16 Feb 2018

The Hon Justice Rachel Pepper
Chair
Hydraulic Fracturing Taskforce
GPO Box 4396
Darwin NT 0801

Dear Justice Pepper,

Re: HYDRAULIC FRACTURING INQUIRY – INFORMATION SUBMISSION

Please find herein Pangaea (NT) Pty Ltd (Pangaea) submission to the Hydraulic Fracturing Inquiry of its Pangaea Beetaloo Basin Development Model for Public Benefit.

Please do not hesitate to ask if further information is required.

Yours sincerely,

Tim Radburn
Executive Director

PANGAEA (NT) PTY LIMITED
A.C.N.159 197 029
GPO Box 4160, SYDNEY NSW 2001
Ph: (02) 9017 9600 Fax: (02) 9017 9699

14th February 2018

To whom it may concern,

RE: Letter of Support for Onshore Gas Industry and Pangaea Resources

The Urban Development Institute of Australia - Northern Territory seeks to advance the credibility and integrity of the development sector in the Northern Territory. The Institute actively represents the interests of land and built form property developers in the Northern Territory. The Institute strives to ensure excellence and innovation are the hallmarks of property development in the Northern Territory, advocating for access to land for development, investment in infrastructure, and a strong planning framework to foster housing affordability and economic growth.

We have closely followed the progress of the Territory oil and gas industry, government reviews and industry forecasts and completed comprehensive reviews of leading organisations' economic modelling and business plans.

Dr. Allan Hawke's *Independent Inquiry into Hydraulic Fracturing in the Northern Territory, 2014* concluded that:

"This Inquiry's major recommendation, consistent with other Australian and International reviews, is that the environmental risks associated with hydraulic fracturing can be managed effectively subject to the creation of a robust regulatory regime."

The Hawke Report's finding was consistent with other national and international reviews of onshore gas, including Justice Pepper's final draft conclusion. Based on the substantive weight of expert opinion, the Institute is a supporter of the development of the Territory's onshore gas industry.

The success of the Territory property development sector relies on a growing economy and a growing population to create demand for high quality commercial and residential properties. The recent CBA State of the States report confirmed our member's in-market experience that housing finance and dwelling commencements are perilously declining. But most concerning was that population growth, a leading indicator of the economy was found to be rapidly declining. The Territory desperately needs private sector investment and local jobs to support population growth. We believe that the onshore gas industry can significantly support local jobs and population growth across all demographics and industry sectors as a baseline to ensure the Territory grows, thrives and sustainably survives.

The Institute recently completed a comprehensive review of Pangaea's most recent submission to the Scientific Inquiry into Hydraulic Fracturing: *'Pangaea Resources (NT) Beetaloo Basin Development Model for Public Benefit (The NT Way)*. We reviewed Pangaea's 2015 works program (actual) and their Analogue by Unit methodology and forecasting based on Exploration, Appraisal and Production phases acknowledging that the economics used were actual figures taken from real time shale production budget forecasts.

Following our review, we fully endorse this economic development model based on Pangaea's business plan and operational methodology of 'The NT Way'. Furthermore, we fully endorse Pangaea's commitment to working diligently towards Training and sustaining regional Indigenous employment initiatives, Veterans Re-integration and employment initiatives. And efforts thus far in their proven and ongoing commitment to 'Buy Local', develop local and ultimately continue to operate 'The NT Way'.

Our final conclusion, consistent with Deloitte Access Economics' *Economic Impact of Shale and Tight Gas Development in the NT 2015;* and ACIL Allen's *Economic Impacts of a Potential Shale Gas Development in the NT*2017, is that Onshore Gas will increase local jobs, increase population growth, and regional community growth through all industries in a safe sustainable way and underpin stable economic growth for decades to come throughout the Territory.

The Urban Development Institute of Australia - Northern Territory is a proud supporter of Pangaea Resources and the Territory onshore gas industry as a whole. In order to support population growth and provide conditions conducive to private sector investment, we believe that the Northern Territory Government should immediately lift the Moratorium on Hydraulic Fracturing.

Yours faithfully,

W A (Bill) Headley
Chief Executive Officer

0457 882 793

INFORMATION SUBMISSION TO THE SCIENTIFIC INQUIRY INTO HYDRAULIC FRACTURING IN THE NORTHERN TERRITORY

Document Number:	180215_Pangaea_ Information Submission_Scientific Inquiry into Hydraulic Fracturing
Title:	The Pangaea Beetaloo Basin Development Model for Public Benefit (The *NT WAY*)
Author:	Pangaea (NT)
Date:	15 February 2018

APPROVAL FOR EXTERNAL RELEASE

Tim Radburn
Executive Director
Pangaea Resources Pty Ltd

Date : 15 Feb 2018

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Appendices

Attachment:

1. Model expenditure and employment opportunity on a per unit basis
2. Model local opportunity on a per unit basis under demand scenarios
3. Model job opportunity on a per unit basis by industry/sector

Enclosures:

1. About Pangaea
2. Supply Hub Case Studies
3. Pangaea's NT work program
4. Breakdown of Opportunities by Industry
5. Training and Employment Opportunities
6. Business Development Opportunities
7. Volume data on a per unit per well basis

Introduction

Pangaea (background contained in enclosure 1 and permit areas indicated in figure 1) would like to thank the Inquiry for enabling further submission of a model (the Pangaea Beetaloo Basin Development Model) showing a real assessment of public benefit generated through the development of the onshore gas industry based on a range of timeframes, pace of development and scale of development to meet various demand scenarios. It does not attempt to display what will be done but to indicate what can be done based on a number of factors, not least withstanding the lifting of the moratorium on hydraulic fracturing without further delay. The lifting of the moratorium being commensurate with the continuation of exploration in 2018; whilst conducting a regional baseline assessment on a clear pathway towards production.

