aligned limits. No 2026 generation point is inferred from installed-capacity data.

2.4 Seven common stress environments

Every pathway is tested under the same set of external and delivery environments. These are composite cases, so an observed difference cannot be attributed to one isolated driver. The supplied analytical workbook records the underlying parameter schedules. (contextual inputs: [1, 2, 16]).

Table 2.2

Environment	Purpose of the common test
Reference	Compare the unstressed pathway assumptions
Moderate Downside	Weaker hydrocarbon conditions and associated macro-fiscal effects
Severe Downside	More demanding combined market and macro-fiscal conditions
High-Price Upside	Test whether favourable hydrocarbon markets preserve expansion's fiscal advantage
Technology Acceleration	Lower clean-technology costs alongside the case's other assumptions
Financing Stress	Higher borrowing and capital costs with weaker growth assumptions
Implementation Stress	Reduced achieved renewable-energy, electrification and efficiency delivery

Each environment applies to A, B and C in both countries. Severe Downside includes a 40% reduction in the oil-price index and a 15% reduction in the production-linked revenue-volume factor. High-Price Upside tests stronger fossil-market conditions. None has a probability weight. These are comparative sensitivities, not event-specific forecasts of the 2026 conflict.

2.5 Outcomes across 2030, 2040 and 2050

The model compares horizons rather than identifying a precise year when transition costs end or later benefits begin. Its timing results depend on the combined assumptions for revenues, spending, financing and energy-system delivery. (fiscal inputs: [1, 2, 9, 10]).

2030 captures an early adjustment point. Path A has the strongest annual fiscal balance of the three pathways in every tested environment in both countries. B and C have lower hydrocarbon receipts and additional transition and support expenditure, while the assumed diversification benefits have had less time to accumulate. This does not demonstrate a four-year adjustment period or identify the exact year of a fiscal crossover.

2040 shows the effect of accumulating the scenario differences. C exceeds A's annual balance in six of seven environments in each country. B exceeds A in three: Moderate Downside, Severe Downside and Technology Acceleration. The Reference case illustrates why a generic statement that "managed transition outperforms" would be too broad: Saudi B is below A at this horizon, while C is above A.

2050 tests a much longer continuation of the assumptions. C exceeds A's annual balance in all seven environments in both countries. B exceeds A in all seven Saudi cases and six UAE cases. Those results remain conditional on repeated growth, expenditure and financing assumptions; increasingly extreme debt outcomes should be read as stress indicators.

The fiscal gain is not attributed to production cuts alone. The transition packages also assume higher non-hydrocarbon revenue growth, different primary-spending growth, support allocations and public investment. A steeper production decline without a corresponding assessment of those drivers has not been tested.

The common comparison therefore reveals a timing trade-off: higher early hydrocarbon receipts can preserve an annual budget advantage, while an alternative package can improve later balances. Whether that package can be delivered, and whether it meets climate and equity requirements, are separate questions.

2.6 Evidence assessment for all six hypotheses

The results challenge unconditional claims for expansion and identify selected renewable and efficiency opportunities. The table treats all six hypotheses consistently and states the boundary of each conclusion.

Table 2.3

Hypothesis	Assessment	Evidence boundary
H1	Conditional early advantage; no robust long-term fiscal superiority of expansion	Not a project-level CAPEX, profitability or NPV assessment
H2	Existing receipts can support transition; necessity of new expansion is not established	Alternative returns and actual usable sovereign wealth are not verified
H3	Selected opportunities for renewable generation and electrification	No hourly dispatch, reliability equivalence or deployment forecast
H4	Coherent package can improve outcomes within the scenario assumptions	Joint assumptions do not independently establish causality
H5	Operational emissions can improve while energy costs rise	Incomplete production costs, demand and investment economics
H6	Different implementation needs are justified	No national fair-share date or verified justice outcome

"Conditional" describes the scope of the evidence. It does not mean that a hypothesis has been proved by choosing assumptions that favour it. In particular, the study does not calculate a complete expansion-project NPV, optimise a national energy system or certify a just transition. [30, 32]

2.7 How to interpret the comparison

The scenarios are conditional comparisons, not forecasts or a search for an optimal national transition pathway. Their distinct analytical boundaries must remain visible when the findings are communicated.

The fiscal model follows public revenues, expenditure, borrowing and an assumed financing-asset envelope. It does not calculate the full capital cost and risk-adjusted return of new extraction projects, reconstruct the 2026 conflict or trace sectoral exposures in overseas portfolios. Its horizon calculations are not continuous annual debt-sustainability forecasts. [1, 2].

The power screen compares new-build generation with stated grid and system-service allowances. Gas cases distinguish administered prices, production costs, long-run marginal costs and an export-parity proxy. They do not establish current TTF or JKM netbacks, country-specific export access or equal hourly reliability across technologies. [23, 24]

The application and industrial screens quantify representative energy costs and operational emissions. They do not cover every production cost, all upstream emissions, actual national deployment, employment impacts or verified product footprints. Different output units must not be aggregated as though they describe one national industrial total. [16]

Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC) provides the interpretive framework for climate justice. The study has not constructed national greenhouse-gas pathways, cumulative carbon budgets, an independently justified fair-share allocation or a comparison with national climate commitments. [30, 32, 33]

No pathway is therefore certified as Paris-aligned or socially just. The neutral B/C names reflect that limit. A further phase-out study would need separate oil and gas trajectories, complete emissions accounting, explicit equity choices, and costed protection for affected people. The present report contributes an economic counterargument to the asserted necessity of further fossil expansion.

3

Fiscal resilience: early advantage and longer-term risks

Fiscal resilience depends on more than annual hydrocarbon receipts. The composition of public income, expenditure commitments, accumulated debt, available financing assets and the productivity of investment determine how resource wealth supports lasting prosperity.

The long-term development challenge for Saudi Arabia and the United Arab Emirates is not simply to preserve hydrocarbon revenues, but to convert finite resource wealth into diversified public income, productive assets and lasting economic security.

Hydrocarbon revenues have provided Saudi Arabia and the UAE with substantial financial resources to support public services, infrastructure, industrial development and economic diversification. Both countries have used these revenues to accumulate capital and build institutions capable of mobilising large-scale investment.

However, the long-term fiscal value of hydrocarbon resources depends on how revenues are managed and invested, as well as on the future demand and prices for oil and gas.

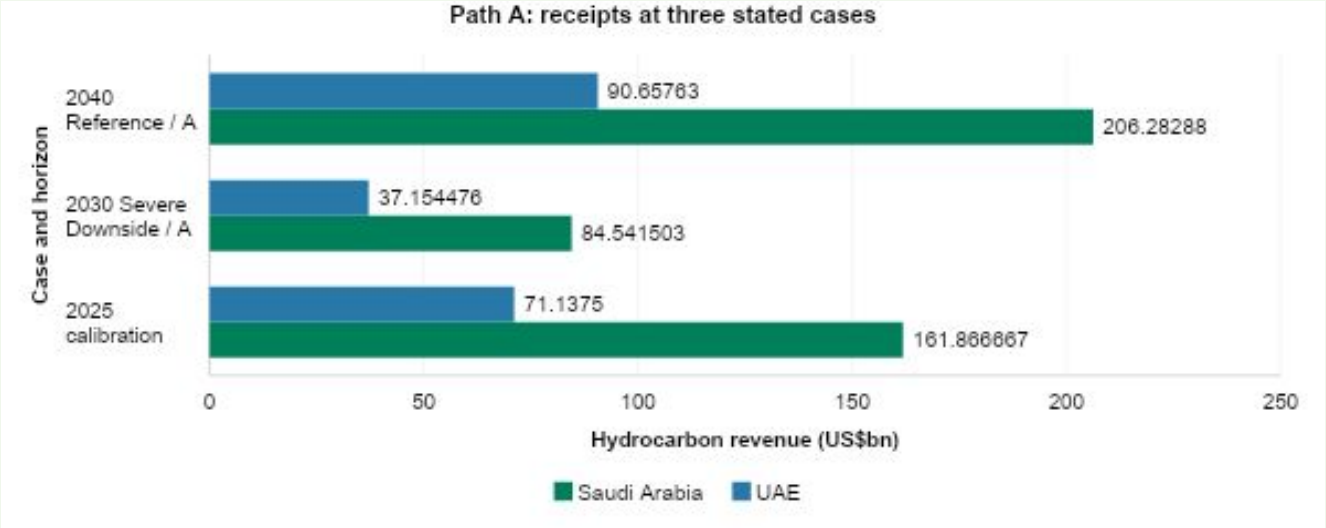
3.1 Revenue levels and revenue composition

The upper panel compares Path A hydrocarbon receipts at a historical base and two explicitly labelled cases. The lower panel holds the horizon and environment constant: 2040, Reference, A versus C. The panels answer different questions and should not be read as one continuous series.

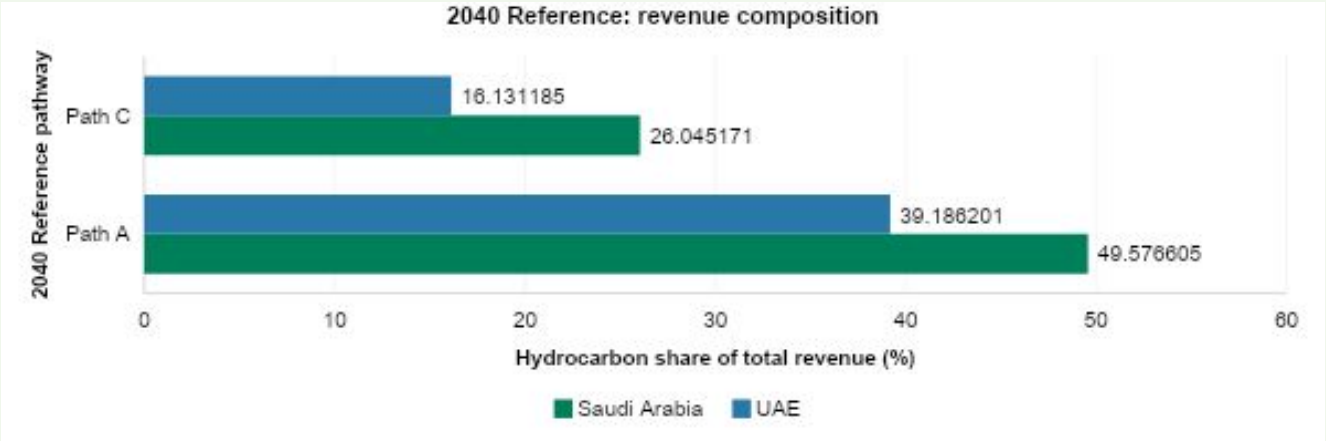
The 2025 calibrated receipts are US$161.9 billion for Saudi Arabia and US$71.1 billion for the UAE. In the 2030 Severe Downside test, A receipts fall to US$84.5 billion and US$37.2 billion despite higher assumed production-linked volumes. A lower hydrocarbon share caused by falling receipts is not, by itself, successful diversification.

Exhibit 3.1 [1, 2, 9, 10].

Hydrocarbon government revenue (US$ bn)



Hydrocarbon share of total revenue (2040 Reference, %)



The 2040 revenue-share panel reflects both lower hydrocarbon receipts and the stronger assumed non-hydrocarbon revenue growth in C. It does not measure investment returns.

3.2 Early financing needs and later annual balances

Annual fiscal balance means total government revenue minus primary and interest expenditure in the stated year. The Reference case shows an early A advantage and a different ranking by 2040 and 2050.

In 2030, Saudi balances are –8.0%, –9.3% and –10.0% of GDP under A, B and C. UAE balances are +2.8%, +1.4% and +0.6%. The transition paths have lower early hydrocarbon receipts and additional spending, while stronger assumed diversification has not yet fully accumulated. The model does not identify the exact year when the ranking changes.

By 2040, Saudi balances are approximately –12.2%, –12.8% and –11.3% of GDP for A, B and C. The corresponding UAE balances are +1.0%, +0.4% and +2.0%. Thus C improves on A in the Reference case in both countries, while B does not. The remaining Saudi deficit also shows that relative improvement is not the same as fiscal sustainability.

