THE FIBRE IS THE FOSSIL

How abandoned wells, petrochemical giants and the clothes in our wardrobes are bound by a single molecule

THE MOLECULE THAT NEVER DIES

A methane molecule escapes from a rusting wellbore in Crane County, Texas. It rises through cracked cement, slips into a pocket of over-pressurised shale, and finds its way into the open air. It is invisible, odourless, and 80 times more potent than CO_2 over a 20-year period. It drifts across mesquite scrubland, over cattle fences, over the remnants of Gulf Oil's mid-century boom.

Another molecule from the same field takes a different path. It is captured, compressed, and pushed through a gathering line into a petrochemical complex on the Gulf Coast. There, in the furnaces of Chevron Phillips Chemical (CPChem), it is cracked into ethylene, polymerised into PET, spun into polyester, woven into fabric, dyed, cut, sewn, shipped, and sold for £12.99 on a high street thousands of miles away.

The well and the wardrobe are not separate stories. They are two ends of the same industrial continuum — extraction at one end, fabrication at the other. The molecule never disappears. It simply changes form.

This feature traces that journey: from the North Sea's £44 billion decommissioning bill to Texas's "zombie wells," from Chevron's inherited liabilities to the petrochemical furnaces that feed the global synthetic-fibre economy. It is a story about what happens when the end of extraction is treated as an afterthought — and how the costs of the fossil-fuel era reappear in the most familiar objects we own.

THE GEOGRAPHY OF ABANDONMENT

The UK North Sea — A Mature Basin with an Immature Ending

More than 44 billion barrels of oil equivalent have been extracted from the UK Continental Shelf since the 1970s. The rigs that once symbolised national energy independence now stand as ageing monuments to a fading era.

Operators spent a record £2.4 billion on decommissioning in 2024. The remaining cost is estimated at £44 billion.

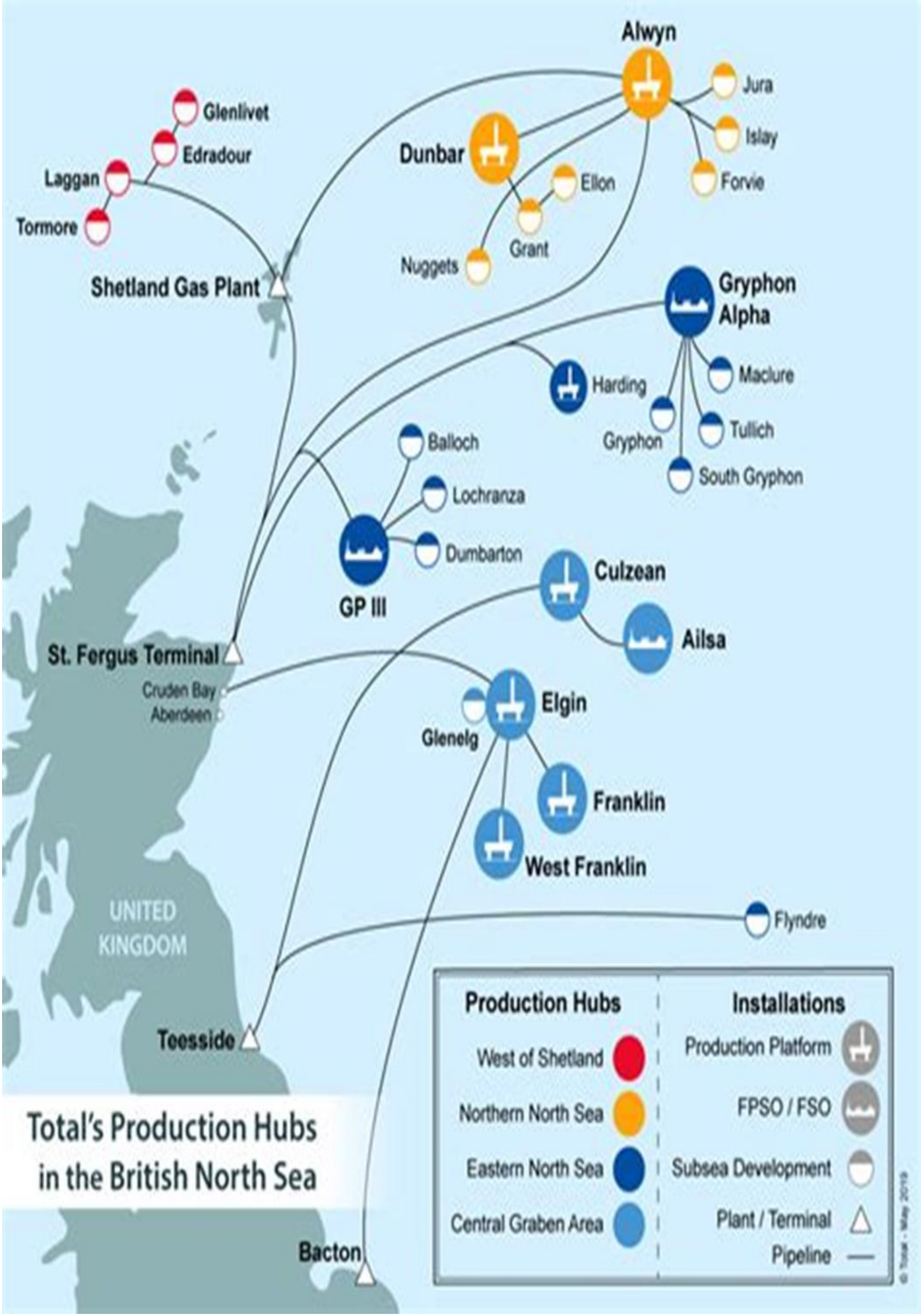
The Petroleum Act 1998 was designed to prevent the UK from inheriting a North Sea graveyard. It requires operators to submit detailed decommissioning programmes, demonstrate financial capability, and — crucially — allows the government to pursue former owners through Section 29 notices. In theory, liability is joint, several, and inescapable.