The Pangaea Beetaloo Basin Development Model for Public Benefit has been built based on analogue demand scenarios of 400TJ/day and 1000TJ/day, similar to the wind and gale scenarios developed by ACIL Allen, however showing in some detail the volume of expenditure and number of jobs anticipated to be available in any given operating year. The model has been further broken down into industry / sectors in order to demonstrate that there are multiple benefactors within the Territory economy and community, and that ample public benefit flows from enhanced business development opportunities.

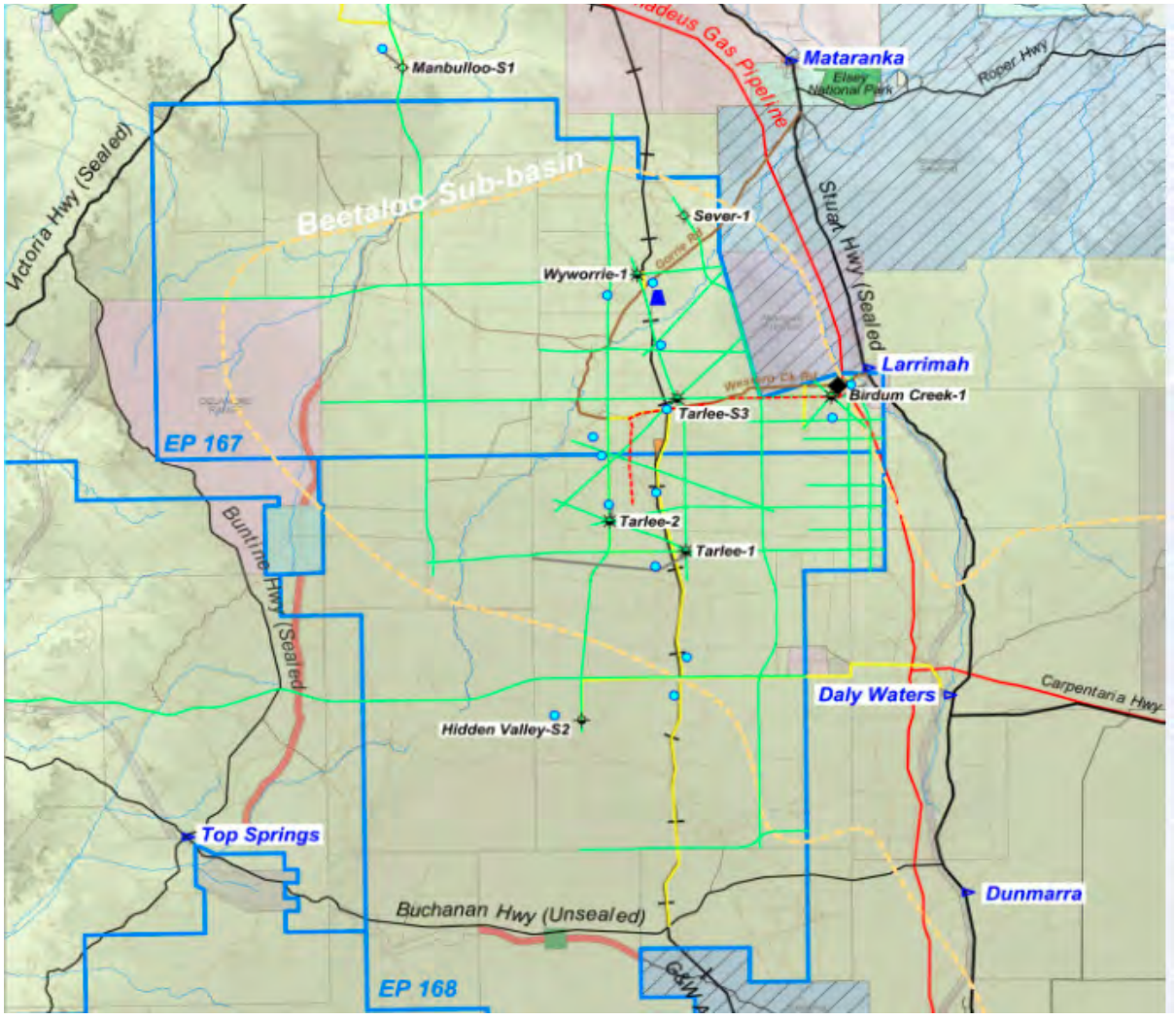

Figure 1. Map of Pangaea's permit area and work program to date

Global and historic models

In preparing the Pangaea Beetaloo Basin Development Model for public benefit, a review of previous economic models (Deloitte Access Economics 2015 and ACIL Allen 2017), demand scenarios and case studies (Institute for Economic Development 2014, Peel Gas and Oil 2015 and Marcellus Shale Coalition 2017) from other basins around the world has been conducted (enclosure 2). There are simple connections to the scale of other basins, the potential of the Beetaloo Sub-basin and the conservative estimates most recently published.

