Shell Revitalize: Leveraging Geothermal Power To Extend Shell Asset Life

Repurposing offshore platforms for geothermal energy extraction to expand EV energy to turn a $777 million capital loss into $387 million in annual profit by 2035.

SHELL REVITALIZE: CENTRAL NORTH SEA GEOTHERMAL PROJECT

EXECUTIVE SUMMARY

The Problem

High Profit Loss from Oil Well Decommissioning

1. Industry wide, **50%** of North Sea offshore oil operations are predicted to become unprofitable in the next 5 years, resulting in well abandonment.

2. Regulations require Shell to decommission abandoned offshore oil complexes, which will cost Shell **$981M** over the next 5 years.

3. The 5-12 yr time period for decommissioning each offshore oil rig results in total **$19.3bil+** loss in revenue, capital, & opportunity cost.

The Opportunity

Shell Revitalize: Converting Offshore O&G to Geothermal

1. Converting offshore platforms to geothermal plants can save **~$687M** in decommissioning costs & extend asset life by **30+ years**, a natural transition to renewables from O&G.

2. The Central North Sea is home to **4** offshore operations ***(Shearwater, Pierce, Nelson, Gannett)***, with a collective **200mW** in geothermal potential & capacity.

3. **1,576.8 gWh** of annual energy from Shell Revitalize can be sold at Shell Recharge EV stations.

The Result

$11.6B Profit & 34 million tCO_2e Reduction in Carbon Emissions

1. By 2035, the CNS Geothermal Project will annually produce **1,576,800 mWh, $387M** in profit, and reduce emissions by **712,713 metric tons of CO_2.**

2. Shell Revitalize will supply the FME[1] energy needs for **331,678 EV'S,** standing to profit **$387M** annually.

3. Shell's geothermal expansion will scale to produce **$11.6B+** in profit and **200mW** in energy capacity and will eliminate **34 million tCO2e** over the course of 48 years.

THE PROBLEM

50% of offshore oil wells will be decommissioned in the next 5 yrs.

Expensive

Decommissioning offshore oil complexes in the North Sea costs between $500 and $900 million. This brings Shell's expenses to **981M** over the next 5 years.

Time Intensive

Decommissioning an offshore oil rig takes 5-12 years, depending on the depth, size and condition of the rig. This results in **$19.3bil+** in lost profits, capital, & opportunity cost.

Unavoidable

Government regulations in the UK require companies to decommission non-operational wells. In the next 25 years, Shell will cease operations and decommission **168** wells.

Where to focus?

The North Sea, located in the U.K. is the best geographical location to focus on, as Shell's offshore operations in the region have wells ripe for geothermal energy extraction.

WHERE TO FOCUS

Offshore wells = geothermal opportunity.

OFFSHORE VS ONSHORE - Offshore wells are larger in diameter and depth compared to onshore wells, meaning that the geothermal potential is greater. Cooling is also important when it comes to geothermal, and surrounding seawater provides a natural, low-to-no-cost cooling solution. Offshore rigs also possess the existing infrastructure such as pipelines from the platforms to land provide a way to get utility-grade cables run to land to connect to the grid.

1. Large Diameter & Deep Wells

Offshore wells, specifically those in the North Sea, are **drilled deeper and with a larger diameter than onshore wells.** This is important as geothermal relies on a mass flow rate for power generation, making offshore wells ideal.

2. Existing Infrastructure

Offshore wells are built to last, and if the conversion to geothermal is made just as O&G production slows, **the assets' life can be prolonged.** Preexisting flowlines to land can be run with utility lines, allowing generated electricity to flow to land.

3. No Drilling and Casing Costs

About 24% of the total costs associated with geothermal plant construction is drilling. Also, the cost of casing the wells adds additional costs. Offshore wells are pre drilled, and are cased, meaning that the conversion to geothermal can be done at a discount.

4. Deferring Decommissioning Costs

The cost of decommissioning offshore rigs is decreasing by 6% every year due to the pressure to phase out O&G operations. Converting to geothermal allows Shell to defer the cost of decommissioning further into the future, minimizing their decommissioning costs while maximizing geothermal profits.

THE SOLUTION

Converting high potential offshore platforms to geothermal plants to prolong asset life.

Why Geothermal?

Converting platforms to geothermal energy generators can extend the lifespan of Shell assets while making a natural transition from oil to renewable energy practices.

Why Shell?

Shell has committed to reaching carbon neutrality by **2050**, and repurposing decommissioned offshore rigs allows for the investment into green energy sources at a discounted cost. They also have the existing assets and the know how to convert from oil & gas to geothermal.