The 2040 C-minus-A annual improvement is US$17.1 billion for Saudi Arabia and US$8.8 billion for the UAE. The following exhibit decomposes those changes. Lower hydrocarbon receipts are offset by the assumed increase in non-hydrocarbon receipts and lower primary spending, after interest. Those figures describe the same 2040 Reference comparison, not the 2030 results above.

By 2050, the Reference case produces a Saudi deficit of 19.9% of GDP under A and 13.2% under C. The UAE records –0.9% and +6.3%. Such long-horizon results depend heavily on the continued growth and spending assumptions and should not be presented as annual budget forecasts.

The UAE's stronger baseline public finances provide context for its greater financing flexibility, but the model does not causally attribute its outcomes to a measured programme of past diversification. In both countries, transition investment, alternative public revenues and spending decisions have to be read together. [1, 2]

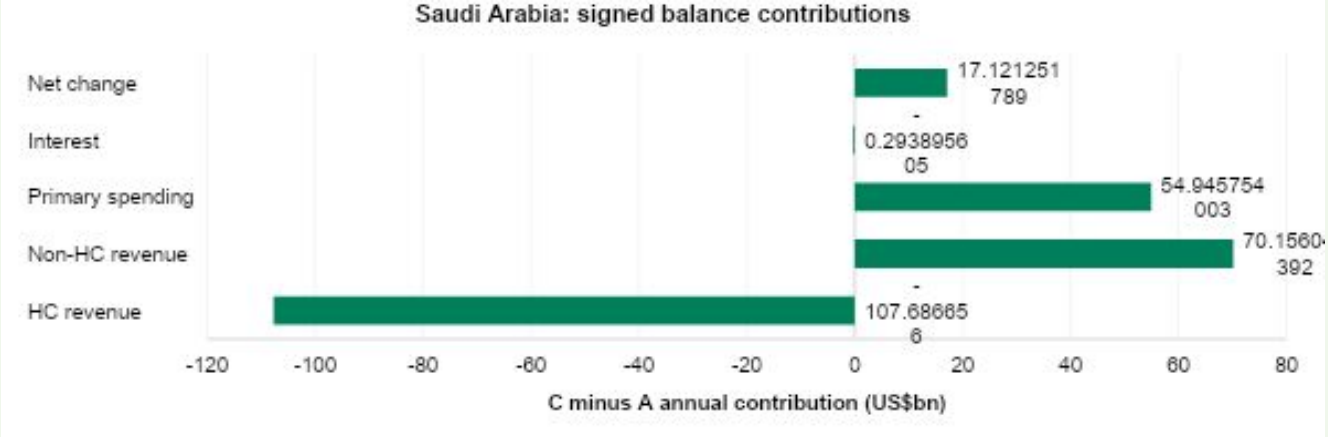
3.3 Why the 2040 Reference balance improves under C

The charts show signed contributions to the change in annual balance from A to C, in US$ billion. Positive bars improve the balance. A spending reduction is therefore positive; a revenue loss or higher interest cost is negative.

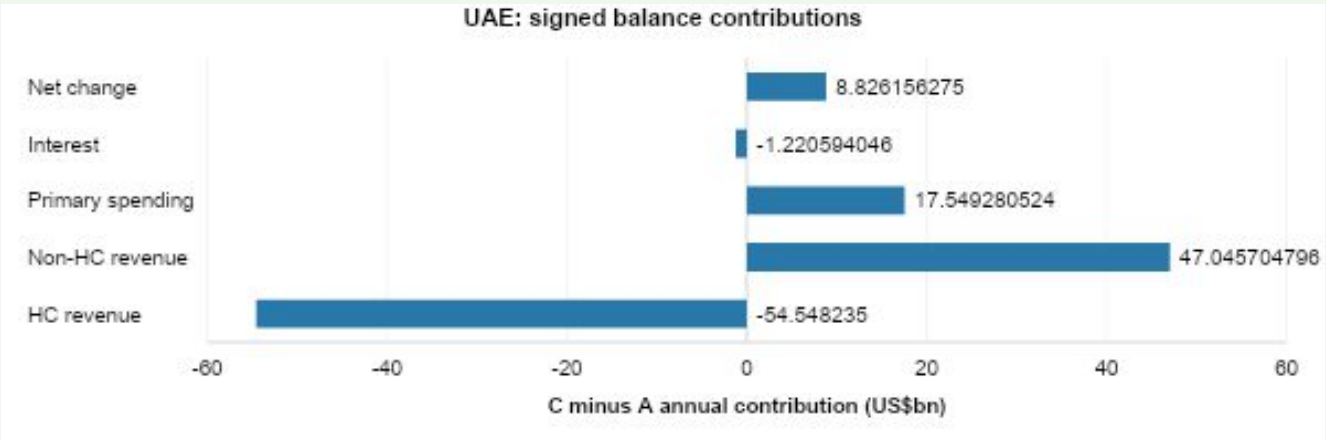
The net improvement is US$17.1 billion for Saudi Arabia and US$8.8 billion for the UAE. It results from the whole assumed reform package, not production decline alone. The signed contribution charts separate revenue losses from expenditure savings and show how the annual balance changes.

Exhibit 3.2 [1, 2, 9, 10].

Saudi Arabia



UAE



2040 Reference, C minus A. HC means hydrocarbon. Primary-spending bars show expenditure savings. Contributions sum to the net change. Figures are annual flows, not cumulative savings or project returns.

3.4 Fiscal diversification requires closing the primary gap

Non-oil GDP growth and non-oil public revenue are different outcomes. The study's non-oil primary balance uses total GDP as its denominator and should not be confused with IMF measures based on non-oil GDP. Under Reference assumptions in 2040, the Saudi gap improves from –20.9% of GDP under A to –14.2% under C; the UAE improves from –9.0% to –1.1%.

The long-term sustainability of public finances depends increasingly on the ability of non-hydrocarbon economic activity to generate reliable revenues without undermining productive growth. Economic diversification and fiscal diversification are related, but they are not interchangeable. An economy can increase the share of non-oil activities in GDP while government revenues remain heavily dependent on oil and gas. This distinction is particularly relevant to Saudi Arabia and the UAE, where substantial non-oil economic activity coexists with continued reliance on hydrocarbon-related public income. [1, 2, 9, 10]

The relevant fiscal question is whether non-hydrocarbon revenues can finance a growing share of public expenditure under conditions of declining fossil-fuel receipts. In the model's 2025 baseline, non-hydrocarbon government revenues amount to approximately US$135 billion in Saudi Arabia and US$90 billion in the UAE. Under the 2040 reference case, Saudi Arabia's non-hydrocarbon revenues increase to approximately US$210 billion in Path A and US$280 billion in Path C. For the UAE, the corresponding values are approximately US$141 billion and US$188 billion.

Higher non-hydrocarbon revenue growth is an explicit assumption of the alternative development pathways. The model does not independently establish the tax instruments, administrative reforms or economic growth mechanisms required to generate these receipts. The relationship between non-hydrocarbon revenues and expenditure is therefore a more informative measure of structural fiscal adjustment. The study uses a simplified non-oil primary balance calculated as non-hydrocarbon government revenue minus primary expenditure, expressed as a percentage of total GDP.

3.5 Debt reflects accumulated financing decisions

Debt is a stock built up through past financing decisions. An annual balance can improve while debt remains high, and a lower 2030 deficit does not determine the 2040 debt ranking.

The fiscal calibration begins in 2025 with debt at 31.8% of GDP in Saudi Arabia and 34.5% in the UAE. Deficits increase borrowing after the assumed share financed from assets; surpluses can reduce debt and build assets under the stated allocation rules. Interest is linked to prior debt, so early choices affect later annual spending. [1, 2]

In the 2040 Reference case, Saudi debt reaches about 145.5% of GDP under A, 137.7% under B and 127.1% under C. A has the smallest deficit in 2030, but its later annual balances are weaker and its financing rules differ. There is no contradiction between an early flow advantage and a worse accumulated stock.

The corresponding UAE debt ratios are 17.6%, 21.7% and 20.3%. The decline from the 34.5% calibration is a model result under the Reference surplus and financing assumptions, not an observed or guaranteed debt reduction. C's stronger 2040 annual balance coexists with more debt than A because of earlier adjustment costs and the treatment of assets and surpluses.

Financing assets also matter. Drawing them down reduces immediate borrowing but leaves fewer resources for subsequent shocks. Conversely, retaining assets while borrowing can preserve a buffer but increase debt service. Neither the gross debt ratio nor total sovereign wealth is sufficient on its own to describe usable fiscal space.

Extreme ratios in the longer-horizon and downside results are mechanical warning indicators. The model does not impose all the fiscal adjustments, market constraints or policy responses that would arise in practice. It is not a sovereign-default forecast or a complete debt-sustainability assessment.

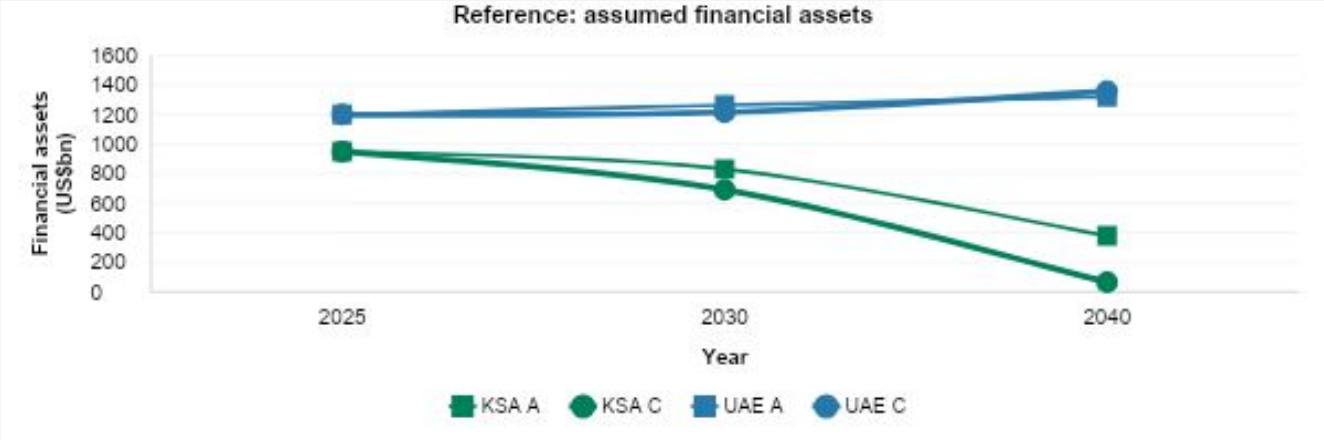
3.6 Financial assets and the timing of drawdowns

The assumed 2025 financing envelopes are US$950 billion for Saudi Arabia and US$1,200 billion for the UAE. The panels compare A and C under Reference and Severe Downside, in US$ billion. They are not audited liquid sovereign wealth.