The Deloitte report (Deloitte Access Economics 2015) produced figures that are varied due to very optimistic analysis of CAPEX, OPEX and cost at well head, as well as other factors that were somewhat accurate at the time but that in 2018 are no longer accurate. The scale of production considered by Deloitte was however reasonable in that it considered a rate of production three times higher than the highest scenario utilised by ACIL Allen, which is appropriate in light of expansion of LNG trains to full capability.

The highest scenario anticipated by ACIL Allen is probably a reasonable forecast of the initial level of production with just one operator at full production. The Gale scenario developed by ACIL Allen did not take into account any expansion of LNG trains but simply backfill of existing capacity as offshore resources enter decline. With this in mind, it is easy to reach the volume of supply anticipated by Deloitte even if the cost figures should more reasonably reflect those produced by ACIL Allen.

If all three operators in the Beetaloo Basin were to reach a state of production each equivalent to the Gale scenario produced by ACIL Allen, to meet the highest domestic demand as well as the maximum capacity LNG export demand, then the scale of the Beetaloo Basin as a whole begins to look more like the case studies of the Bowland and Marcellus Basins (enclosure 2) – the economic and employment benefits in particular. The Beetaloo Basin is a global scale resource and if fully developed can be compared to some of the largest basins in the world, meaning there is every possibility of reaching the scale of production identified by Deloitte which would have an effect of multiplying the figures derived by ACIL Allen by a factor of at least three.

The Pangaea Beetaloo Basin Development Model

The Pangaea Beetaloo Basin Development Model for Public Benefit has been derived from Pangaea's 2015 work program (enclosure 3) and US shale gas industry well and logistics volume data (enclosure 7). The model has been built around a concept of development units. Under this model there is an exploration unit, an appraisal unit and a production unit. Each unit is defined by a number of pads, wells, seismic surveys, infrastructure projects (figure 2) and so forth in order to attribute a value based on a realistic understanding of the amount of development occurring at any given time.

The calculated expenditure on a per unit basis is provided in full at attachment 1 along with the logistics volume data underpinning the expenditure (enclosure 7).

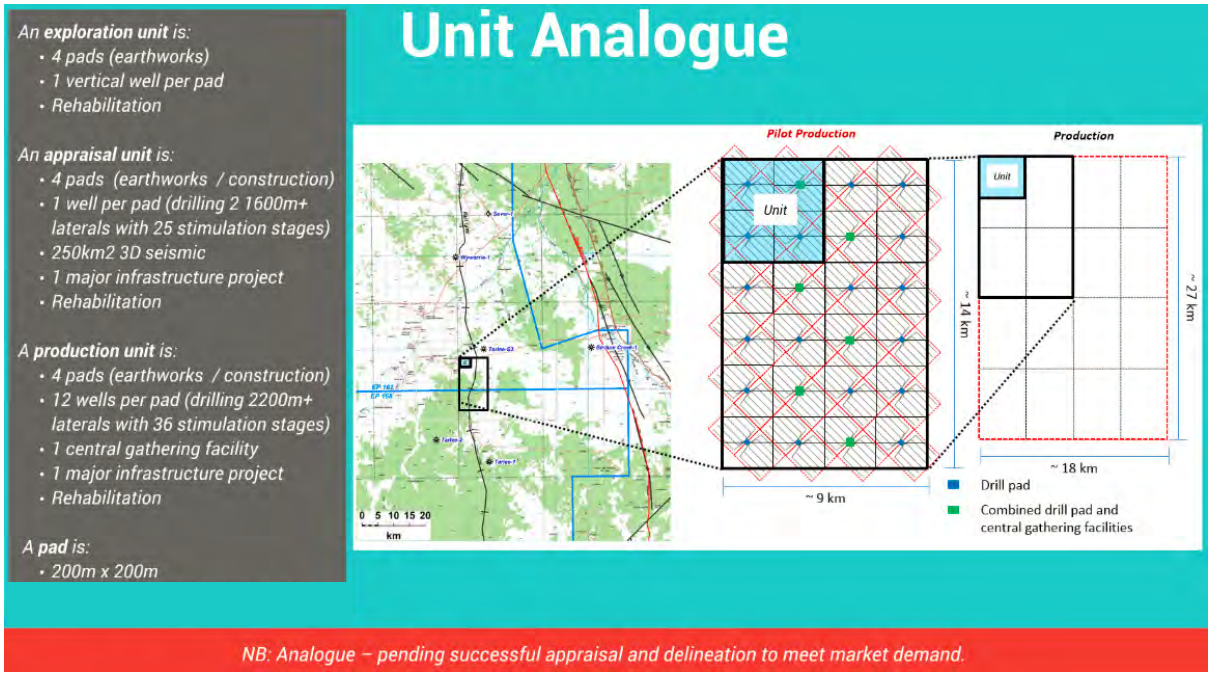

Figure 2. Unit definition

Exploration units are characterised by the same number of pads being spread much further apart with less wells. Appraisal units are characterised by being closer together narrowing in on a sweet spot with a combination of vertical and horizontal wells to determine flow rates. Production units are characterised by being focussed in a sweet spot yet still spread out by the length of horizontal laterals with gathering facilities on at least one of the pads. Major infrastructure projects such as infield facilities and pipelines, roads and other earthwork/construction work are factored into respective units with the greater spends allocated against production units.