Highlights of Geothermal:

1

Long Lasting

Geothermal plants can last over **40 years**, posing a massive opportunity to create long term cash flow.

2

Sustainable

Geothermal energy is green, and transitioning to geothermal practices will help Shell reach its **2050 carbon neutrality goal**.

3

Low Operating Costs

Geothermal plants are cheap to operate, at **just $0.03/kWh.** This means Shell will have little recurring costs while expanding their asset portfolio.

THE OPPORTUNITY

Save ~$687mil in decommissioning costs & extend asset life by 30+ years.

Money: Geothermal energy is a **24/7** source of energy with operational costs cheaper than other forms of energy. However, because of a high cost, high risk and challenging drilling process, it is not commonly used.

With a pre-drilled deep offshore well, the challenge of drilling is eradicated. No need for drilling and casing of the well **saves 40%** of the total start-up costs for geothermal energy.

The cost of decommissioning a platform in the North Sea has **decreased by 6%** annually over the past 4 years. If the asset is kept for another 30 years, the cost would have decreased by over 70%, accounting for stagnation of the 6%.

	Solar	Wind	**Geo**	Oil	Gas
¢/kWh	8	5	**4**	10	6

Operational cost of different energy sources.

Time: Current practices in the O&G industry show that offshore well operations are ceased after about 30 years of use due to poor extraction efficiency. By converting these wells to geothermal plants, we are able to extend the life of these structures by over 30 years as the heat capacity is still present in the well.

CASE STUDY - SHELL'S BRENT FIELD

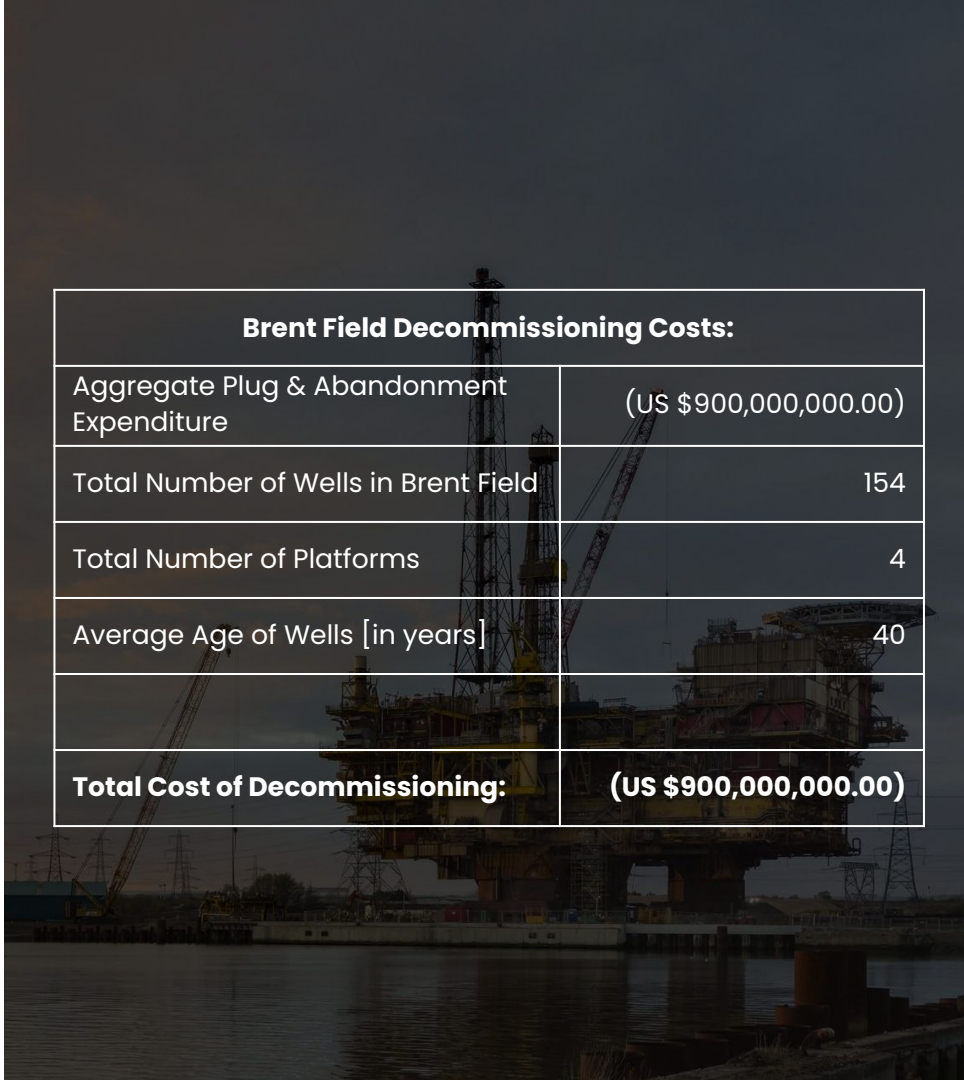
Remember Brent Field?