But the system contains a quiet contradiction: decommissioning costs are tax-deductible. For every pound spent on cleanup, the Treasury reimburses 40–60 pence. The National Audit Office has repeatedly warned that HM Treasury lacks full visibility into the long-term fiscal implications.

The result is a paradox: the UK has one of the strongest legal frameworks in the world — and yet the public still pays billions.

UK NORTH SEA INSTALLATIONS

A schematic map of UK North Sea production hubs, pipelines and terminals.



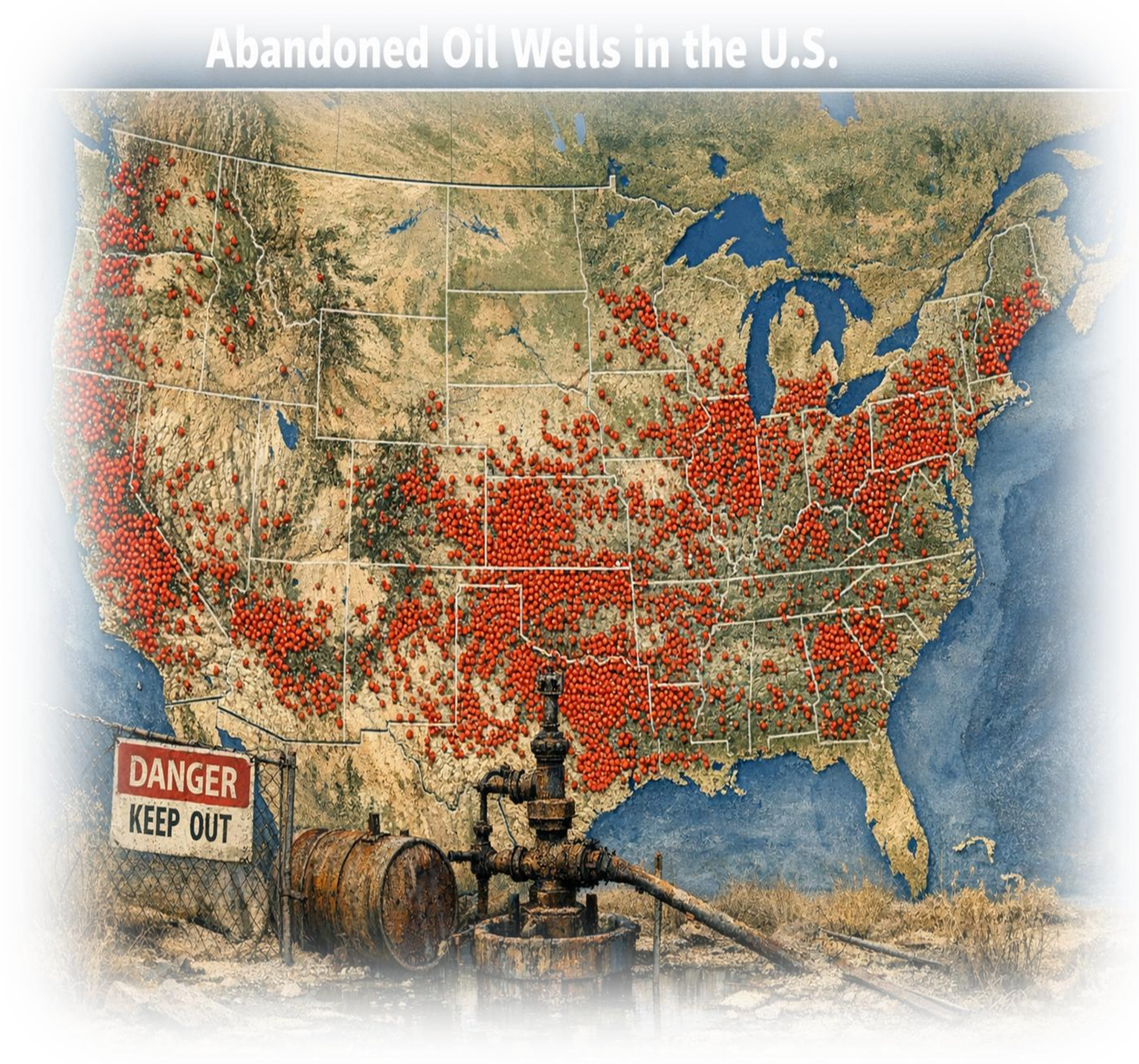
THE U.S. — A PATCHWORK WITH SYSTEMIC HOLES

The United States has no unified national framework for onshore well decommissioning. Instead, it operates under a patchwork of state laws, federal rules, and historical exemptions. Bonding requirements — the financial guarantees meant to ensure cleanup — are chronically insufficient.

Many states allow operators to post blanket bonds that cover hundreds of wells at a fraction of their true cost. A company can drill 200 wells and secure them with a bond worth less than the cost of plugging a single one.

When operators dissolve, go bankrupt, or simply disappear, wells become orphaned. The state inherits the bill.

The U.S. has over **2.6 million known abandoned wells**. Plugging them is estimated to cost **$280 billion**.
The Bipartisan Infrastructure Law allocated $4.7 billion — barely enough to address 2% of the problem.