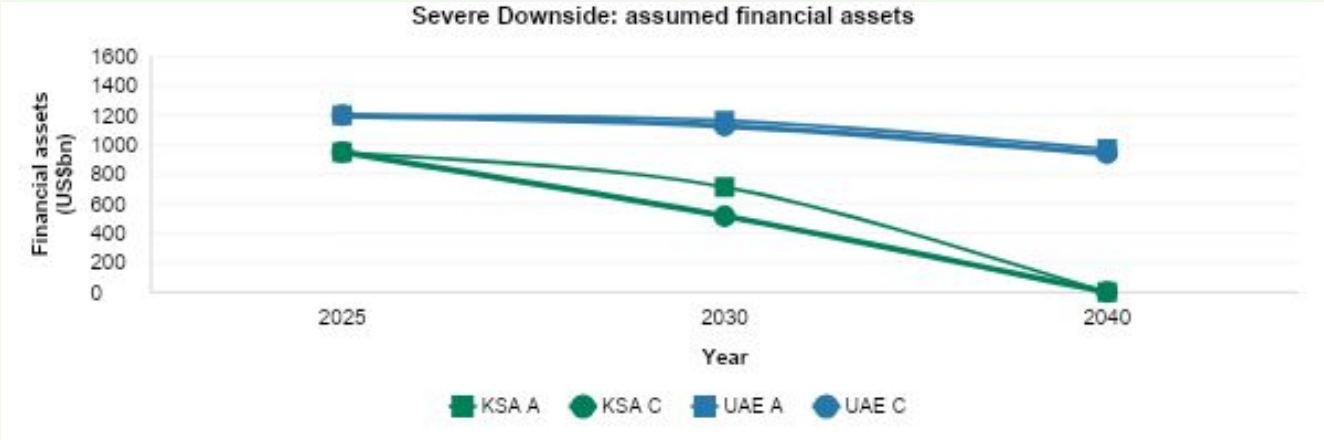
In the 2040 Reference case, Saudi remaining assets are about US$380 billion under A and US$66 billion under C. The greater early C drawdown persists despite its better annual balance in 2040. UAE assets are about US$1,319 billion under A and US$1,358 billion under C at that horizon. Under Severe Downside, both Saudi envelopes are depleted by 2040, while UAE assets fall below the assumed starting envelope.

Exhibit 3.3 [1, 2, 9, 10].

Reference – financing assets (US$bn)



Severe Downside – financing assets (US$bn)



Four lines in each panel: Saudi A/C and UAE A/C. Earlier deficits, drawdown shares and surplus allocation explain the stock differences. No claim about actual sovereign-fund liquidity is made.

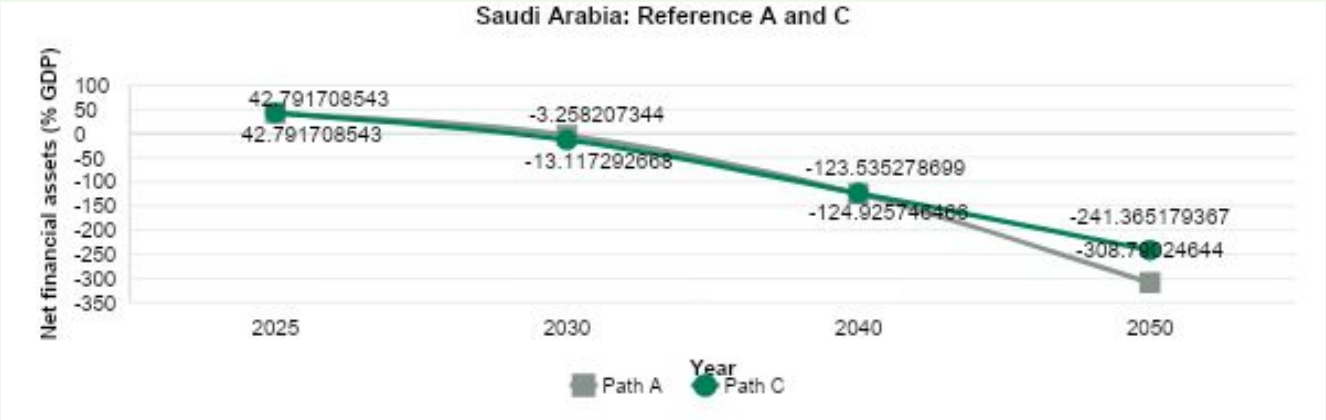
3.7 Net public financial assets across the full horizon

The measure is (assumed financing assets minus modelled public debt) divided by GDP. Both country charts now show 2025, 2030, 2040 and 2050 for A and C under Reference assumptions. Negative values mean debt exceeds that assumed asset envelope.

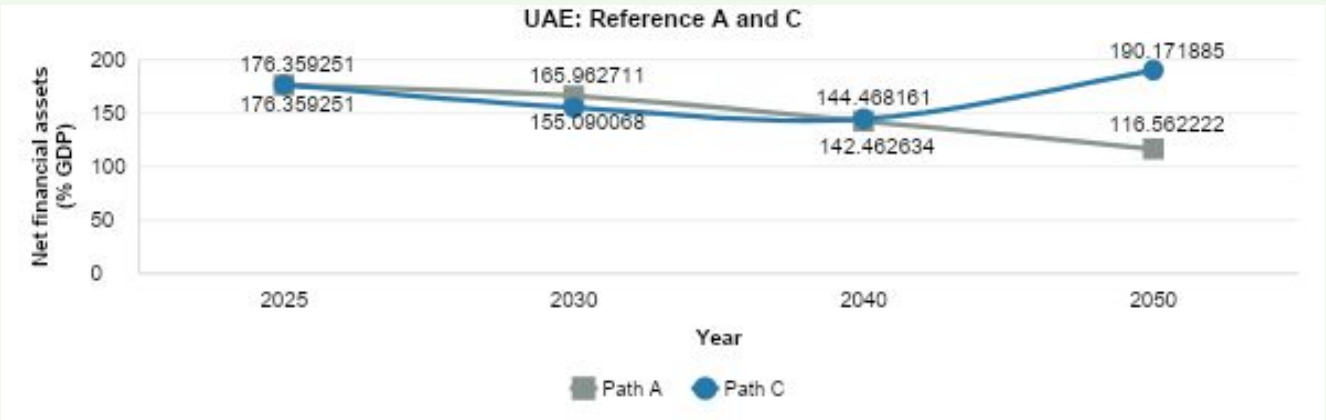
The measure excludes resource reserves, infrastructure, human capital and many environmental liabilities. By 2050 the Saudi values are approximately –309% for A and –241% for C; UAE values are +117% and +190%. The extreme Saudi ratios reflect cumulative model mechanics and must not be read as a comprehensive national-wealth or default forecast.

Exhibit 3.4 [1, 2, 9, 10].

Saudi Arabia



UAE



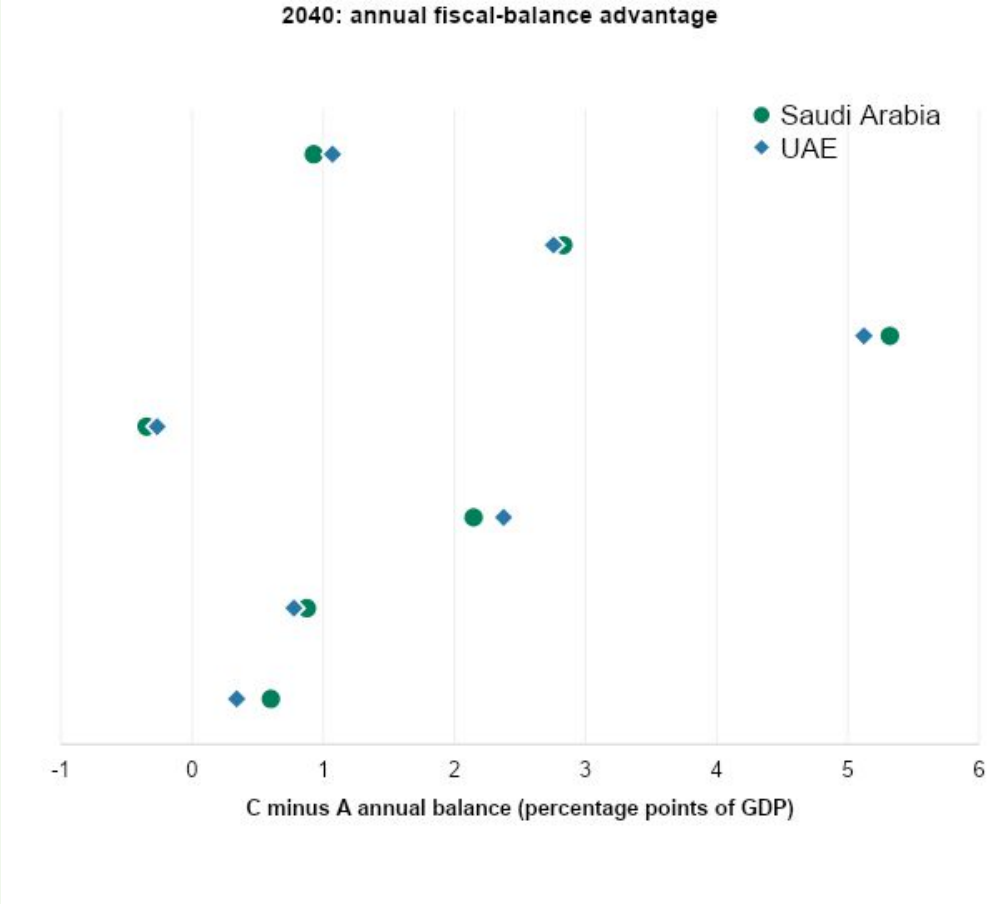
Reference case. Vertical axes: net public financial assets (% of GDP). The C-minus-A financial-stock difference is smaller in 2040 than the difference in that year's annual balance because prior financing decisions remain in the stock.

3.8 The 2040 fiscal advantage across seven environments

The horizontal axis measures C minus A annual fiscal balance in percentage points of GDP in 2040. Values to the right of zero favour C. Both countries favour C in six defined environments; High-Price Upside is the exception.

The Severe Downside advantages are 5.32 points for Saudi Arabia and 5.12 for the UAE, even though both paths still produce deficits. The High-Price Upside test gives A a small advantage, about 0.35 and 0.27 points. No probabilities are assigned to these environments, and the comparison is not an investment-profitability ranking.

Exhibit 3.5 [1, 2, 9, 10].



Severe downside: KSA +5.32 pp; UAE +5.12 pp

High-price upside: KSA -0.35 pp; UAE -0.27 pp

3.9 Financing and implementation stress tests

The named tests are model cases, not assertions that those delivery failures will occur. They show how financing costs, weaker growth and incomplete implementation can reduce the apparent benefit of a transition package. [1, 2, 9, 10].

Under the Financing Stress test, sovereign borrowing costs rise by two percentage points, while growth and non-hydrocarbon revenue assumptions weaken. Saudi C's 2040 deficit increases from about 11.3% of GDP in Reference to 14.4%. Access to capital alone therefore does not determine resilience; debt service and the delivery of alternative income also matter.

The Implementation Stress test applies a different set of assumptions. It reduces achieved renewable deployment, electrification uptake and efficiency improvements while retaining the pathway's production ceilings. In Saudi C in 2040, the modelled renewable-generation share falls from 80% in Reference to about 59%. This is a simplified delivery mechanism, not an engineering forecast.

That test also lowers annual non-hydrocarbon revenue growth by one percentage point and raises core expenditure growth. Worker and household support costs rise by 25%, while public transition investment rises by 20%. The adverse fiscal result therefore combines weaker delivery with higher costs; it cannot be attributed to any one factor in isolation.

The practical interpretation is that reductions in fossil exposure, renewable procurement, network readiness and alternative public income must be evaluated together. Investment in generation cannot deliver its expected application benefits without connections, storage or other flexibility, and the necessary equipment and skills.

The model does not allocate financing constraints across sovereign institutions, utilities, private developers or individual projects. It also does not model the full 2026 reconstruction, insurance and logistics shock. Those omissions matter when translating these comparative results into an actual investment or policy decision.

3.10 Different fiscal starting points imply different priorities

Saudi Arabia must prioritise durable non-hydrocarbon revenues, productive public investment and the timing of transition finance. The UAE has greater recent fiscal-flow flexibility, but still needs prudent capital allocation, liquid buffers and coordination across public institutions. Both must protect essential services and affected households during adjustment.

Saudi Arabia faces greater near-term fiscal adjustment pressure, while the UAE has more favourable fiscal-flow conditions but still needs to translate its advantages into lower long-term hydrocarbon dependence. The comparative assessment demonstrates that Saudi Arabia and the UAE face a shared challenge but enter the transition with different fiscal risks and financial capacities. Both countries have benefited from hydrocarbon revenues, accumulated financial resources and invested in economic diversification. Saudi Arabia's greater dependence on hydrocarbon revenues creates direct exposure to changes in oil prices and export earnings. [1, 2]

Its 2025 fiscal position also begins in deficit, increasing the importance of coordinating development expenditure with the growth of alternative fiscal revenues. The model suggests that under the reference case, accumulated deficits can generate substantial debt and financing pressures over the longer term. While Path C improves Saudi Arabia's annual fiscal balance relative to Path A by 2040, the country continues to record significant modelled deficits. The strategic priorities are therefore to strengthen durable non-hydrocarbon revenues, improve public-investment efficiency and manage the timing of transition expenditure.