In 2008, Shell decided to decommission one of their biggest offshore oil operations, Brent Field over 12 years.

The cost of decommissioning was over $900 million to plug & abandon the field and remove an undisclosed percentage of the platforms.

If Shell chose to remove all of Brent's platforms, that would've cost an additional $700 million.

The decision to decommission this oil field will serve as an example of the potential geothermal has in Shell's operations.



Brent Field Decommissioning Costs:	
Aggregate Plug & Abandonment Expenditure	(US $900,000,000.00)
Total Number of Wells in Brent Field	154
Total Number of Platforms	4
Average Age of Wells [in years]	40
Total Cost of Decommissioning:	**(US $900,000,000.00)**

CASE STUDY - SHELL'S BRENT FIELD

Missed out on $18 billion in profit.

Fixed costs: For an offshore rig to be converted to a geothermal plant, it costs ~$3 million per mW of capacity. This equates to $600 million for a 200mW plant. Transmission of the electricity would require $500 million for 116 miles of underwater power lines to shore, with the cost of wiring estimated at $4.31 million/mile. **Totalling $1.1 billion in initial investment.** ***[Only $200 million more than abandonment costs to revive asset.]***

Operational costs: Geothermal runs extremely efficiently after construction, averaging **$0.02/kwh**, vs. natural gas at **$0.08/kwh**. Brent would have supplied energy for **~332k EV's annually**.

ELECTRIC VEHICLES:	
Average number of miles driven (per yr)	14,263
Average electric consumption per year	4,754kWh
# of full-mileage equivalent vehicles Brent would have powered annually.	**331,678.59**

[1] Full-mileage equivalent vehicles: based on total annual geothermal energy production divided by avg. electric consumption per EV. Also assumes EV's recharge at Shell stations all year.

The Economic Benefit of a 200mW Geothermal Plant Conversion (USD)	
Cost of Construction ($3mil/mW capacity)	**($600,000,000.00)**
Initial Submarine Wiring for Transmission	($500,000,000.00)
Yearly Operational Costs	($31,536,000.00)
Total costs for plant over 24 years	($1,856,864,000.00)

Source of Revenue	
Number of kWh (total over 48 years)	75,686,400,000 kWh
Energy Sales (if priced at $0.28/kwh)	$21,192,192,000.00

200mW Geothermal Plant Economic Potential *over 48 years	
Total Revenue	$21,192,192,000.00
Total Costs (Fixed and Operational)	($2,613,728,000.00)
Net Profits	**$18,578,464,000.00**
Net Profits ***(per 1yr)***	$387,051,333.00
LCOE (per mWh)	$34.534
LCOE (per kWh)	$0.035

PILOT PROJECT RECOMMENDATION

WHY GANNET COMPLEX?