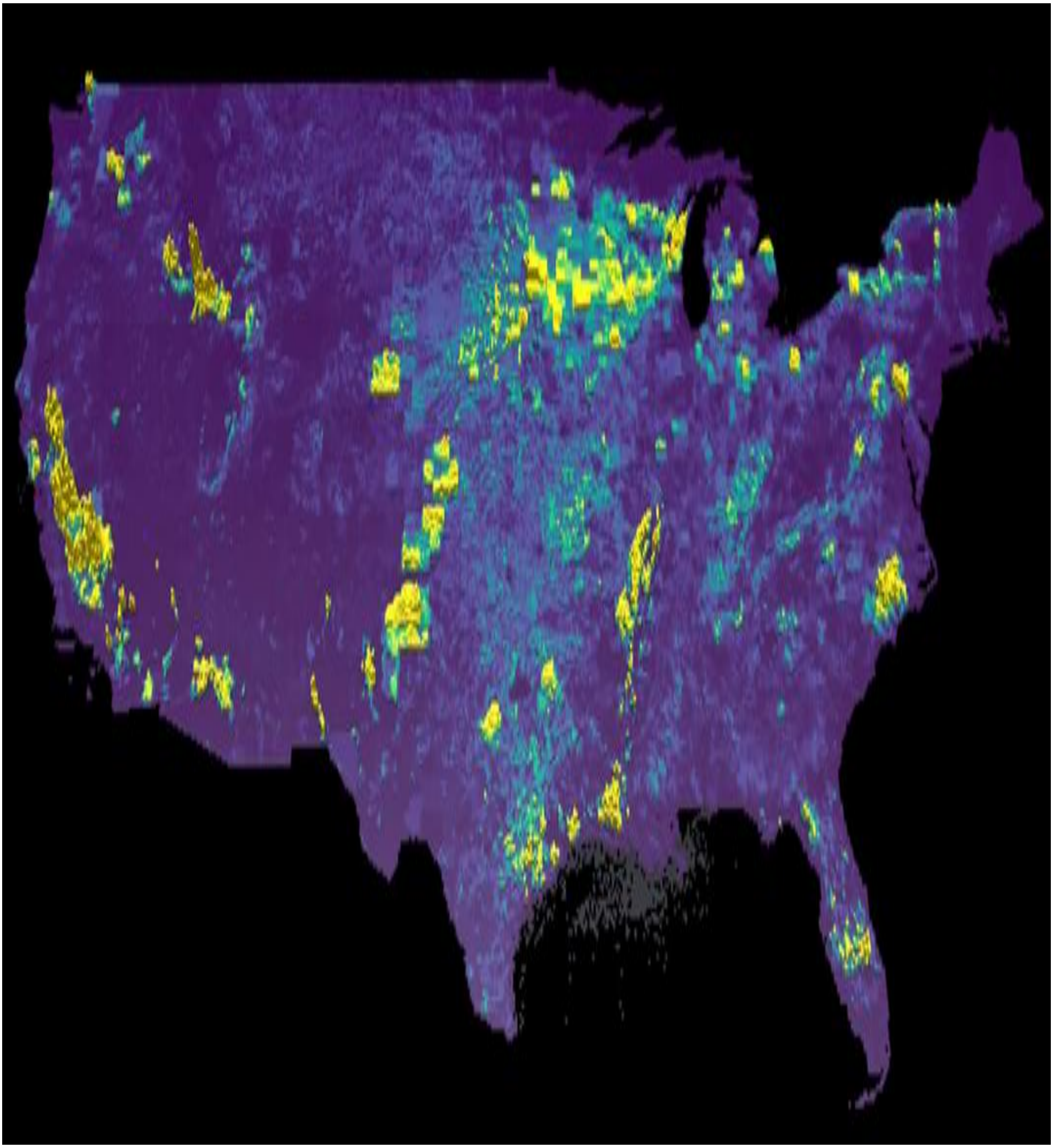


Environmental Fallout

Abandoned wells leak methane, benzene, radium, arsenic, and saline wastewater. They contaminate aquifers, kill vegetation, and create explosive hazards in basements and fields. In some communities, methane seeps through soil and accumulates in homes.

METHANE PLUME OVERLAY

A schematic of methane hotspots across the United States.



TEXAS — WHERE THE SYSTEM FULLY BREAKS

Texas is the epicentre of the orphan-well crisis. Wells drilled in the 1940s and 50s have been sold repeatedly to thinly capitalised operators. Many now leak methane or erupt geysers of toxic water.

Some wells have erupted geysers over 100 feet high.
In West Texas, residents have faced benzene contamination in drinking water linked to historic oilfield activity. Along the Gulf Coast, legacy pipelines and storage sites have required federal intervention.

The Texas Railroad Commission oversees the system, but chronic under-bonding ensures taxpayers absorb the difference. The state's orphan-well programme is perpetually underfunded relative to the scale of the problem.

CORPORATE LIABILITY ACROSS DECADES—
CHEVRON'S INHERITED WELLS

Chevron's acquisition of Gulf Oil in 1984 came with thousands of legacy wells. Many now fail due to fracking-related pressure changes.

The Antina Ranch case revealed the scale of the problem: rancher Ashley Watt alleged that Gulf Oil failed to properly plug hundreds of wells on her family's 22,000-acre ranch. Some leaked toxic wastewater. Others erupted violently. Chevron denied a field-wide blowout but admitted to re-plugging several wells. The case settled before trial.