The development of competitive non-oil industries and productive employment will be important, but their contribution to fiscal revenue must be evaluated realistically. These adjustments should be pursued while protecting essential public services, household wellbeing and affected workers. The UAE begins from a stronger fiscal-flow position, supported by a more diversified commercial structure and a positive recent government balance. This provides comparatively greater flexibility to absorb some adjustment costs and finance new investment. [9, 10]

4

The economics of renewable power and electrification

Low-cost renewable generation creates an opportunity; reliable delivery and viable end uses determine how much economic value it produces. Gas valuation, financing, networks and demand-side efficiency are central to the comparison.

The economic opportunity for Saudi Arabia and the United Arab Emirates lies not simply in producing renewable electricity at lower cost, but in using competitive, reliable and increasingly low-carbon power to reduce fossil-fuel dependence and strengthen productive economic activity.

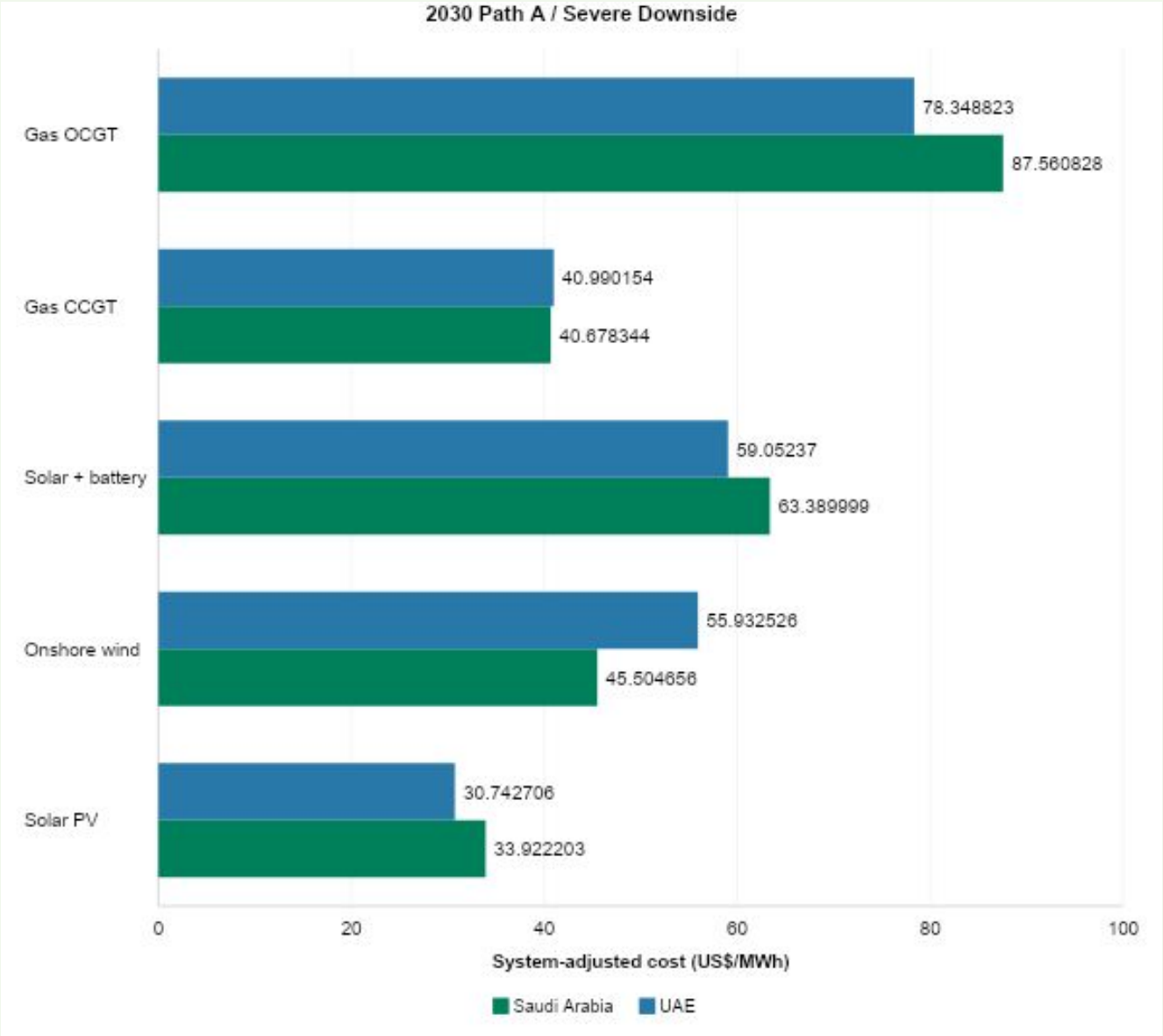
Electricity-system transformation is central to the long-term development prospects of both countries. Affordable and reliable electricity supports industrial production, water desalination, cooling, transport and emerging economic activities. As electricity demand grows and technologies evolve, decisions about generation, networks and energy pricing will increasingly influence national competitiveness and fiscal resilience.

4.1 New-build electricity costs in the selected screen

Solar PV is the lowest-cost new-build option in the selected Path A / 2030 / Severe Downside screen. System-adjusted costs are about US$33.9/MWh in Saudi Arabia and US$30.7/MWh in the UAE, against US$40.7 and US$41.0 for CCGT at administered gas assumptions.

The chart compares generation plus the stated system-service allowances in US$/MWh. It does not establish equal hourly reliability. Open-cycle gas turbines (OCGT) also provide peaking and reserve services that an average energy-cost measure cannot fully value.

Exhibit 4.1 [16, 22, 23, 24].



CCGT: combined-cycle gas turbine. OCGT: open-cycle gas turbine. Solar plus battery costs include the stated storage package and residual-firming allowance. This cost screen is not a full power-system design.

4.2 Gas valuations and opportunity cost

The four gas cases are transparent sensitivity assumptions, not live market quotations. They distinguish a domestic financial price from production cost, long-run marginal cost and the value of a possible alternative use.

Table 4.1 Analytical gas-value assumptions

Gas valuation (US$/MMBtu)	Saudi Arabia	UAE
Administered price	1.75	2.00
Production cost	2.00	3.00
Long-run marginal cost	4.50	5.50
Export-parity proxy	6.00	7.00

For the selected Path A / 2030 / Severe Downside power screen, new combined-cycle gas turbine (CCGT) costs are about US$40.7/MWh in Saudi Arabia and US$41.0/MWh in the UAE at the administered assumptions. Saudi costs rise to about US$58.8/MWh at the long-run marginal assumption and US$68.7/MWh at the export-parity proxy. The equivalent UAE values are about US$64.4 and US$74.5/MWh.

An actual export opportunity cost would use an accessible destination price, less liquefaction or pipeline, transport, shipping, insurance and other delivery costs. The model does not link to European TTF or Asian JKM prices, and it does not establish that all domestically used gas could be exported. The US$6-7 assumptions are fixed proxies, so they may understate the alternative value during high-price periods.

Higher opportunity costs generally strengthen the economic comparison for renewable generation relative to gas, all else equal. The appropriate next step is a transparent netback sensitivity, not silently replacing the base assumptions with a spot price. An economic resource valuation also does not prescribe an immediate increase in consumer tariffs. [16, 22, 23, 24]

4.3 Generation costs and reliable electricity delivery

The levelised cost of electricity (LCOE) spreads generation costs over lifetime output. The study then adds stated system-service allowances, but it does not calculate equal hourly reliability for every technology. [23, 24]

In the selected Path A / 2030 / Severe Downside case, solar PV generation LCOE is about US$28.4/MWh in Saudi Arabia and US$25.7/MWh in the UAE. Grid, balancing and curtailment allowances raise the system-adjusted values to US$33.9 and US$30.7. These are technology-level cost screens, not delivered tariffs for every end user.

The solar-and-battery capital package includes the stated storage assumption, with additional residual-firming and integration allowances. Its system-adjusted costs are about US$63.4/MWh in Saudi Arabia and US$59.1/MWh in the UAE. A storage package and an average firming allowance do not, however, prove a specified availability or loss-of-load standard.

The model also includes grid capital expenditure and delivery premiums in the electrification applications. That answers the review question on whether network costs are ignored: there are explicit allowances. What is absent is a detailed transmission expansion plan, hourly dispatch optimisation and a complete system-adequacy assessment.

Cooling, desalination and industrial demand require dependable service during hours when solar or wind output may be low. Storage, flexible demand, network connections and other system services therefore affect the value of renewable deployment. Their required scale and cost need system-level assessment. [22, 24]
The cost results identify opportunities for renewable electricity and reduced fossil-fuel consumption. They should support better scrutiny of power choices without being presented as proof that technologies provide identical services or that an existing plant should close solely because a new-build LCOE is lower.

4.4 Gas-price thresholds for generation cost parity

A switching threshold is the gas value at which the modelled system-adjusted cost of new CCGT equals the named renewable option. Above that value, the renewable option has the lower screened cost. This is a cost comparison, not a complete substitution or reliability test.

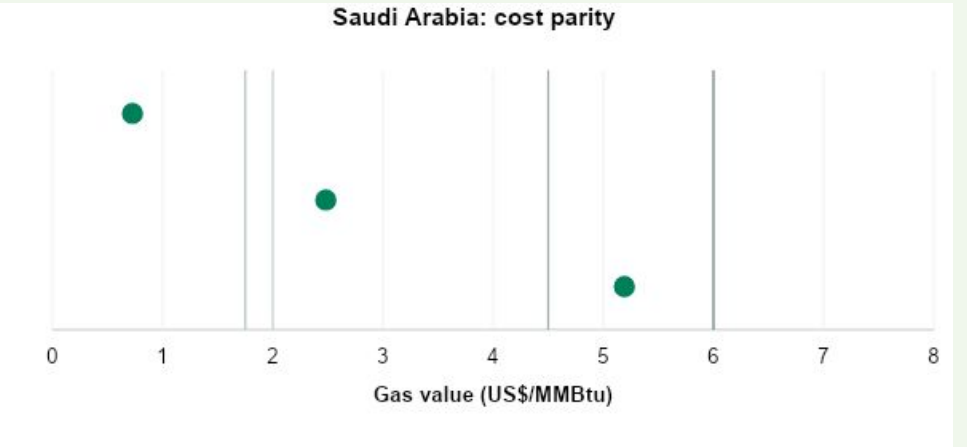
Exhibit 4.2 [16, 23, 24].