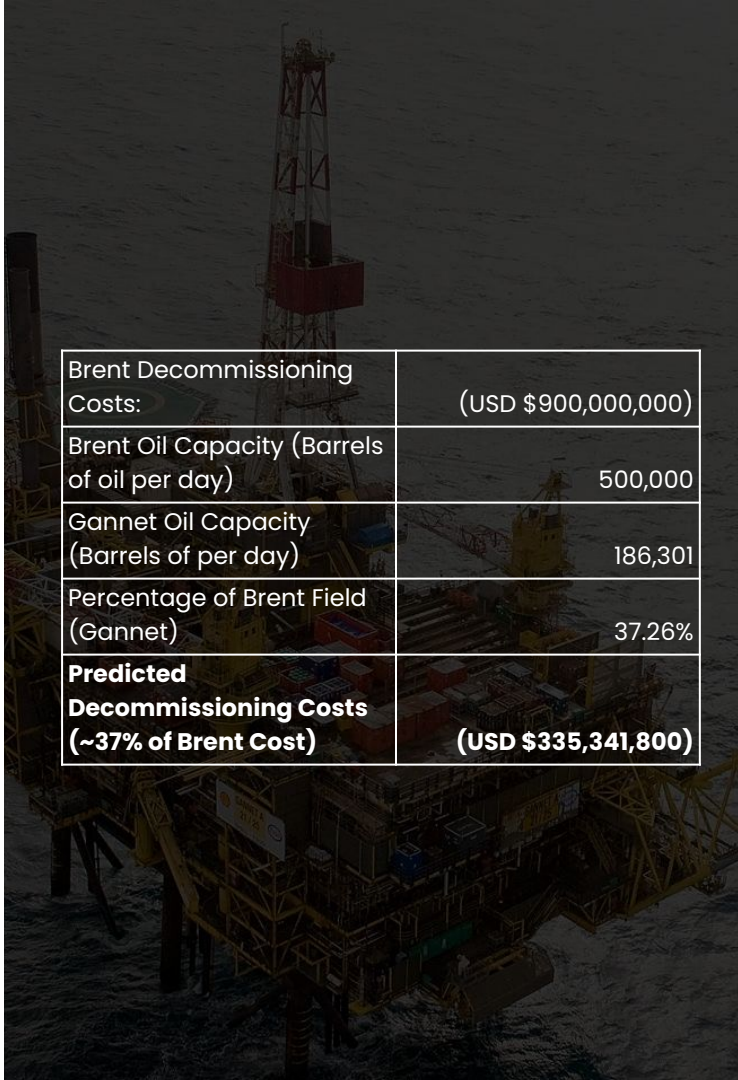
The perfect place to start.

Gannet Complex is the closest in proximity to shore at only **112 miles East of Aberdeen**, with the highest geothermal capacity in the Central North Sea region at **75mW.**

Gannet produces ~180,000 barrels of oil a day and has been operational since 1993. Using Brent Field as a benchmark, we predict that Gannet Complex is reaching the end of its useful life, hence **it poses an opportunity to switch to geothermal.**

Moreover, due to its centralized location, we can route energy from future surrounding geothermal rigs through Gannet-Aberdeen power lines. This alone will save **$650 million+** in future submarine cable & energy transportation costs. As a result, laying the foundations for Shearwater, Pierce, & Nelson.

By our calculations, decommissioning Gannet will cost over $335 million, resulting in a capital loss. Extending Gannet's life by 30 years will cost only $140 million more to generate ~$143 million/year in profit.



Brent Decommissioning Costs:	(USD $900,000,000)
Brent Oil Capacity (Barrels of oil per day)	500,000
Gannet Oil Capacity (Barrels of per day)	186,301
Percentage of Brent Field (Gannet)	37.26%
Predicted Decommissioning Costs (~37% of Brent Cost)	**(USD $335,341,800)**

This pilot at Gannet turns a $335 million loss, into an $6.90 billion opportunity.

PILOT PROJECT - FINANCIALS

Unlock over $6.9bil+ in profit with initial investment of $475mil.

Decommissioning Costs = USD $335.34 million

Initial Geothermal Costs = USD $475 million

Net Capital Cost To Save Asset = USD $139.66 million

Net Profit: USD $143 million yearly

Break Even Point: ~5 years & 3 months

Although the initial costs of building a geothermal asset in place of Gannet exceed the costs of decommissioning, it creates billions in wealth for Shell over 50 years of operations. This allows Shell to prolong the useful life of this asset, while maximizing the profits they incur.

ELECTRIC VEHICLES:	
Average number of miles driven (per yr)	14,263
Average electric consumption per year	4,754kWh
# of full-mileage equivalent vehicles Gannet can power annually.	**124,379.25**

[1] Full-mileage equivalent vehicles: based on total annual geothermal energy production divided by avg. electric consumption per EV. Also assumes EV's recharge at Shell stations all year.

Geothermal Power Plant (Offshore Oil Rigs to Electricity for EV Stations)	
Cost of Construction ($3mil/mW capacity)	**(US $225,000,000.00)**
Initial Submarine Wiring for Transportation	(US $250,000,000.00)
Yearly Operational Costs	(US $11,826,000.00)
Total costs for plant over 24 years	(US $758,824,000.00)

Source of Revenue	
Number of kWh (total over 24 years)	14,191,200,000 kWh
Energy Sales (priced competitively with Tesla)	US $3,973,536,000.00

75mW Geothermal Plant Economic Potential *over 48 Years	
Total Revenue Over 48 Years	US $7,947,072,000.00
Total Costs (Fixed and Operational) Over 48 Years	(US $1,042,648,000.00)
Net Profits over 48 Years	**US $6,904,424,000.00**
Net Profit Per Year	US $143,842,166.67
Breakeven Time	5.275393284

LCOE (per mWh)	$36.736

SCALING - WHY WE CHOSE THE CENTRAL NORTH SEA REGION

High concentration of offshore assets, geothermal capacity & profitability.