Every major oil company carries inherited liabilities from mergers, acquisitions, and decades of drilling under weaker regulatory regimes.

The wells may be old.
The liability is not.

THE GLOBAL GEOGRAPHY OF ABANDONMENT

The crisis is not confined to the UK or the United States.
Across the world, millions of wells drilled under earlier eras of expansion now sit unplugged, undocumented, or entirely forgotten.

Canada's western provinces hold more than 170,000 inactive and orphaned wells. China's state-owned fields contain thousands of legacy wells drilled before modern cementing standards. Russia's Siberian basins are pocked with abandoned infrastructure from Soviet-era exploration. In Nigeria, Angola and Venezuela, wells drilled by international majors have been left to corrode as political and economic conditions shifted.

No global registry exists.
No international body tracks the true number.
But the International Energy Agency estimates that **millions** of wells worldwide are improperly plugged or not plugged at all. The molecule does not respect borders.

Abandoned Oil Wells Worldwide

MODELLING THE COST OF ABANDONMENT

The financial burden of decommissioning is often described in abstract terms — billions here, billions there — but the underlying mechanics are simple. Every well, platform or pipeline carries an expected end-of-life cost, and that cost must ultimately be paid by someone: the operator, the taxpayer or, in many cases, both. A basic model makes the structure visible.