Saudi Arabia

Solar PV
0.73

Onshore wind
2.48

Solar + battery
5.19



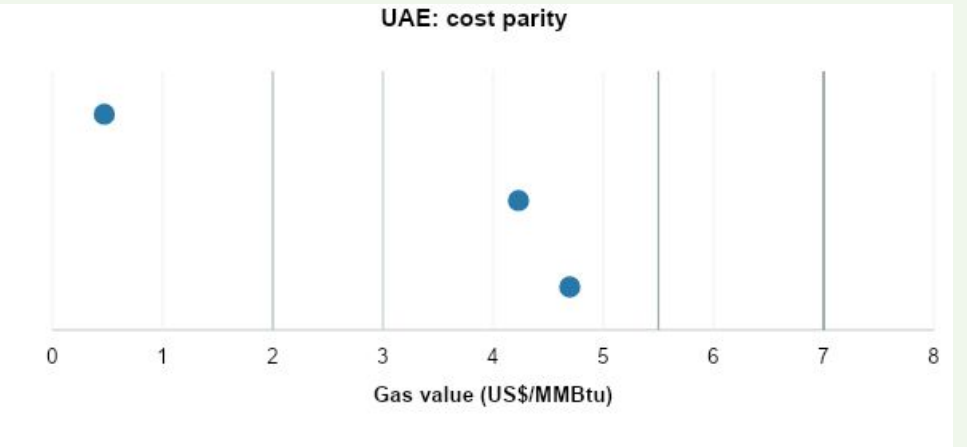
Gas cases: administered 1.75; production 2; LRMC 4.5; export 6

UAE

Solar PV
0.47

Onshore wind
4.23

Solar + battery
4.70



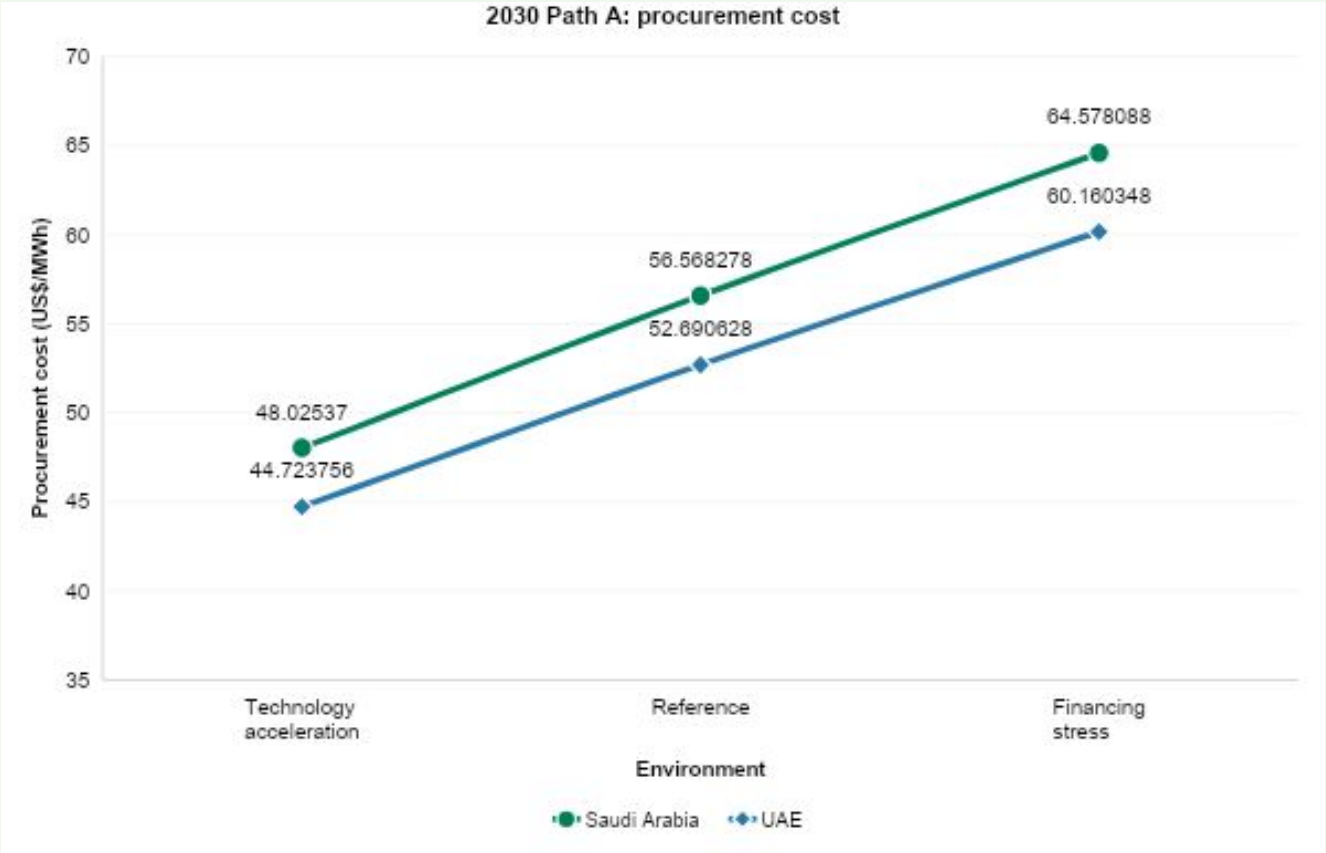
Gas cases: administered 2; production 3; LRMC 5.5; export 7

Path A, 2030, Severe Downside technology and finance assumptions. Horizontal axes: gas value, US$/MMBtu. PV plus battery thresholds are 5.19 (Saudi Arabia) and 4.70 (UAE). LRMC means long-run marginal cost.

4.5 Technology and financing change procurement costs

The vertical axis shows the modelled electricity-procurement cost in US$/MWh for Path A in 2030. The three environments combine financing and technology assumptions; the differences are not an isolated causal estimate of the cost of capital.

Exhibit 4.3 (technology inputs: [16, 23, 24]).



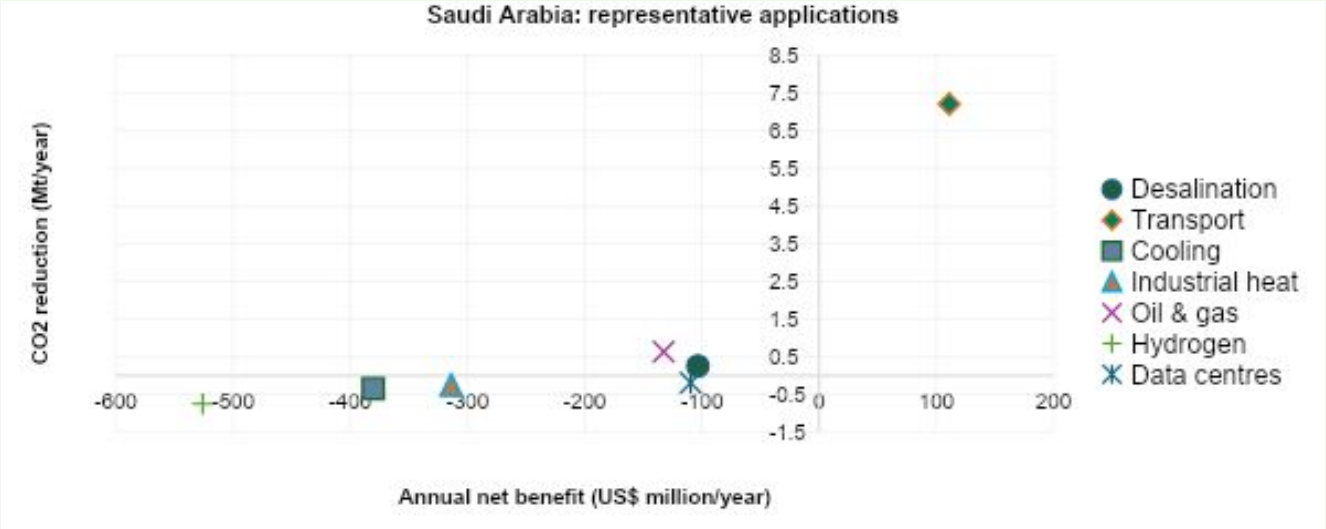
Technology Acceleration / Reference / Financing Stress use power-project weighted average cost of capital (WACC) assumptions of 6.0% / 7.0% / 9.5%. Technology Acceleration lowers renewable and battery CAPEX. Financing Stress raises both by 5%. Delivery assumptions also affect costs.

4.6 Seven representative electrification applications

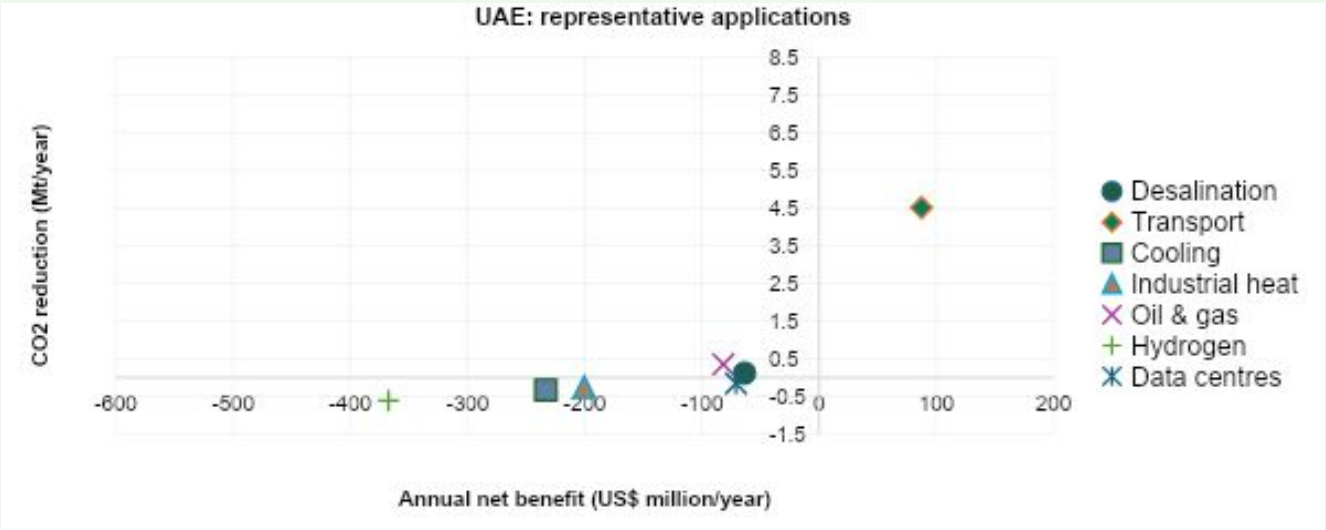
The points compare annual net economic benefit with annual operational CO_2 reduction. The selected case is Path A, 2030, Severe Downside, administered gas, in both countries. Positive values on both axes identify a combined cost and emissions benefit in that screen.

Exhibit 4.4 [16, 23, 24].

Saudi Arabia



UAE



Horizontal axes: annual net benefit, US$ million/year. Vertical axes: annual operational CO_2 reduction, Mt/year. Results use assumed application scales, uptake, annualised equipment and grid CAPEX; they are not national deployment forecasts.

4.7 Transport, desalination and cooling

Transport is the only application with both a positive annual net benefit and lower operational emissions in both countries in the selected Path A / 2030 / Severe Downside screen. Application boundaries explain why this does not extend to every use of electricity.

Transport. The assumed project scales produce annual net benefits of US$111 million for Saudi Arabia and US$87 million for the UAE, with CO_2 reductions of 7.21 and 4.51 million tonnes. Annualised equipment and grid investment are included. The result is a representative service comparison, not a forecast of whole-sector savings or a claim that all vehicle applications are equally attractive.

Desalination. Replacing the representative fuel-based process with an electric alternative reduces operational CO_2 by about 0.25 million tonnes per year in Saudi Arabia and 0.12 in the UAE, while adding about US$103 million and US$64 million in annual screened costs. The result depends on the starting technology, useful-water-service assumptions, investment costs and electricity procurement.

These desalination figures do not establish that reverse osmosis is generally less economic than thermal desalination. Plant scale, water quality, existing assets, system integration and the power supply need a project-specific assessment. The screen identifies a conditional emissions opportunity rather than a universal cost ranking.

Cooling and buildings. The generic comparison is direct fuel switching, not a comprehensive assessment of air-conditioning or building efficiency. It should not be read as evidence against efficient cooling. High-efficiency equipment, passive measures, demand reduction and thermal storage need comparisons based on the actual service provided. [16, 24]

The common implication is to identify the process, scale, electricity source and infrastructure before generalising the result. A technology label alone cannot establish an economic or emissions benefit.

4.8 Industrial heat and other electricity applications

The selected application figures use Path A, 2030, Severe Downside and administered gas. The separate B/C scenarios change electricity procurement and uptake; these should not be mixed with a technology-option result.

Industrial heat. Electric boilers, heat pumps and other equipment have different temperature, utilisation and connection requirements. The strongest opportunities depend on the useful heat service, the existing fuel and reliable renewable electricity. The screen does not establish that every high-temperature process should switch at the same pace or cost. [16]

Retained oil and gas operations. Electrifying the representative pumping, compression and processing services reduces annual operational CO_2 by about 0.63 million tonnes in Saudi Arabia and 0.35 in the UAE, while adding about US$132 million and US$82 million in screened annual costs. Lower operating emissions from existing activity do not establish a case for more fossil-fuel production or continued expansion.