Development approach

Development of a shale gas play occurs in phases, from exploration to appraisal, then delineation, pilot production, development and production. As the development moves from exploration and appraisal of one development area, further exploration and appraisal continues in order to find the next development area.

With this in mind, the number and type of units under the model calculations can be scaled up or down based on demand scenarios, they can be rolled out quickly or slowly based on the degree of ramp up, and importantly they can exist in multiple combinations such that even in production there is still a continuation of exploration and appraisal occurring in other areas. An example of the local opportunity on a per unit basis, based on a combination and scale of units under the two demand scenarios can be seen at attachment 2.

Formula rollout

Once an area has been appraised and deemed suitable for production, the scale of development can gradually ramp up and in turn the degree of expenditure moves towards the figures identified in the model on a production unit basis. The footprint remains relatively small, in accordance with figure 3 but the degree of expenditure increases

significantly due to the number of wells being drilled on each pad which in turn generates a sizable logistics investment (Accenture, 2013).

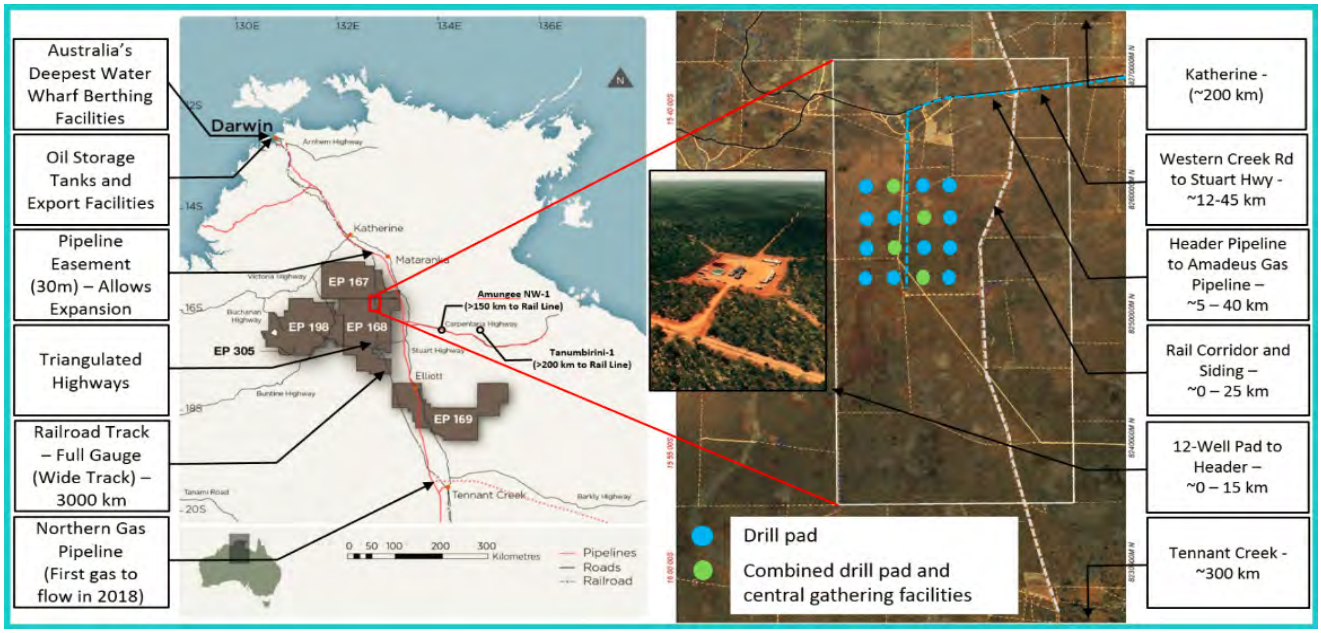

Figure 3. 7 year development analogue based on 400TJ/day or 0.5 of a production unit per annum

Expenditure by industry analogue

The expenditure on a per unit basis has been broken down based on industry / sector and can be clearly identified at attachment 1. This has been further explained in a graphical representation of supporting industries to the onshore gas industry and the nature of opportunities and expenditure within these industry / sectors (enclosure 4). Additionally an example of further business development opportunities that may be available as a result of the development of the onshore gas industry has been considered (enclosure 6).

Training and employment pathways

A calculation of direct job opportunities available on a per unit basis is displayed at attachment 3. Furthermore the commitment to investment in training programs and generating pathways into the onshore gas industry have been assessed in the model based on Pangaea's *NT WAY* approach to operating in the Territory (enclosure 5). This strategic approach to engagement between Government, Educational institutions and Industry is summarised in figure 4.