Let (N) be the number of assets requiring cleanup and let (C_i) be the expected cost of decommissioning asset (i). The total cost of abandonment is therefore:

$$C_{total} = \sum_{i=1}^{N} C_i$$

In reality, cleanup rarely happens immediately. Costs escalate over time due to inflation, rig rates and labour shortages, while governments discount future liabilities. If (g) is the real cost-escalation rate and (r) the real discount rate, the present value of decommissioning asset (i) in year (T_i) becomes:

$$\mathrm{PV}C_i = \frac{C_{i,0} \cdot (1+g)^{Ti}}{(1+r)^{Ti}}$$

The question is not only what the cleanup costs, but who pays. Let (α_i) be the operator's share and (β_i) the public share, with $(\alpha_i + \beta_i = 1)$. The distribution of liability is then:

$$C_{operator} = \sum_{i=1}^{N} \alpha_i \cdot PV(C_i)$$

$$C_{public} = \sum_{i=1}^{N} \beta_i \cdot PV(C_i)$$

This simple structure reveals the political economy of abandonment: change the liability fractions, and the burden shifts dramatically. Applied to real jurisdictions, the asymmetries become stark.

In the UK North Sea, a £44 billion decommissioning horizon interacts with a tax-relief system that reimburses operators for a large share of their cleanup spending. With effective relief rates between 40% and 60%, the Treasury's exposure sits between £18 billion and £26 billion. Operators pay upfront, but the state refunds them through the tax code, turning decommissioning into a long-tail public liability. What appears as private responsibility in statute becomes, in practice, a fiscal obligation spread across decades.

Texas operates at the opposite end of the regulatory spectrum, yet the outcome is similar. Chronic under-bonding means that when operators fail, the state inherits the cost. A conservative scenario — 100,000 at-risk wells, a 25% probability of orphaning and a $70,000 shortfall between true plugging cost and bond coverage — produces an expected public burden of roughly $1.75 billion. The Texas Railroad Commission oversees the system, but the mathematics of under-secured wells ensures that taxpayers absorb the difference whenever a company disappears.

Chevron's legacy wells in Texas illustrate how corporate history becomes a modern liability. Thousands of wells drilled by Gulf Oil in the mid-20th century now sit in landscapes destabilised by fracking-related pressure changes. Even a modest model — 10,000 legacy wells, a 30% failure probability and Chevron held liable in half those cases — yields an expected cleanup exposure of around $120 million. Stronger enforcement or higher failure rates push that number sharply upward. The Antina Ranch settlement hints at the scale of what lies beneath: a portfolio of ageing wells whose risks are only now surfacing, decades after the profits were extracted.

The model is simple, but its implications are not. Whether in the North Sea, the Permian Basin or a corporate balance sheet, the cost of abandonment is a function of geology, law and political choice. Change the assumptions, and the burden shifts — but it never disappears. The mathematics merely reveals what the industry has long known: extraction ends, but liability does not.

FROM EXTRACTION TO FABRICATION

The story of oil does not end at the wellhead.
It continues through a vast petrochemical lattice.

Chevron’s upstream operations supply the hydrocarbons.
CPChem converts them into monomers and polymers — the building blocks of plastics and synthetic fibres.

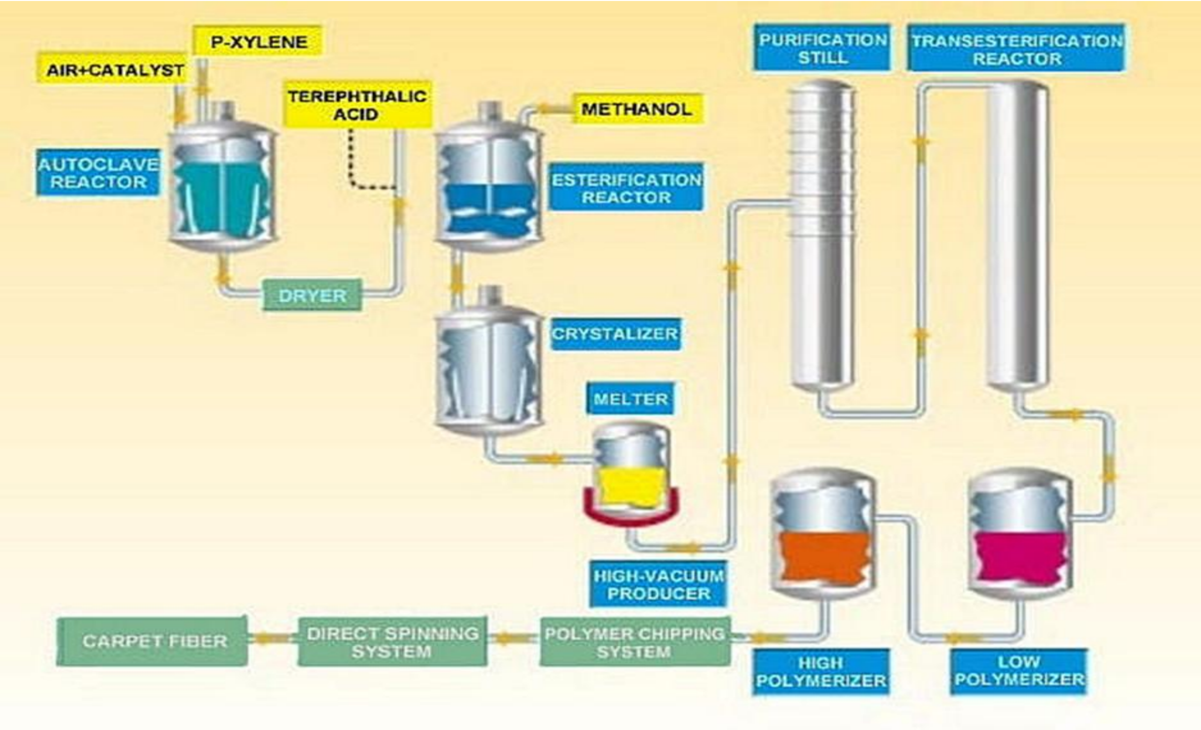
CPChem’s financials reveal a company built for scale:
$12.47 billion in annual revenues and **$21.47 billion in assets**.