OFFSHORE ASSETS
Shell owns & operates **8** significant offshore assets in the North Sea region, split evenly between the Central/Northern and Southern regions.

In the Central region, all of the offshore oil rigs are in close proximity (<50 miles apart from each other).

ENERGY TRANSMISSION
We chose Gannet as our pilot project location. The centralized location and existing infrastructure would then allow Shearwater, Pierce and Nelson to route energy produced through Gannet.

This will save over **$650 million** in submarine cable costs alone, and hundreds of miles in separate wiring for each plant.

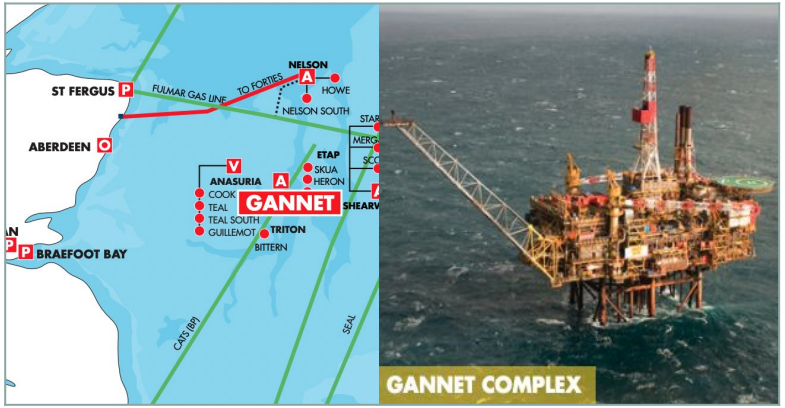
OPTIMAL GEOTHERMAL CONDITIONS
Shell's current North Sea offshore oil wells operate at high temperatures (50-150°C per km of well depth), deep below the surface level (1.5-3+km) with optimal well diameters (3m+).

These properties fulfill and exceed the optimal conditions required for high efficiency geothermal plants, resulting in high geothermal capacity.

PROFITABILITY
As the geothermal technology improves in the next coming years, the cost of converting offshore oil rigs to geothermal producers are estimated to **drop by ~30%** thanks to innovations from startups like Sage Geosystems.

Moreover, saving ~300 miles in wiring required, and connecting future repurposed geothermal plants to Gannet, slashes initial costs by **~49%.**

	Distance (East of Aberdeen)	**Est. Geothermal Capacity**
Shearwater	140 miles	40mW
Pierce	165 miles	25mW
Nelson	124 miles	60mW
Gannett	112 miles	75mW



SCALING - FINANCIALS

Unlock $11.6+ billion in profits & 125mW in energy capacity with $625 million.

Decommissioning Costs = USD $441.23 million

Initial Geothermal Costs = USD $625 million

Net Capital Cost To Save Three Assets = USD $183.77 million

Net Profit: USD $243.2 million yearly.

Break Even Point: ~4 years & 5 months.

The Central North Sea (CNS), is home to the Shearwater, Pierce, Nelson and Gannet O&G operations. These operations will be ceased soon, and converting to geothermal generate 125mW of geothermal energy. Shell has committed to 100% renewable sources powering their EV operations, and this geothermal generation would expand operations in Europe. Growing geothermal here after the Gannet Pilot, would minimize transmission costs, as wiring could be run through the Gannet facility, saving $650+ million.

# of full-mileage equivalent vehicles this expansion can power annually	**207,298.75**

[1] Full-mileage equivalent vehicles: based on total annual geothermal energy production divided by avg. electric consumption per EV. Also assumes EV's recharge at Shell stations all year.

CNS Geothermal Field (Offshore Oil Rigs to Electricity for EV Stations)	
Cost of Construction per mW	**(US $3,000,000)**
Initial Submarine Wiring for Transportation	(US $250,000,000)
Yearly Operational Costs	(US $19,710,000)

Source of Revenue	
Number of kWh (total over 24 years)	23,652,000,000 kWh
EV Stations Energy Sales ($0.28/kWh)	US $6,622,560,000

125mW Geothermal Field Economic Potential *over 48 Years	
Total Revenue	US $13,245,120,000.00
Total Costs (Fixed & Operational)	(US $1,571,080,000.00)
Net Profits	**US $11,674,040,000.00**

Net Profit Per Year	US $243,209,166.67
Breakeven Time	4.514796934

LCOE (per mWh)	$33.212

APPLICATION OF ENERGY

Shell Recharge x "Shell Revitalize"

Shell has committed to expand to **50,000** electric vehicle (EV) charge points in the U.K. **by 2025**, branded Shell Recharge.