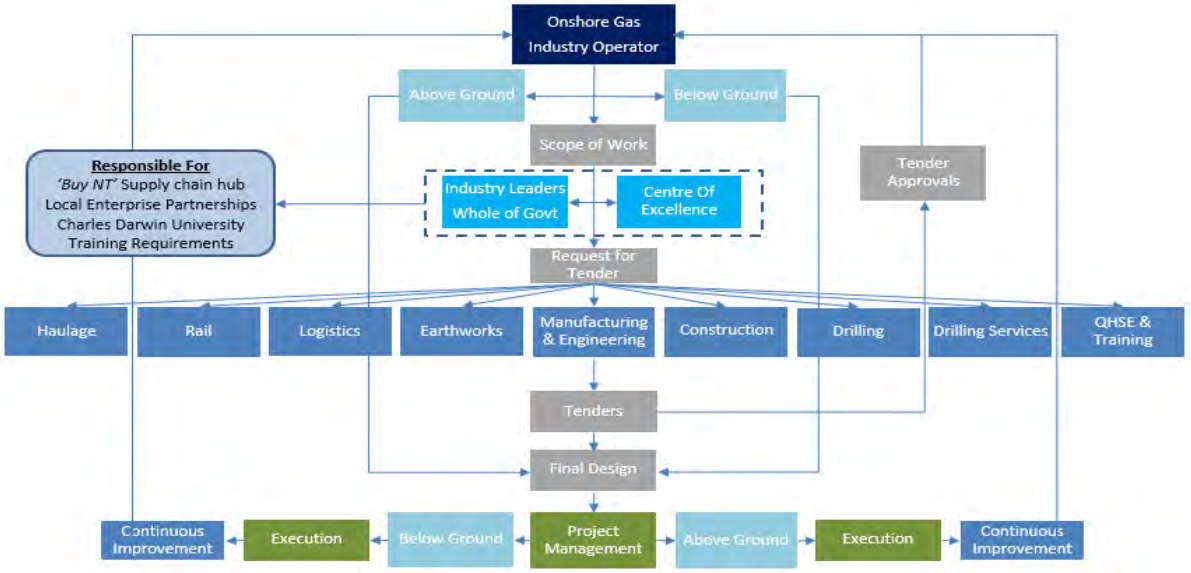

Figure 4. Whole of Government and Industry strategic approach to training and employment pathways linked to project tenders and local business opportunities

Conclusion

The Pangaea Beetaloo Basin Development Model is based on actual expenditure by Pangaea in its exploration work program in 2015 and our best budget estimates based on close analysis of actual onshore gas development in multiple basins in the United States and more recently in the United Kingdom. The model does not take into account the geological uncertainty inherent in all projects of this nature and assumes that any changes to the existing regulatory framework is appropriate and economically viable. The purpose of the model has been to provide a more accurate and detailed account of the amount of expenditure and the scale of employment opportunities, including the specific areas that it is most likely to be spent in. Ultimately the growth of the onshore gas industry, the social and economic benefit of development (enabled through hydraulic stimulation), in Pangaea's view, does not need to come at an adverse environmental cost. Pangaea would like to see a successful onshore gas industry grow in the Northern Territory in a way that enables the growth, success and public benefit to be felt Territory wide.

Pangaea achieves its *NT WAY* approach to business ensuring it is fully integrated into the whole of community and works through, by and with it. World's best geological analysis combined with industry best practice innovation and technology, forms the basis of Pangaea's technically led sub-surface approach. This in turn forms a nexus that creates sufficient flexibility to design operations around attainment of Territory best social benefit (continuous retention of social license to operate and maintenance of stakeholder goodwill). Pangaea takes very seriously the views and opinions of all Territorians and asserts again that with appropriate regulation - which Pangaea believes is currently in place for exploration to continue immediately - the industry can grow to ensure best practice is nested with proper protection of the environment, Territorians and industry employees.

References

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Model expenditure opportunity on a per unit basis

Disclaimer

This Pangaea Beetaloo Basin Development Model for Public Benefit is an analogue based on Pangaea assessment of logistics volumes required on a per unit basis, under ACIL Allen demand scenarios, combined with assessment of reports on scale and supply hubs from US and UK shale basins.

EXPLORATION ANALOGUE BY UNIT	
Exploration Unit	**Spend $**
1 unit = 4 pads with 1 vertical well per pad in exploration mode	$49,489,221.00
Total Spend	**$49,489,221.00**
Local spend per unit in 2015 (2015 works program actual)	$9,341,738
Local spend per unit achievable in 2019	$13,977,698
Local spend per unit achievable by 2021 NB: based on level of local industry / business capability development over time	**$13,977,698 - $36, 510, 595**
Component of spend available to local industry / business	**Spend $**
Earthworks (by exploration unit)	**$6,441,358**
Drill pad access and civils	$4,334,874
Drilling Sump/pump	$230,010
Water storage	$545,630
Surveys	$36,400
Road Maintenance	$135,965
Gates and Fencing	$12,201
Tiltmeter Seismic Prep	$241,945
Seismic Clearance	$696,851
Rehabilitation 2D and Tilt	$207,482
Sector employment in 2015 (total/local)	**100/80**
Construction/Engineering (by exploration unit)	**$4,605,173**
Road engineering	$360,000
Pipeline engineering	$150,000
Laydown area	$150,000
All weather access	$600,000
Safety management system	$30,000
Dam (water management)	$100,000
Crane service	$408,429
Camp and site office	$2,806,744
Sector employment in 2015 (total/local)	**15/15**
Manufacturing (by exploration unit)	**$3,367,368**
Well Tubulars (e.g casing, tubing)	$2,411,367
Well Tubular Accessories	$238,925
Drilling Bits	$501,156
Wellhead Equipment	$215,920
Sector employment in 2015 (total/local)	**5/5**
Drilling (by exploration unit)	**$10,732,811**