Its dual-key governance model — requiring approval from both Chevron and Phillips 66 — locks the company into petrochemical expansion. It is not designed for contraction.

As oil demand for transport plateaus, petrochemicals become the industry’s growth engine. Plastics and synthetic fibres are central to that strategy.

CPCHEM PETROCHEMICAL COMPLEX

A schematic of an ethane cracker and polymerisation system.



THE SYNTHETIC FIBRE ECONOMY

Fashion’s reliance on polyester, nylon and acrylic is not a trend.
It is a structural dependency engineered by petrochemical economics.

“Approximately 95% of Chevron’s methane emissions originate from the production of oil and natural gas.”
These same hydrocarbons feed CPChem’s furnaces.

Methane leakage, flaring and venting are therefore embedded in every synthetic garment.

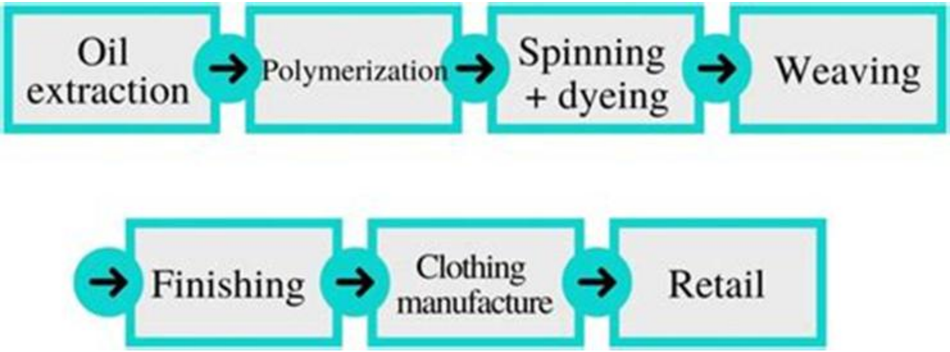
Why Synthetics Dominate

They are cheap
They are scalable
They are tied to fossil-fuel economics
They are subsidised by public liability
They are embedded in global supply chains

Natural fibres cannot compete under current conditions.

MOLECULE JOURNEY FLOWCHART

A flowchart showing the molecule’s path from extraction to retail.



Why Polyester Stays Cheap Even When Oil Doesn’t

Polyester’s dominance is not simply a matter of cost — it is a matter of insulation. Petrochemical feedstocks do not track oil prices in a straight line. Ethane and naphtha often remain cheap even when crude spikes, because they are by-products of gas production and benefit from long-term supply contracts, subsidies, and overbuilt cracking capacity.

When oil prices rise, natural fibres become more expensive to produce and transport, while synthetics remain tethered to a petrochemical system designed for surplus.

Fast fashion is not a market preference.
It is a price signal engineered by fossil capital.

CONFLICT, VOLATILITY AND THE PRICE OF THE MOLECULE

Oil prices rise with war because conflict constrains supply, disrupts shipping lanes, and injects risk into every barrel traded. When prices spike, operators accelerate drilling to capture short-term margins. When prices crash, marginal wells are abandoned, deferred or sold to thinly capitalised firms.

Volatility produces abandonment.
Abandonment produces leakage.
Leakage produces climate damage.

The molecule never disappears.