These stations commit to using 100% renewable energy. Currently, Shell states that they rely on wind and solar energy, which fluctuate in stability and supply.

Our average *Levelized Cost of Energy (LCOE)* for geothermal energy is **$34.97/mWh**. We predict this is comparable to Shell's LCOE/mWh for onshore & offshore wind power plants, while adding stability to base-load power for Shell's EV stations.

The Central North Sea (CNS) Geothermal Project *("Shell Revitalize")* will generate 1,576,800 mWh/annually, supplying the **FME[1]** energy needs for **331,678 EV'S** annually.

Based on *Shell Recharge's* current EV charging fee of **£0.45/kWh** ($0.60/kWh), they stand to profit **US $387 million** annually.

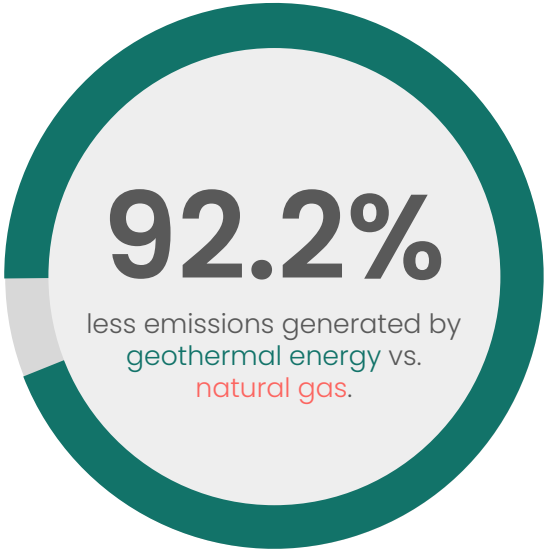
[1] **Full-mileage equivalent vehicles**: based on total annual geothermal energy production divided by avg. electric consumption per EV. Also assumes EV's recharge at Shell stations all year.

CARBON FOOTPRINT

Eliminate 34+ million tCO2e.[1]

By converting Shearwater, Pierce, Nelson, and Gannett to geothermal energy plants, Shell will remove **34.2 million[2] metric tons of CO2** of full life-cycle emissions (tCO2e) over the plants' lifespan, when compared against emissions from the same amount of energy extracted from natural gas. That's **712,713 metric tons of CO2 annually!**

That's equivalent to removing the emissions generated by **132 thousand U.K. residents[3]** annually.



[1] tCO2e: metric tons of carbon equivalent.
[2] Full life-cycle carbon emissions are 92.24% less for geothermal when benchmarked against natural gas. The Central Sea Geothermal Plants will produce 75.68 billion kWh over 48 years. *Source*: *World Nuclear Association*
[3] Average U.K. resident emits 5.4 metric tons of CO2 emissions annually.

TIMELINE FOR IMPLEMENTATION

Here’s how to implement Shell Revitalize in 5 years.

Gannet Complex Pilot Project

Year 0: Our analysis shows that Gannet is reaching the end of its life as an O&G asset. If Shell data supports this, our pilot is ready to be implemented.

1. Validate Asset Efficiency

2. Eng. Study + Permitting

Year 1.5: Conduct an engineering study to determine the technical process of making the conversion to geothermal. Apply for permitting to complete the conversion with the U.K. Government in parallel.

Year 2: Ensure that the well and platform integrity is adequate to make an investment into geothermal. If not, further investment into platform and well maintenance is required before plant construction.

3. Assess Asset Integrity

4. Begin Construction

Year 3: Begin the conversion of wells to geothermal wells, as well as the conversion of O&G platforms into platforms adequate for geothermal power generation.

Year 4: Post construction, the plant must be connected to the grid. This can be done in parallel with plant construction if high probability of geothermal success.

5. Connect To The Grid

SCALING SHELL REVITALIZE

How Shell can become a leader in geothermal.

Target underperforming & aging offshore wells for conversion first.

Shell Geothermal Expansion

2023 - 2028

Pilot Project: Gannet Complex Conversion & Collecting Data

Our pilot project will allow Shell to test its ability to convert their offshore wells to geothermal plants. This pilot will serve as a benchmark for the time needed to make the conversion.