Hydrogen. The application screen treats a representative energy service, whereas Chapter 5 separately considers electrolytic hydrogen as an industrial product. Neither establishes a complete hydrogen-production cost or an offtake market. The source and emissions intensity of electricity remain critical, especially when a mixed grid supply is assumed. [34, 35]

Data centres. Replacing a fuel service and improving electricity efficiency are different interventions. The fuel-switching screen should not be confused with the separate power-usage-effectiveness comparison in Chapter 5. Service demand, cooling, reliability and existing equipment need facility-level assessment.

The screens therefore support selective investigation rather than a blanket recommendation to electrify all processes. Renewable procurement, suitable equipment and connection capacity must be evaluated alongside efficiency, methane-emissions reduction where relevant, and the broader reduction in fossil-fuel dependence.

4.9 Networks, storage and reliable services

Renewable deployment delivers value when generation, networks and electricity uses can develop together. The report focuses on renewable electricity, storage, demand management and efficiency, without recommending nuclear generation.

Both countries need reliable electricity for cooling, water and industrial activity. Solar output can coincide with some daytime cooling demand, but evening and overnight requirements remain. Storage, thermal demand management, flexible loads and grid connections can help address that mismatch; the appropriate combination requires hourly and network analysis. [17, 20, 21, 22, 24]

The model recognises delivery costs through grid and balancing allowances and application-level grid CAPEX. Its Implementation Stress test also reduces achieved renewable deployment, electrification and efficiency relative to the selected pathway assumptions. Those mechanisms are simplified representations, not engineering designs.

In Saudi Path C in 2040, the assumed renewable-generation share falls from 80% in Reference to approximately 59% under the Implementation Stress test. The example illustrates the economic risk of incomplete delivery. It does not predict a specific delay or imply that a nominal capacity target guarantees the expected output.

Saudi Arabia's demand scale and industrial base make connection capacity and procurement arrangements important to the application results. In the UAE, coordination across relevant institutions and delivery areas also affects renewable integration. Neither country's historical electricity mix should be substituted for a facility's future contracted supply. [17, 18, 19, 20, 21]

Lower generation cost will not automatically become a lower end-user cost. Networks, storage, system services and equipment investments remain part of the comparison. The findings therefore identify an economic opportunity for renewable-based electricity while preserving the need to demonstrate reliable and affordable service.

5

Industrial competitiveness in a lower-carbon economy

Cleaner electricity improves operational emissions in several representative processes. Turning that improvement into competitiveness requires complete production economics, reliable procurement, process innovation and access to customers. Lower emissions alone do not establish commercial returns.

Saudi Arabia and the United Arab Emirates possess established industrial capabilities, but maintaining competitiveness in a lower-carbon global economy will increasingly depend on how effectively they combine affordable energy, lower-emissions production, technological capabilities and access to international markets.

Industrial development has been an important component of economic diversification in both countries. Hydrocarbon resources, access to energy and feedstocks, infrastructure investment and government-supported industrial development have helped establish production capabilities in metals, chemicals, construction materials and other energy-intensive activities.

5.1 What the industrial screen measures

The study compares six representative applications across three pathways, three time horizons and seven environments. It calculates electricity and gas/feedstock costs and operational emissions. It does not rank national industries or estimate complete factory costs, profitability, employment or verified product footprints.

The central question is whether the transition can strengthen industrial competitiveness while reducing the dependence of economic development on hydrocarbon production and consumption. This chapter examines six representative industrial applications: primary aluminium, natural-gas-based direct-reduced iron and electric-arc-furnace steel, gas-based ammonia, electrolytic hydrogen, data-centre services and blended cement. The model compares electricity and feedstock costs and operational emissions across three development pathways, three time horizons and seven market and implementation environments. Separate technology-option screens examine selected changes in production processes, efficiency and electricity procurement. [16, 34, 36, 37, 38, 39, 40, 41].

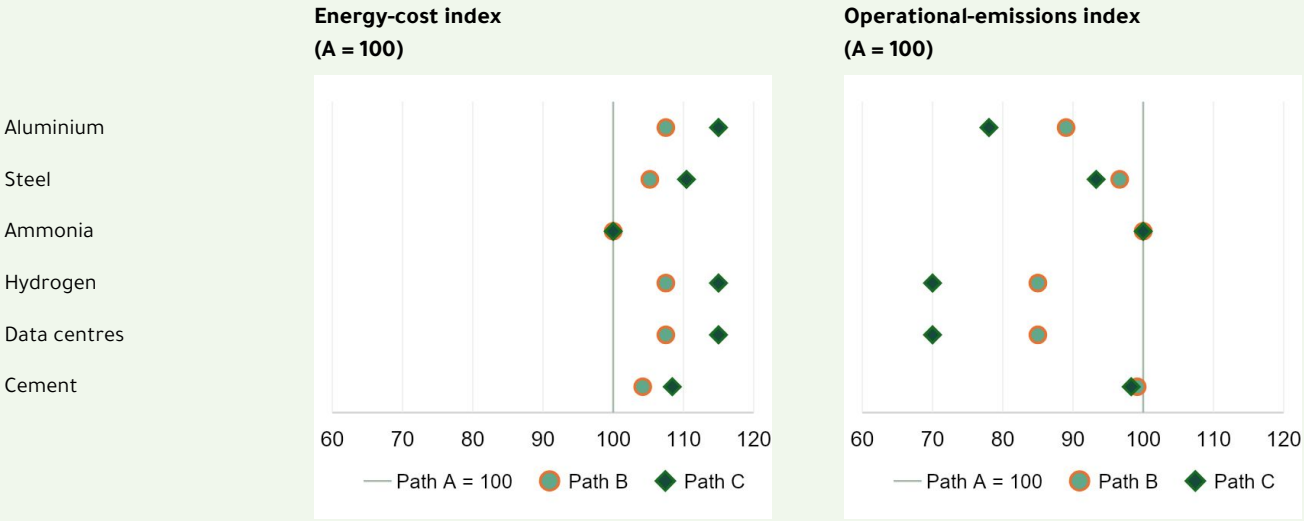
The principal finding is that more renewable electricity can materially reduce the operational emissions of energy-intensive activities, but the economic benefits vary by industry. In several applications, improvements in energy efficiency and production processes may provide more immediately attractive opportunities than electricity substitution alone. Industrial competitiveness must therefore be evaluated through a combination of production economics, verified emissions performance, commercial demand and investment feasibility. The energy transition changes the basis of industrial competitiveness by making energy efficiency, emissions performance and technological capabilities increasingly important alongside conventional production costs.

5.2 Energy costs and emissions under B and C

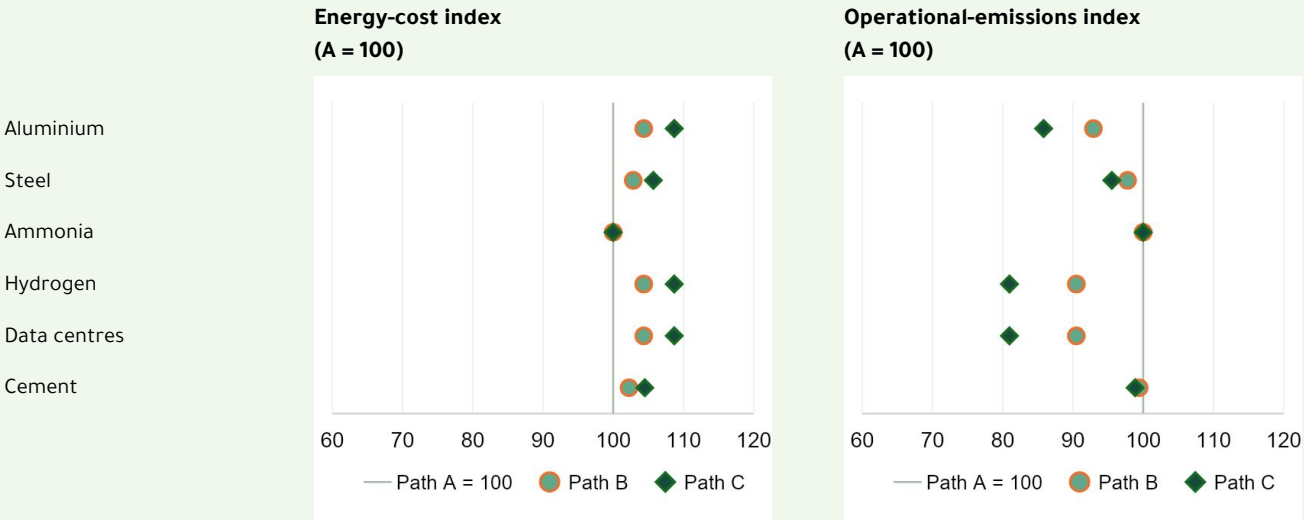
The four panels compare B and C with A for the same application in each country. Every horizontal index uses A = 100. Values above 100 mean higher unit energy cost or emissions; values below 100 mean lower values. The indices have no physical unit and must not be summed.

Exhibit 5.1 [16, 34, 35, 36, 37, 38, 39, 40, 41].

Saudi Arabia



UAE



2030, Severe Downside, administered gas. Circle: B, managed illustrative transition. Diamond: C, faster illustrative transition. A = 100 is the reference line. Five electricity-using applications reduce operational emissions while energy costs rise; gas-based ammonia is unchanged.

5.3 Six industrial applications reveal different trade-offs

The results below retain the selected 2030 Severe Downside / administered-gas comparison. They describe representative unit energy/feedstock costs and operational emissions, not complete product costs or verified investment returns.

Table 5.1 [34, 35, 36, 37, 38, 39, 40, 41].

Application	Saudi Arabia: A → C	UAE: A → C	Interpretation
Aluminium	US$637 → 733/t 5.98 → 4.66 tCO ₂e/t	US$611 → 664/t 6.26 → 5.38 tCO ₂e/t	More renewable electricity lowers operational emissions but increases screened energy cost
NG-DRI/EAF steel	US$45.8 → 50.6/t 0.980 → 0.914 tCO ₂e/t	US$46.5 → 49.1/t 0.994 → 0.950 tCO ₂e/t	Gas reduction remains; a hydrogen option needs genuinely low-carbon power
Gas-based ammonia	US$39.0/t 1.57 tCO ₂e/t, unchanged	US$44.6/t 1.57 tCO ₂e/t, unchanged	28GJ/t gas, no material purchased electricity in the reference process
Electrolytic hydrogen	Operational emissions –30%	Operational emissions –19%	55MWh/t hydrogen. Energy cost rises; full production economics excluded
Data-centre IT services	Operational emissions –30%	Operational emissions –19%	Procurement comparison holds the process constant. Efficiency is a separate option
Blended cement	Operational emissions –1.7%	Operational emissions –1.2%	Lower clinker content and process changes target emissions beyond purchased electricity

5.4 Metals and electricity procurement

The selected 2030 / Severe Downside / administered-gas comparisons distinguish the A-to-C pathway change from a separate renewable-procurement option. Neither is a complete commercial appraisal.

Aluminium uses an assumed 14 MWh of electricity per tonne and a representative direct-emissions component of 1.6 tCO_2e/t. In the A-to-C comparison, operational emissions fall but energy costs rise, as Table 5.1 shows. The calculations use common engineering assumptions rather than verified smelter measurements. [36, 42]
The separate renewable-electricity procurement option is compared with Path A, not with C. It reduces screened operational emissions by about 73% in Saudi Arabia and 74% in the UAE, while increasing energy cost by approximately US$318/t and US$279/t. These are technology-option results, not a replacement label for the pathway comparison.