Rig mobilisation	$5,092,081
Rig operation (includes Crew cost)	$5,640,730
Sector employment in 2015 (total/local)	**30/0**
Drilling services (by exploration unit)	**$8,270,451**
Equipment rental (fishing, wellhead, fraccing)	$231,135
Wireline	$3,321,974
Mud logging	$485,558
Cementing	$1,539,608
Stimulation mobilisation	$265,000
Coring operations (including mobilisation)	$1,414,355
Core analysis - field	$526,256
Completion operations (including mobilisation)	$486,565
Sector employment in 2015 (total/local)	**15/0**
Logistics (by exploration unit)	**$1,361,210**
Freight	$392,346
Haulage	$266,992
Core storage and handling	$276,208
Sand	$177,212
Fuel Charge	$59,921
Helicopter Charter	$83,147
Accommodation/meals	$105,384
Sector employment in 2015 (total/local)	**15/15**
Training (by exploration unit)	**$627,407**
Safety/risk	$40,000
Construction/earthworks	$20,000
Engineering/manufacturing	$10,000
Indigenous/youth (program establishment)	$557,407
Sector employment in 2015 (total/local)	**55/55**
Consulting (by exploration unit)	**$1,100,320**
Environmental Consulting	$270,831
Pastoral Consulting	$511,350
Cultural Consulting	$161,411
Management Consulting	$142,415
Safety Consulting	$111,500
Cultural Awareness Training	$14,313
Sector employment in 2015 (total/local)	**25/25**
Employment (by exploration unit)	**$1,621,971**
Drilling specialists	$669,263
Coring personnel	$489,625
Tubing personnel	$72,771
Stimulation crew	$365,650
Pump unit personnel	$24,662
Overall unit employment in 2015 (total/local)	**260/195**

APPRAISAL ANALOGUE BY UNIT	
Appraisal Unit	**Spend $**
1 unit = 4 pads with 1 horizontal well per pad in appraisal mode	$59,813,642.00
250 km2 3D seismic	$9,465,000.00
1 major infrastructure upgrade project	$26,000,000.00
Total Spend	**$95,278,642.00**
Local spend per unit achievable in 2019	$23,762,094
Local spend per unit achievable by 2022 NB: based on level of local industry / business capability development over time	**$24,019,501 - $86,472,657**
Component of spend available to local industry / business	**Spend $**
Earthworks (by appraisal unit)	**$10,855,879**
Drill pad access and civils	$4,894,874
Drilling Sump/pump	$230,010
Surveys	$545,630
Road Construction	$36,400
Road Maintenance	$135,965
Tiltmeter Seismic Prep	$250,000
3D Seismic Clearance	$4,263,000
Rehabilitation 3D	$500,000
Sector employment from 2019 (total/local)	**200/150**
Construction/Engineering (by appraisal unit)	**$9,196,099**
Road engineering	$360,000
Pipeline engineering	$150,000
Laydown area	$150,000
All weather access tracks	$600,000
Gates and Fencing	$50,000
Water management	$2,176,170
Safety management system	$100,000
Crane service	$408,429
3D seismic mobile camp	$5,201,500
Camp and site office	$2,806,744
Major infrastructure project (pipeline/road etc)	$26,000,000.00
Sector employment from 2019 (total/local)	**110/100**
Manufacturing (by appraisal unit)	**$5,545,261**
Well Tubulars (e.g casing, tubing)	$3,540,884
Well Tubular Accessories	$352,000
Drilling Bits	$892,553
Wellhead Equipment	$215,920
Pad Production Equipment (e.g. tanks, separators, flowlines)	$543,904
Sector employment from 2019 (total/local)	**10/10**
Drilling (by appraisal unit)	**$11,046,958**
Rig mobilisation	$5,469,024