It moves from abandoned wells into petrochemical furnaces, from furnaces into fibres, from fibres into wardrobes. The garment is the well. The wardrobe is the refinery.

To understand the clothes we wear is to understand the system that made them possible.
To unpick the seams of this system is to see fashion not as a cultural artefact but as a material extension of fossil capital.

Only by tracing the molecule — from oilfield to outfit — can we begin to design a world that does not abandon the earth in order to clothe it.

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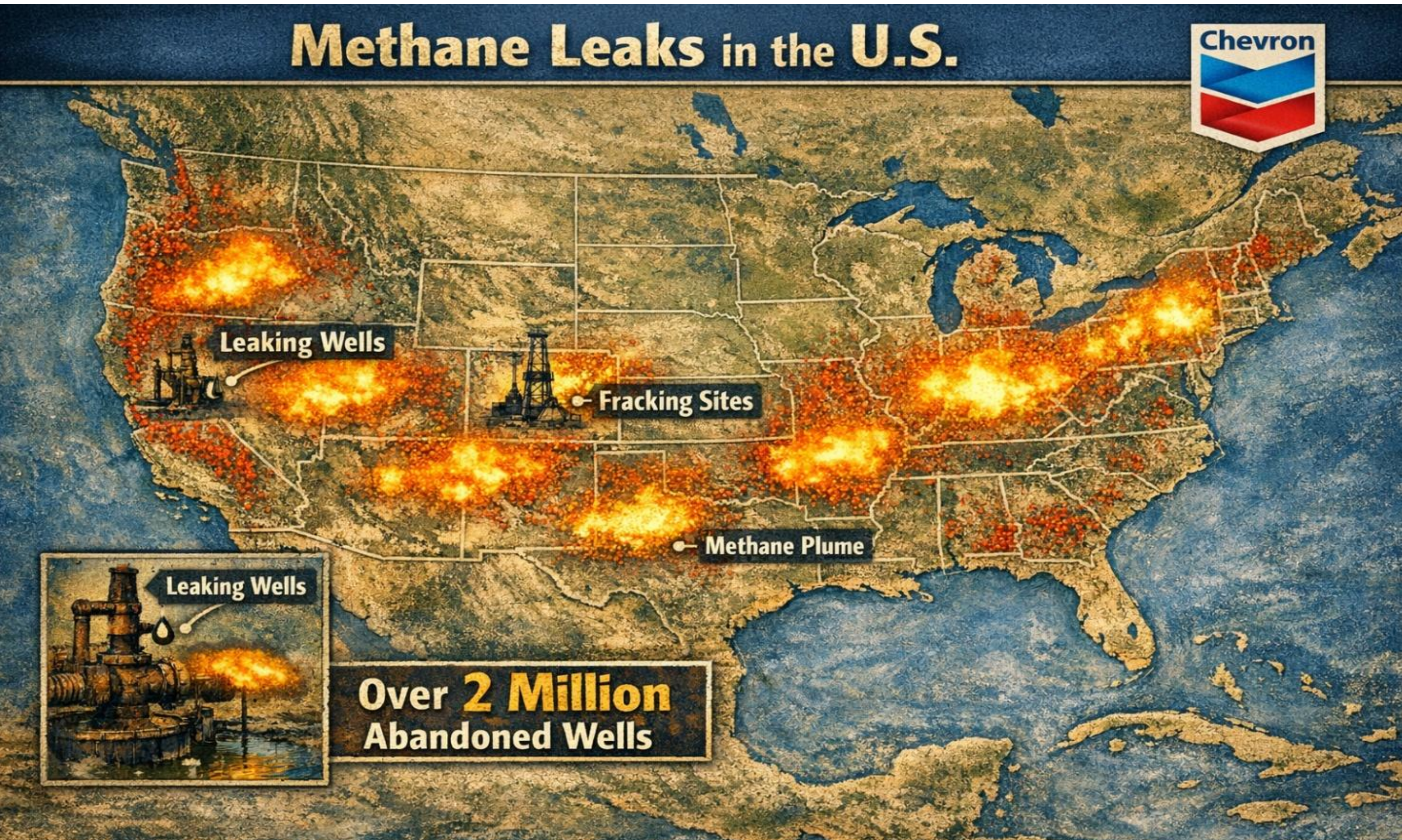
Don't Dump it, Swap it®



ANNEX:

Modelling the Cost of Abandonment

1. Core structure: total cleanup cost

Let:

- **(N)** = total number of assets (wells, platforms, pipelines, etc.)
- **(C_i)** = expected cleanup cost of asset (i) (in today's prices)