Scaling: Shearwater, Pierce, Nelson & Collecting Data

2028 - 2035

Shell must find another asset that has a high geothermal capacity, that is also at the end of its useful life as a offshore well. We suggest investigating further into Shearwater, Pierce, & Nelson operations for conversion.

Beyond 2035: Monitor Results & Explore Gulf of Mexico

The Central North Sea is the tip of the iceberg. Decommissioning is inevitable, and the conversion to geothermal is an economically feasible opportunity for Shell to leverage in extending offshore well life across the globe. The Gulf of Mexico is home to over 70 Shell owned oil platforms, making that a likely target.

Every year *after 2035*, the CNS Geothermal Project will: generate **1,576,800 mWh,** create **$387 million** in profit, & reduce emissions by **712,713 metric tons of CO_2.**

WHAT EXPERTS SAY

Who to get in touch with to take the next step.

These are the top experts we have consulted during this challenge to understand geothermal potential in offshore rigs.

Kevin Kitz
Founder
KitzWorks LLC

"I am impressed by the pivots in your thinking as you built your expertise and knowledge. The method of utilizing abandoned offshore oil wells for geothermal is a viable zero carbon source of electricity."

Cindy Taff
Co-Founder & COO
Sage Geosystems

"Geothermal is the most effective option for the oil and gas industry to transition into clean renewable electricity. Offshore wells offer higher potential for geothermal energy due to their well depth in comparison to their onshore counterparts."

AK McCormick
CEO
Dream Well Inc.

"I love your thinking and concept, and your whole process of wondering if they can be changed from onshore to offshore geothermal conversion. The greater depth, diameter and geothermal gradient would yield greater results."

Ben Bodishbaugh
Co-Founder
ICE Thermal Harvesting

"Peak temperature in geothermal wells is the key to generating profitable amounts of electricity. As the technology scales and manufacturing costs of the equipment come down, those economics of geothermal will improve."

Sage Geosystems focuses on converting low-temperature & low-depth onshore orphan wells into geothermal energy plants. Cindy's team is currently investing heavily in creating more effective turbines for geothermal energy. From her perspective, Shell currently has the in-house expertise in their "Unconventional Wells" department to pilot, launch, deploy and scale offshore geothermal energy plants & fields.

POTENTIAL OVERSIGHTS

KEY ASSUMPTIONS

Many assumptions were made during this challenge. Here are some major ones, and how we accounted for them.

1. Brent Field Decommissioning Costs

Our pilot project financial estimates and plan for CNS Geothermal is based on the economics of Brent Field decommissioning process. We are assuming that the costs of that project scale to other O&G fields.

2. Geothermal Energy Allocated to EV Ops

We assume that all of the energy that the geothermal plants generate will go towards EV stations. This determined the projected cost at which we sell the energy in our calculations, and a change here would alter our financial projections.

3. Asset Maintenance is Consistent

The recommendation to prolong asset life by decades is only feasible if regular maintenance has been conducted on the offshore platforms/wells to a point where they can sustain further use.

4. Data Integrity

Our calculations & recommendation were built on several external resources and data, as Shell data was unavailable. We accounted for this by being conservative with our calculations, and consulting industry experts to validate our numbers.

Thank you, Shell.

Dear Shell Legends,

We'd like to thank you for giving us the opportunity to dive deep into the energy sector in search of an economically incentivized pathway towards Shell's 2050 net-zero emissions target. Without access to official Shell data, it's been an incredible learning experience to use external research & make calculations using proxies; we hope our calculations and analysis match proprietary information.

Through leveraging publicly available Shell shareholder data & annual reports, interviewing industry experts for external perspective, and leveraging mental models/frameworks, we've learnt more about Shell's operations, and the energy sector this month than ever before.

We hope that we were able to provide a feasible solution to the problems that Shell and its shareholders face today. We'd be happy to answer any questions you had about our recommendation via email. We're all very excited to see the Shell reach its goal of changing the world by 2050.