Rig operation (includes Crew cost)	$5,577,934
Sector employment from 2019 (total/local)	**60/0**
Drilling services (by appraisal unit)	**$16,855,678**
Equipment rental (fishing, wellhead, fraccing)	$1,099,631
Wireline	$4,463,259
Mud logging	$556,492
Cementing	$1,697,384
Stimulation	$1,085,400
Coring operations (including mobilisation)	$1,736,147
Core analysis - field	$526,256
Completion operations (including mobilisation)	$2,876,406
Camp services and supplies	$2,153,550
Operation services and maintenance	$661,153
Sector employment from 2019 (total/local)	**20/0**
Logistics (by appraisal unit)	**$4,241,817**
Freight	$392,346
Haulage	$266,992
Core storage and handling	$177,212
Sand	$2,906,720
Fuel Charge	$323,750
Helicopter Charter	$83,147
Accommodation/meals	$91,650
Sector employment from 2019 (total/local)	**20/20**
Training (by appraisal unit)	**$700,000**
Safety/risk	$180,000
Construction/earthworks	$140,000
Engineering/manufacturing	$80,000
Indigenous/youth	$300,000
Sector employment from 2019 (total/local)	**75/75**
Consulting (by appraisal unit)	**$988,820**
Environmental Consulting	$270,831
Pastoral Consulting	$511,350
Cultural Consulting	$161,411
Management Consulting	$30,915
Cultural Awareness Training	$14,313
Sector employment from 2019 (total/local)	**50/50**
Employment (by appraisal unit)	**$990,002**
Drilling Specialists	$669,263
Contract Labour	$291,170
Stimulation Crew	$256,575
Stimulation Specialists	$442,257
Overall unit employment from 2019 (total/local)	**535/395**

PRODUCTION ANALOGUE BY UNIT	
Production Unit	**Spend $**
1 unit = 4 pads with 12 horizontal wells per pad in production mode	$645,669,754.00
1 gathering station with associated gathering facilities	$35,880,000.00
1 major infrastructure development project	$26,000,000.00
Total Spend	**$707,549,754.00**
Local spend per unit achievable by 2023 NB: based on level of local industry / business capability development over time	**$227,947,237 - $552,761,890**
Component of spend available to local industry / business	**Spend $**
Earthworks (by production unit)	**$32,663,014**
Drill pad access and civils	$31,214,874
Drilling Sump/pump	$230,010
Surveys	$545,630
Road Maintenance	$172,500
Rehabilitation	$500,000
Sector employment from 2023 (total/local)	**200/200**
Construction/Engineering (by production unit)	**$107,150,664**
Road engineering	$360,000
Pipeline engineering	$150,000
Gathering facilities	$35,880,000
Laydown area	$150,000
All weather access tracks	$600,000
Gates and Fencing	$50,000
Water management (including haulage)	$65,153,920
Safety management system	$500,000
Crane service	$1,500,000
Camp and site office	$2,806,744
Major infrastructure project (pipe/road/rail/water/sand)	$26,000,000.00
Sector employment from 2023 (total/local)	**120/120**
Manufacturing (by production unit)	**$108,805,832**
Well Tubulars (e.g casing, tubing)	$37,708,948
Well Tubular Accessories	$8,448,000
Drilling Bits	$16,024,800
Wellhead Equipment	$5,690,400
Pad Production Equipment (e.g. tanks, separators, flowlines)	$13,053,684
Gathering Facility Equipment (e.g. compression, treatment units, metering)	$27,880,000
Sector employment from 2023 (total/local)	**30/10**
Drilling (by production unit)	**$60,184,000**
Rig mobilisation	$19,000,000
Rig operation (includes Crew cost)	$41,184,000
Sector employment from 2023 (total/local)	**100/80**

Drilling services (by production unit)	**$106,875,358**
Equipment rental (surface, fishing, wellhead, fraccing)	$18,592,640
Wireline	$33,951,552
Mud logging	$5,056,000
Cementing (including freight)	$16,055,440
Stimulation	$19,680,000
Completion operations (including mobilisation)	$2,876,406
Inspections, Maintenance and supplies	$5,240,280
Operation services and supplies	$5,423,040
Sector employment from 2023 (total/local)	**70/70**
Logistics (by production unit)	**$116,736,845**
Freight	$392,346
Haulage (hot shots)	$266,992
Sand (including haulage)	$107,827,000
Fuel Charge	$4,694,500
Helicopter Charter	$83,147
Drive in / Drive out transport	$1,500,000
Accommodation/meals	$1,972,860
Sector employment from 2023 (total/local)	**150/150**
Training (by production unit)	**$1,420,000**
Safety/risk	$330,000
Construction/earthworks	$260,000
Engineering/manufacturing	$140,000
Petroleum	$240,000
Indigenous/youth	$450,000
Sector employment from 2023 (total/local)	**150/150**
Consulting (by production unit)	**$1,574,507**
Environmental Consulting	$270,831
Pastoral Consulting	$511,350
Cultural Consulting	$161,411
Community Engagement Consulting	$120,000
Safety Consulting	$240,000
Media / Communications Consulting	$90,000
Political / Regulatory Consulting	$90,000
Management Consulting	$30,915
Cultural Awareness Training	$60,000
Sector employment from 2023 (total/local)	**100/100**
Employment (by production unit)	**$13,069,463**
Drilling specialists	$3,784,143
Contract Labour	$4,896,320
Stimulation crew	$1,185,000
Stimulation Specialists	$3,204,000
Overall unit employment from 2023 (total/local)	**920/880**

Model local opportunity on a per unit basis under demand scenarios

Disclaimer

This Pangaea Beetaloo Basin Development Model for Public Benefit is an analogue based on Pangaea assessment of logistics volumes required on a per unit basis, under ACIL Allen demand scenarios, combined with assessment of reports on scale and supply hubs from US and UK shale basins.