The option does not establish the cost of fully firm renewable supply or the economics of replacing an existing captive plant. Alumina sourcing, upstream emissions, perfluorocarbons, plant capital costs and product demand are incomplete. A lower operational footprint can therefore be identified without claiming a verified product footprint or investment return.
Gas-based direct-reduced iron and electric-arc-furnace steel retain gas-related emissions even as electricity procurement changes. A hydrogen-reduction option also needs electricity with genuinely low emissions. Under the selected mixed-electricity assumptions, the hydrogen-based option can raise operational emissions rather than reduce them. [37, 43]

The industrial implication is to examine the production route and the electricity contract together. The publication does not infer carbon-border payments or endorse carbon markets from these energy-cost and operational-emissions results.

5.5 Ammonia and hydrogen depend on their energy inputs

The reference ammonia process and electrolytic hydrogen have different energy boundaries. More renewable electricity affects them differently, and neither an electrolytic route nor a hydrogen label establishes low emissions by itself.

Gas-based ammonia. The representative process uses 28 GJ of gas per tonne and no material purchased-electricity input. In the selected 2030 / Severe Downside / administered-gas case, its energy and feedstock cost is about US$39.0/t in Saudi Arabia and US$44.6/t in the UAE under A, B and C. Operational emissions remain about 1.57 tCO_2e/t in both countries. [38]

Changing purchased-electricity procurement therefore leaves this reference ammonia process unchanged. That is a property of the specified process boundary, not evidence that ammonia is unaffected by the wider transition. Feedstock, hydrogen production, process efficiency and fugitive emissions require separate assessment.

Electrolytic hydrogen. The model assumes 55 MWh of electricity per tonne. The A-to-C procurement change lowers operational emissions in the selected industrial screen while increasing energy costs. These costs exclude important full-plant, storage, transport and commercial requirements and should not be presented as a complete levelised hydrogen cost. [34, 35]

The separate alternative-ammonia route illustrates the electricity constraint: Saudi operational emissions reach about 3.22 tCO_2e/t under the selected mixed-procurement assumptions, above the gas-based reference. Electrolysis supplied by carbon-intensive electricity cannot be labelled renewable hydrogen or assumed to deliver a climate benefit.

The publication focuses on renewable electricity, efficiency and transparent process boundaries. Carbon capture is not quantified as a solution or recommended here. Credible hydrogen and ammonia appraisals require verified electricity supply, complete emissions accounting and realistic product demand. [25, 26]

5.6 Cement materials and data-centre efficiency

Two separate process options illustrate opportunities beyond electricity substitution. The figures use the 2030 / Severe Downside / administered-gas setting and compare the option with the Path A reference process, unless an A-to-C result is stated.

Cement. Purchased electricity accounts for only part of its operational emissions. In the A-to-C comparison, Saudi screened energy cost rises from US$8.11/t to US$8.80/t, while emissions fall from about 0.547 to 0.538 tCO_2e/t. UAE energy costs rise from about US$8.43/t to US$8.81/t. Changing electricity alone therefore leaves most process emissions unaddressed. [39, 41]

The separate material-substitution option reduces clinker per tonne of cement from 0.71 to 0.57. It lowers screened operational emissions by about 18.6% in Saudi Arabia and 18.5% in the UAE, and energy costs by about US$0.70/t and US$0.80/t. Clinker is the energy-intensive intermediate whose production also releases process CO_2; lowering its share targets both energy use and process emissions.

The 0.57 clinker ratio is an illustrative alternative, not a validated target for each plant. The screen excludes the cost and availability of substitute materials, product performance, certification, grinding and blending changes, and implementation CAPEX. The reported energy saving is not a full production-cost saving.

Data centres. Power usage effectiveness (PUE) measures total facility electricity relative to IT electricity. Improving PUE from 1.4 to 1.2 reduces electricity per unit of IT service by 14.3%. At unchanged procurement, the screen gives the same proportional reduction in energy cost and operational emissions. It does not imply a 14.3% reduction in service demand or complete facility expenditure. [40]

These options show why process design and material and energy productivity matter alongside renewable procurement. Neither the cement result nor the data-centre calculation relies on an assumed carbon-capture or offset benefit.

5.7 Country opportunities and industrial boundaries

Saudi Arabia and the UAE can investigate different industrial opportunities while applying the same requirements for verified energy costs, emissions and commercial feasibility. The model does not rank national industrial competitiveness.

Saudi Arabia. Its existing industrial base and domestic market provide a context for renewable electricity procurement, efficient equipment and process changes. The selected A-to-C screen also shows higher energy costs in several electricity-using applications. Industrial scale does not remove the need to assess the price, reliability and emissions of delivered electricity.

The UAE. Commercial networks, logistics and established industrial activities provide a different starting point. Re-exports and aggregate FDI do not establish domestic technological value added or an absence of fossil exposure. Facility-level procurement and process data remain necessary before inferring an industrial advantage from the national electricity mix. [3, 4, 14]

For both countries, aluminium and hydrogen are sensitive to electricity procurement, gas-based steel retains feedstock-related emissions, and cement needs process and material changes beyond purchased power. The gas-based ammonia reference remains unchanged by procurement alone. These differences support application-specific analysis rather than a common industrial-cost claim. [16, 34, 36, 37, 38, 39, 40]
The calculations identify energy and operational-emissions effects under stated scenarios. They omit parts of capital cost, labour, raw materials, product demand, upstream emissions and other commercial drivers. The report therefore does not translate an emissions reduction into an automatic competitiveness, employment or investment-return conclusion.

The economic findings stand independently of an endorsement of a particular trade mechanism or national programme. They identify where energy procurement and process changes merit closer examination while preserving the need for complete commercial and environmental evidence.

6

Climate justice and differentiated transition pathways

Economic resilience, climate responsibility and social justice are separate requirements. Country differences shape implementation and financing, but cannot substitute for a credible direction away from fossil-fuel dependence or for verified protection of affected people.

A credible transition away from fossil fuels must be economically viable, environmentally effective and socially just. For Saudi Arabia and the United Arab Emirates, the challenge is to reconcile differentiated national circumstances with shared responsibilities to reduce emissions, protect affected populations and safeguard the wellbeing of future generations.

The preceding chapters demonstrate that Saudi Arabia and the UAE possess substantial financial, energy and institutional capabilities to support economic transformation. However, their reliance on hydrocarbons, fiscal positions and readiness for structural adjustment differ.

These differences are important when determining how the transition should be designed, financed and implemented.

6.1 What a just transition requires

A just transition reduces fossil-fuel dependence while protecting rights, livelihoods, communities and the environment. It concerns who bears adjustment costs, who benefits and who can influence decisions, as well as the energy mix. [31, 32, 44]

The distinction matters because economic feasibility does not establish social justice. A pathway can improve an annual fiscal balance while still placing burdens on workers or households, excluding affected communities from decisions or leaving environmental damage unaddressed.
The support allocations in B and C are additional worker and household spending allowances expressed as shares of GDP. They are included in the fiscal arithmetic, but are not costed protection plans. The model does not identify all eligible populations, income losses, programme coverage or the adequacy of transfers and services.
Worker protection needs to include relevant indirect, migrant and contract workers, not only direct employment in extraction. Household affordability involves access to essential energy and water, income security and the actual incidence of any change in prices. Those outcomes cannot be inferred from aggregate GDP or sovereign assets. [32]

The chapter applies responsibility, capacity, dependence and implementation capability as separate analytical lenses. It then examines intergenerational equity, participation and seven safeguards. It does not combine them into a numerical certificate of justice or assign an equitable phase-out date.
This framework remains necessary even where data are incomplete. Reporting the missing evidence prevents an illustrative economic scenario from being presented as a just transition already demonstrated. Country circumstances can shape financing and implementation without becoming a justification for indefinite expansion. [30]

6.2 CBDR-RC in the Gulf context

CBDR-RC recognises shared climate responsibilities alongside differences in historical emissions, capabilities and national circumstances. The study uses responsibility, capacity, dependence and implementation capability as separate lenses. It does not combine them into a single justice ranking or equate broader equity expectations with identical treaty-based finance obligations.

CBDR-RC recognises that countries share responsibility for addressing climate change, but their contributions should reflect differences in historical emissions, capabilities and national circumstances. The principle of Common but Differentiated Responsibilities and Respective Capabilities is a foundational element of the international climate framework. Article 2.2 of the Paris Agreement establishes that implementation should reflect equity and CBDR-RC in light of different national circumstances. Article 4 further recognises that developed-country Parties should continue taking the lead in emissions reduction efforts, while developing-country Parties should progressively strengthen mitigation action according to their circumstances. [30]

The principle therefore combines a shared global objective with differentiated responsibilities and implementation conditions. Its application to Saudi Arabia and the UAE requires careful consideration. Both countries are hydrocarbon producers with substantial financial capabilities, high levels of per-capita territorial emissions and significant opportunities to deploy renewable energy and support economic diversification. At the same time, hydrocarbons play different roles in their fiscal systems, external trade and domestic economic activity. Saudi Arabia faces greater dependence on hydrocarbon revenues and exports, while the UAE has a comparatively diversified commercial structure and stronger recent fiscal-flow indicators. [32, 44, 45]

These differences affect the practical conditions under which a transition can be financed and implemented. However, differentiation should not be interpreted as an exemption from emissions reduction or as an automatic justification for continued fossil-fuel expansion.

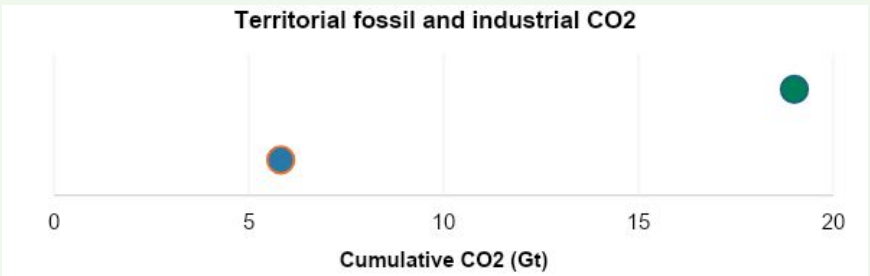
6.3 Historical totals and annual emissions per person

The two panels use territorial fossil and industrial CO_2 with explicit units. Cumulative emissions through 2024 are about 19.0 $GtCO_2$ for Saudi Arabia and 5.82 $GtCO_2$ for the UAE; annual 2024 values are 20.38 and 20.13 tonnes per person. [46, 47, 48, 49]

The larger Saudi historical total and the similar recent per-capita values answer different questions. Neither includes all greenhouse gases, the combustion of exported fuels or a national fair-share allocation. A global cumulative ranking cannot be inferred from a two-country dataset or substituted from a different all-GHG/land-use series. [30]

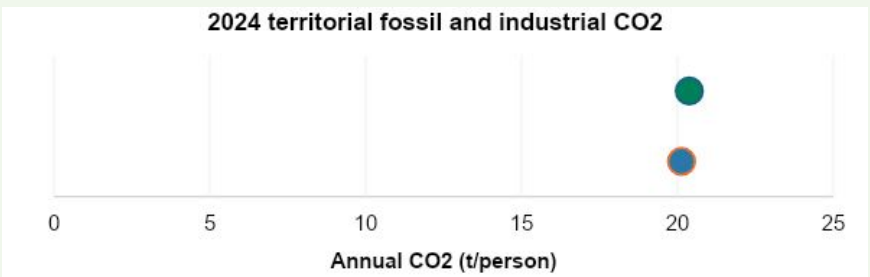
Exhibit 6.1

Cumulative emissions through 2024 ($GtCO_2$)



Saudi Arabia 19.00 $GtCO_2$; UAE 5.82 $GtCO_2$

Annual emissions per person, 2024 (tCO_2/person)



Saudi Arabia 20.38; UAE 20.13 tCO_2/person

Cumulative territorial fossil/industrial CO_2 and annual territorial CO_2 per person are distinct measures. They inform responsibility, but do not independently determine an equitable extraction phase-out date.

6.4 Financial and institutional capacity

Capacity concerns usable resources and the ability to deliver protection and change. National income and sovereign wealth inform the discussion, but neither establishes a country's fair share or an equitable production schedule.