All the best,
Anuraj, Elizabeth, Sualeha and Kevin

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Appendix

Figure 1.0

Geothermal Power Plant 200mW (Brent Field Case Study)	
Capital Expenditures and Cost of Construction per mW	**US $3,000,000.00**
Yearly Operational Costs	US $31,536,000.00
Total costs for plant over 24 years	US $1,856,864,000.00
Source of Revenue	
Number of kWh (total over 24 years)	37,843,200,000kWh
CHOICE #1: Energy Sales (priced competitively with Tesla)	US $10,596,096,000.00
Initial Submarine Wiring for Transportation	US $500,000,000.00
200mW example	
Total revenue for plant over 24 years	US $10,596,096,000.00
Total costs for plant over 24 years	US $1,856,864,000.00
Net Revenue Over 24 Years	US $8,739,232,000.00
Total revenue for plant over 24 years	US $10,596,096,000.00
Total Costs for plant over next 24 years	US $756,864,000.00
Net Profits Over Next 24 Years	US $9,839,232,000.00
Total Revenue Over 48 Years	US $21,192,192,000.00
Total Costs (Fixed and Operational) Over 48 Years	US $2,613,728,000.00
Net Profits Over Next 48 Years	US $18,578,464,000.00
Net Profits Over 1 Year	US $387,051,333.33

Figure 1.1

Further Calculations For 200mW Brent Field Geothermal Power Plant	
Number of mWh/day: [200 mW plant]	4320
Daily operational costs [200 mW plant * $20/mWh]	US $86,400.00
Lifetime energy produced [24 years]	37,843,200mWh
Number of mWh/year: [200 mW plant]	**1576800**
Yearly operational costs:	US $31,536,000.00
Lifetime operational costs:	US $756,864,000.00
Lifetime fixed costs:	US $1,100,000,000.00
Total cost over 24 years:	US $1,856,864,000.00
LCOE (per mWh) first 24 years	$49.06731
LCOE (per kWh) first 24 years	$0.04907
LCOE (per mWh) next 24 years	$20.00
LCOE (per kWh) next 24 years	$0.02
LCOE (per mWh) for total 48 years	$34.534
LCOE (per kWh) for total 48 years	$0.035
1 mW power plant can generate 1mW/h.	
Average operational costs -> $0.02kW/h -> $20mW/h	
50-75% of costs are tied up in drilling and well construction.	
Geothermal power plants operate at ~90% uptime (21.6hr out of 24hrs per day), higher operational loads can be achieved however maintenance is more costly. General lifespan of geothermal systems: 24 years	

Figure 2.0

Geothermal Power Plant 75mW (Gannet Pilot Project)	
Capital Expenditures and Cost of Construction per mW	**US $3,000,000.00**
Yearly Operational Costs	US $11,826,000.00
Source of Revenue	
Number of kWh (total over 24 years)	14,191,200,000kWh
CHOICE #1: Energy Sales (priced competitively with Tesla)	US $3,973,536,000.00
Initial Submarine Wiring for Transportation	US $250,000,000.00
75mW example	
Total revenue for plant over 24 years	US $3,973,536,000.00
Total costs for plant over 24 years	US $758,824,000.00
Net Revenue Over 24 Years	US $3,214,712,000.00
Total revenue for plant over 24 years	US $3,973,536,000.00
Total Costs for plant over next 24 years	US $283,824,000.00
Net Revenue Over Next 24 Years	US $3,689,712,000.00
Total Revenue Over 48 Years	US $7,947,072,000.00
Total Costs (Fixed and Operational) Over 48 Years	US $1,042,648,000.00
Net Profits over 48 Years	US $6,904,424,000.00
Net Profit Per Year	US $143,842,166.67
Breakeven Time	5.275393284

Figure 2.1

Further Calculations for 75mW Geothermal Power Plant	
Number of mWh/day: [75 mW plant]	1620
Daily operational costs [75 mW plant * $20/mWh]	US $32,400.00
Lifetime energy produced [24 years]	14,191,200 mWh
Number of mWh/year: [75 mW plant]	**591300**
Yearly operational costs:	US $11,826,000.00
Lifetime operational costs:	US $283,824,000.00
Lifetime fixed costs:	US $475,000,000.00
Total cost over 24 years:	US $758,824,000.00
LCOE (per mWh) first 24 years	$53.47145
LCOE (per kWh) first 24 years	$0.05347
LCOE (per mWh) next 24 years	$20.00
LCOE (per kWh) next 24 years	$0.02
LCOE (per mWh) for total 48 years	$36.736
LCOE (per kWh) for total 48 years	$0.037
Brent Decommissioning Costs:	$900,000,000.00
Brent Oil Capacity (Barrels of oil per day)	500,000
Gannet Oil Capacity (Barrels of per day)	186,301
Percentage of Brent (Oil Capacity)	37.26%
Predicted Decommissioning Costs & Target Initial Costs for Pilot Project	$335,341,800.00