Then the undiscounted total cleanup cost is:

$$C_{total} = \sum_{i=1}^{N} C_i$$

For a uniform average cost per asset $\bar{C}$:

$$C_{total} \approx N \cdot \bar{C}:$$

2. Time, discounting, and escalation

Let:

- **(T_i))** = year in which asset (i) is decommissioned
- **(r)** = real discount rate
- **(g)** = real cost escalation rate (e.g. inflation in rig rates, labour, materials)

Nominal cost of asset (i) in year (**T_i**)):

$$C_i(T_i) = C_{i,0} \cdot (1+g)^{Ti}$$

Present value (PV) of that cost:

$$\mathrm{PV}C_i = \frac{C_{i,0} \cdot (1+g)^{Ti}}{(1+r)^{Ti}}$$

Total present value of cleanup:

$$C_{PV} = \sum_{i=1}^{N} \frac{C_{i,0} \cdot (1+g)^{Ti}}{(1+r)^{Ti}}$$

If (g ≈ r), escalation and discounting roughly offset; if (g > r), future cleanup gets more expensive in real terms.

3. Who pays? Operator vs public

Introduce cost-sharing:

- $\boldsymbol{\alpha_i}$= fraction of cleanup cost of asset (i) borne by the operator
- $\boldsymbol{\beta_i}$ = fraction borne by the public (taxpayer), with ($\boldsymbol{\alpha_i}$+ $\boldsymbol{\beta_i}$= 1)

Then:

$$\boldsymbol{C_{operator}=\sum_{i=1}^{N} \alpha_i \cdot PV(C_i)}$$

$$\boldsymbol{C_{public}=\sum_{i=1}^{N} \beta_i \cdot PV(C_i)}$$

4. UK-style tax relief (North Sea)

In the UK, operators pay the cost but receive tax relief, so the **effective public share** is via foregone tax.

Let:

- **(τ)** = effective tax relief rate on decommissioning (e.g. 40–60%)

Then, for each asset:

- Operator's cash outlay: (PV ($\boldsymbol{C_i}$))
- Tax relief: (τ▪ PV ($\boldsymbol{C_i}$))
- Net operator burden: ((1-τ) ▪PV ($\boldsymbol{C_i}$))
- Public (Treasury) burden: (τ▪ PV ($\boldsymbol{C_i}$))

So:

$$\boldsymbol{C_{public,UK}=\sum_{i=1}^{N} \tau \cdot PV(C_i)}$$

$$\boldsymbol{C_{operator,UK}=\sum_{i=1}^{N} (1-\tau) \cdot PV(C_i)}$$

5. U.S. orphan wells: bonding and failure

For onshore U.S. wells, the key is **bond shortfall** and **orphan probability**.

Let:

- **(N)** = number of wells
- **(C)** = average plugging and abandonment cost per well
- **(B)** = average bond coverage per well (effective)
- **($\boldsymbol{p_{orphan}}$)** = probability a well becomes orphaned (operator fails / disappears)

Expected public cost per well:

$$\mathrm{E}\{\boldsymbol{C_{public,well}}\} = \boldsymbol{p_{orphan}} \cdot \max(0, C - B)$$

Total expected public cost:

$$\mathrm{E}\{\boldsymbol{C_{public,US}}\} = \boldsymbol{N} \cdot \boldsymbol{p_{orphan}} \cdot \max(0, C - B)$$

You can layer discounting and time if you know when wells are likely to orphan.

6. Chevron-style legacy portfolio

For a company with a legacy portfolio (e.g. Chevron’s inherited Gulf wells):

Let:

- $(\boldsymbol{N_{leg}})$ = number of legacy wells
- $(\boldsymbol{C_{leg}})$ = average cleanup cost per legacy well
- $(\boldsymbol{p_{fail}})$ = probability of failure (leak, casing collapse, etc.) requiring intervention
- $(\boldsymbol{\gamma})$ = fraction of those failures for which the company is held liable (legal / enforcement factor)

Expected corporate cleanup liability:

$$\boldsymbol{C_{Chevron} = N_{leg} \cdot p_{fail} \cdot \gamma \cdot C_{leg}}$$

Reference:

Global Methane Emissions: Visualizations by: Alex Kekesi https://svs.gsfc.nasa.gov/5360/

Global Atmospheric Methane: Visualizations by: Cindy Starr https://svs.gsfc.nasa.gov/4789/

Chevron Supplement to the Annual Report Chevron Methane Report https://www.chevron.com/investors

Chevron Phillips Chemical (CPChem) https://www.cpchem.com/who-we-are

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