The fiscal calibration uses nominal 2025 GDP of about US$1.27 trillion for Saudi Arabia and US$569 billion for the UAE. The former is reported and the latter an estimate in the supplied calibration. Economic scale is relevant, but total GDP does not measure the funds available to affected people. [1, 2]
The assumed financing envelopes are US$950 billion and US$1,200 billion. They are deliberately selected sensitivity inputs, not published estimates of audited liquid government funds. Their purpose is to test financing mechanics. They are not used to infer that either government could readily deploy the whole amount for transition or social protection.

Ownership, liquidity, existing commitments and the ability of public institutions to access resources matter. Overseas assets also need to be classified by their underlying exposure: fossil-related assets do not cease to be fossil-related because they are outside the country. The model does not provide a sectoral inventory of those portfolios. [11, 12]

The baseline includes published institutional and human-capital indicators and separate analyst assessments of delivery capability. Those assessments are not observed measures of participation, safeguards or programme effectiveness. Strong financing access can coexist with gaps in social protection or accountability. [27, 28, 29]
The resulting conclusion is limited but useful: both countries possess substantial capabilities to act, with different fiscal starting points. A credible justice assessment must show how those capabilities support emissions reductions and affected populations, rather than equating the size of financial assets with a verified equitable outcome. [30, 32]

6.5 Dependence shapes adjustment, not an exemption

Hydrocarbon dependence identifies where adjustment can threaten public income, livelihoods and services. It should shape transition support and the development of alternatives, rather than provide an automatic justification for further expansion.

The supplied fiscal and trade baselines show greater Saudi exposure to hydrocarbon public revenue and merchandise exports. The UAE's trading structure is more diversified, but re-exports and aggregate inward FDI do not establish a smaller physical fossil footprint or a non-fossil overseas portfolio. [1, 2, 3, 4]

The workbook's oil-and-gas energy-use inputs are about 7.96 tonnes of oil equivalent per person for Saudi Arabia and 9.65 for the UAE in 2024. These reflect population, climate, industrial structure and economic activity. They are not standalone measures of energy efficiency or verified justice performance. [7, 50]

GDP activity shares in the baseline use different years and classification boundaries. They are not used here to rank physical dependence or reconcile the separate non-oil GDP series. Dependence has to be assessed through the specific revenue, employment, consumption or production channel at risk.

Diversification alone is therefore insufficient if fossil-fuel production, consumption or portfolio exposure continues to grow. Alternative public revenues and productive activities need to develop alongside a credible reduction in fossil dependence, with the adjustment costs addressed explicitly. [30, 31, 32]

The model does not identify a fair national phase-out speed from these indicators. It does show why the sources of vulnerability and the means of protecting affected people need to be considered together. Preserving the vulnerability indefinitely is not the same as managing a just transition.

6.6 Workers, households and support adequacy

The fiscal model includes support allowances but does not estimate the full distributional consequences of transition. Their presence is not evidence that workers or households receive adequate protection.

In the 2030 Reference case, B includes an additional annual worker and household allowance equal to 0.3% of GDP, while C includes 0.6%, for each country. Other stress cases can modify those costs. They are analyst-selected budget assumptions, not observations, legal commitments or bottom-up estimates of the number of people affected.

Worker protection requires information on occupations, employment status, wages, geographic concentration and links to contracting and local services. Relevant migrant, contract and indirect workers must be considered. Income security, rights, job-placement support and recognition of existing skills matter alongside retraining. [32, 44]

The model does not estimate net national employment gains or losses. It therefore cannot conclude that the scenarios automatically create more jobs, that displaced workers can enter new industries, or that the support percentages are sufficient to meet their needs.

Household protection requires income-group energy and water expenditure, access to essential services and the actual effect of any price or employment change. The study has no household-incidence model and does not establish that a particular tariff reform or compensation mechanism is adequate. [32]

The economic comparison is still informative, but the justice conclusion must remain separate: costed programmes, coverage, participation and verified delivery are required before the social outcome of a pathway can be judged. Those requirements apply in both countries and cannot be traded away for a higher fiscal score. [30, 32]

6.7 Intergenerational justice and financial stocks

The study's financial measure is (assumed financing assets minus modelled public debt) divided by GDP. It captures one part of the legacy to future generations, not total national wealth or the complete costs of fossil-fuel dependence.

At the 2025 calibration, that measure is about +42.8% of GDP for Saudi Arabia and +176.4% for the UAE. In the 2040 Reference comparison, Saudi values are –124.9% under A and –123.5% under C; UAE values are +142.5% and +144.5%. These are A/C model results for the same horizon and environment.

The relatively small 2040 stock difference is consistent with C's better annual balance. Past deficits, debt-service costs and asset drawdowns remain in the accumulated stock. A stronger flow in one year does not erase earlier financing requirements.

By 2050, the Reference comparison is more pronounced. Saudi net financial positions are approximately –309% of GDP for A and –241% for C. UAE positions are about +117% and +190%. The extreme Saudi figures are mechanical sensitivities rather than forecasts of sovereign insolvency.

The measure excludes infrastructure, human capital, resource reserves, many environmental liabilities and the distribution of future opportunities. Higher financial assets cannot compensate automatically for irreversible environmental damage, unequal adjustment costs or failures of participation and rights.

Intergenerational justice therefore requires more than preserving a balance-sheet ratio. It concerns whether finite hydrocarbon income becomes lasting productive capabilities and public services while environmental and social burdens are reduced, rather than transferred to future populations. [30, 32]

6.8 Participation and safeguards need independent evidence

All seven safeguard outcomes remain unassessed for both countries. This denotes insufficient evidence, not seven findings of failure. Economic or policy scores cannot compensate for missing rights, affordability or environmental protections.

Table 6.1 [30, 32, 44]

Safeguard	Evidence needed; outcomes currently unassessed
1. Climate alignment	Complete national greenhouse-gas pathways, cumulative emissions and a justified fair-share framework
2. Workers and livelihoods	Verified affected occupations, worker rights, income protection, retraining and redeployment, including migrant and contract workers
3. Household affordability	Income-group energy expenditure, access to essential services, compensation design and actual coverage
4. Participation and remedies	Meaningful participation by affected groups, access to relevant information and effective grievance arrangements
5. Environmental integrity	Environmental and biodiversity impact assessment, responsible supply chains, resource protection and remediation
6. Costed and funded support	Eligible populations, programme costs, funding sources, coverage and delivery verification
7. Differentiated cooperation	Transparent treatment of responsibility, capacity, technology cooperation and international support

6.9 Differentiated sequencing and its evidence limits

Country differences inform how change can be financed and delivered, but do not establish a different standard of climate ambition or social protection. No exact equitable phase-out date is derived from this model.

Saudi Arabia's greater fiscal and export concentration makes the timing of alternative public income and transition expenditure especially important to the economic comparison. The UAE has different commercial and fiscal capabilities, but still needs to reduce fossil exposure in production, domestic use and relevant investment portfolios. [1, 2]

The illustrative production reductions are explicit. B reduces the 2025-linked volume index by 4%, 20% and 40% in Saudi Arabia at 2030, 2040 and 2050, and by 6%, 25% and 50% in the UAE. C uses reductions of 10%, 40% and 70% for Saudi Arabia and 15%, 50% and 80% for the UAE.
The faster UAE decline is an author-selected scenario assumption. It is not a verified requirement of CBDR-RC. Nor is the Saudi schedule evidence that the remaining production would be consistent with a national fair share or the Paris Agreement. [30, 33]
Differentiation can affect support, sequencing and implementation arrangements, but it cannot substitute for the global climate constraint or the rights of affected populations. The seven safeguards remain unassessed, not failed or achieved, in both countries. [31, 32, 44]

The next page distinguishes this economic exercise from an equity-based extraction pathway. Retaining that distinction is more useful than removing the justice discussion: it states clearly what the research contributes and what it cannot establish.

6.10 Climate ambition requires a separate assessment

None of the pathways has been assessed against a complete national greenhouse-gas budget, an explicit fair-share allocation, national climate commitments or a 1.5°C-consistent extraction pathway.

The Civil Society Equity Review offers an external, fuel-specific framework that illustrates why the economic scenario labels cannot define adequate ambition. Its reported phase-out years are Saudi oil 2041 and gas 2034, and UAE oil 2033 and gas 2032. These are that publication's results, not adopted Greenpeace national targets or outputs from this study. [33]

That framework and this model have different baselines and boundaries. The present combined production-linked revenue index starts in 2025 and does not separately specify physical oil and gas extraction. A direct percentage-point comparison or a claim that C satisfies the external framework would therefore be misleading.

A valid assessment would need separate extraction and consumption paths, full greenhouse-gas accounting, cumulative budgets, transparent equity choices and the costs of transition and support. It would also need to test fiscal responses under the steeper trajectories, rather than assume that the current ranking carries over. [30, 32, 33]

The economic conclusion remains relevant within its tested scope: expansion is not consistently the stronger fiscal choice, and a faster illustrative package can improve later annual balances. It is not evidence of an optimal decline rate or proof that every more ambitious pathway has the same economic outcome.

This report therefore supports scrutiny of the economic case for expansion while preserving the independent requirement for a fast, fair fossil-fuel phase-out. It does not use unassessed climate or justice outcomes as a basis for endorsing the modelled production schedules. [31]

Conclusion

Expansion is not a robust fiscal strategy

In the conditions tested, continued fossil-fuel expansion does not consistently provide the strongest long-term annual fiscal outcome. The results challenge the claim that more expansion is necessary to finance economic transformation.

The near-term comparison is different from the longer-term one. A has the stronger 2030 annual balance in all seven environments in both countries. By 2040, C exceeds A in six of seven, including Reference and the downside tests. High-Price Upside retains a small A advantage. Those environments have no probability weights, so the count must not be presented as a quantified likelihood.

The stronger later balance is an outcome of the whole assumed package. More non-hydrocarbon public income and restrained expenditure offset lower fossil receipts. Existing hydrocarbon revenues may contribute to transformation, but that does not demonstrate that additional production capacity is the best use of capital. Project-specific costs and risk-adjusted investment returns are outside the model.

Power and industrial screens identify renewable generation, selective electrification and process efficiency opportunities. Their cost and emissions benefits vary by application and boundary. Reliable electricity delivery, verified procurement and complete commercial appraisal remain necessary before an investment decision.

The 2026 conflict and overseas investment exposures also require explicit treatment in any updated decision analysis. The study's market and delivery tests cover selected channels, but do not include all reconstruction, bypass-infrastructure, shipping or portfolio effects.

The economic argument is consequently clear without overstating it: expansion is not a robust default for long-term fiscal resilience in these tests. Alternative public income and productive transformation deserve assessment on their own terms, alongside a credible reduction in fossil-fuel dependence.

Resilience must meet climate and justice requirements

A planned reduction in fossil dependence can support a stronger development strategy within the tested assumptions. Whether a real transition is climate-aligned and just requires evidence beyond the economic model.

Saudi Arabia and the UAE share the need to build durable income, productive capabilities and public services beyond fossil fuels, but they enter the comparison with different fiscal and commercial structures. Those differences influence financing and delivery; they do not establish an exemption from phase-out or an equitable national production schedule.

Conclusion

The neutral pathway labels preserve that boundary. B and C are illustrative combinations of assumptions. They have not been validated against national fair shares, complete greenhouse-gas budgets or the requirements of 1.5°C. The model also does not establish that its fiscal findings would remain unchanged under a steeper untested trajectory.

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Justice requires protection for workers and households, meaningful participation, accessible remedies and environmental integrity. Additional budget allowances do not demonstrate that support is sufficient or reaches the people affected. All seven safeguard outcomes remain unassessed in both countries.

The report's contribution is an economic test of expansion claims, with explicit limits. It identifies where transition packages can offer stronger later fiscal balances and where renewable electricity or efficiency can improve a representative application. The economic comparison does not prescribe detailed national programmes.

The final decision is therefore broader than a comparison of annual receipts. Hydrocarbon wealth must be assessed against the alternatives for creating lasting prosperity, while climate ambition and the rights and wellbeing of present and future populations remain requirements in their own right.

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