Low-end demand development analogue (400TJ/day)	**Exploration Units**	**Appraisal Units**	**Production Units**	**Total maximum local opportunity by total units**
Analogue maximum local spend per annum 2023-2025	**0.5**	**0.5**	**0.5**	**$133mm - $338mm**
Analogue maximum local spend per annum 2026-2027	**1**	**1**	**1**	**$266mm - $676mm**
Analogue maximum local spend per annum 2028-2040	**0.5**	**0.5**	**0.5**	**$133mm - $338mm**
Analogue local jobs available on average per annum 2023-2040	**97**	**198**	**440**	**735**

High-end demand development analogue (1000TJ/day)	**Exploration Units**	**Appraisal Units**	**Production Units**	**Total maximum local opportunity by total units**
Analogue maximum local spend per annum 2023-2025	**1**	**1**	**0.5**	**$152mm - $399mm**
Analogue maximum local spend per annum 2026-2027	**2**	**2**	**2**	**$531mm - $1,351mm**
Analogue maximum local spend per annum 2028-2040	**1**	**1**	**1**	**$266mm - $676mm**
Analogue local jobs available on average per annum 2023-2040	**195**	**395**	**880**	**1470**

Model job opportunity on a per unit basis by industry/sector

EXPLORATION ANALOGUE BY UNIT	(total/local)
Earthworks	100/80
Construction/Engineering	15/15
Manufacturing	5/5
Drilling	30/0
Drilling services	15/0
Logistics	15/15
Training	55/55
Consulting	25/25
Overall exploration unit employment (total/local)	260/195

APPRAISAL ANALOGUE BY UNIT	(total/local)
Earthworks	200/150
Construction/Engineering	110/100
Manufacturing	10/10
Drilling	60/0
Drilling services	20/0
Logistics	20/20
Training	75/75
Consulting	50/50
Overall appraisal unit employment (total/local)	535/395

PRODUCTION ANALOGUE BY UNIT	(total/local)
Earthworks	200/200
Construction/Engineering	120/120
Manufacturing	30/10
Drilling	100/80
Drilling services	70/70
Logistics	150/150
Training	150/150
Consulting	100/100
Overall production unit employment (total/local)	920/880

Enclosure 1

About Pangaea

About Pangaea (Northern Territory)

It is Pangaea's view that the social and economic benefit of development of an onshore gas industry (enabled through hydraulic stimulation) does not need to come at an environmental or social cost. Pangaea would like to see a successful onshore gas industry grow in the Northern Territory in a way that enables the growth, success and public benefit Territory wide.

Pangaea achieves its 'NT Way' approach to business based on world's best geological analysis, combined with industry best practice innovation and technology. This forms a nexus that creates sufficient flexibility to design operations around attainment of Territory best social benefit (retention of social license to operate).

Pangaea takes very seriously the views and opinions of all Territorians and asserts that with appropriate regulation the industry can continue to grow to ensure best practice is nested with proper protection of the environment, Territorians and employees.

'The NT Way'

In line with our business principle we call 'The NT Way', Pangaea works to attract and retain a talented local workforce:

If we are going to work towards the development of a clean-burning, reliable, and abundant natural gas resource that will improve our energy security and national security for generations of Territorians and Australians to come; indeed, safe shale development is more than human, tradition and environmental safety.

It must also consider community aspects, providing new opportunities for family-sustaining employment in a variety of fields working through, by and with the onshore shale natural gas industry.

Enclosure 2

Supply Hub Case Studies

Onshore Shale Industry Tempo Upside

24/7 - 365

Wet season income

Year round premium workforce talent

Competitive salaries verse southern states

Nature of Onshore Shale Gas Industry

- *The onshore shale gas industry is not a short term construction project (it won't finish in 5 years) and the Beetaloo Sub-basin is not a small basin (it has over 200 years of supply potential).*
- *It is a 20+ year development project requiring new drilling to sustain production.*
- *The US shale gas industry experience has shown that local industry and local business is essential in underpinning high efficiency, low cost development of a commercial gas asset. It simply can not be done without local industry buy in and support.*
- *FIFO of a work force over 20+ years is not efficient or cost effective.*

Creating an Onshore Shale Supply Hub

United States- Supply Chain Catagories

Capital Goods
- ***Construction and utility equipment***
- ***Machine and Cutting tools***
- *Material handling and cranes*
- *Engines and power systems*
- ***Trucks and truck equipment***
- *Pumps and pumping equipment*
- *Gas compression equipment*
- *Pipeline trenching and boring equipment*
- *Flow measurement and control equipment*
- *Storage equipment and tanks*

Materials
- *Steel, tubular and fabricated*
- *Sand*
- *Chemicals*
- *Cement*
- *Hoses fittings and components*
- *Agregates*
- *Ready Mix*

Construction / Well services
- *Well services and drilling support*
- *Well pad access and gathering infrastructure*
- *Processing, and midstream infrastructure*
- *Roads and other public infrastructure*

Logistics
- *Pipeline shipment*
- *Rail shipment*
- *Truck and water shipment*

Professional Services
- *Facilities and site engineering*
- *Land and right of way services*
- *Water supply and managment*
- *Environmental engineering*
- *Waste managment and disposal*

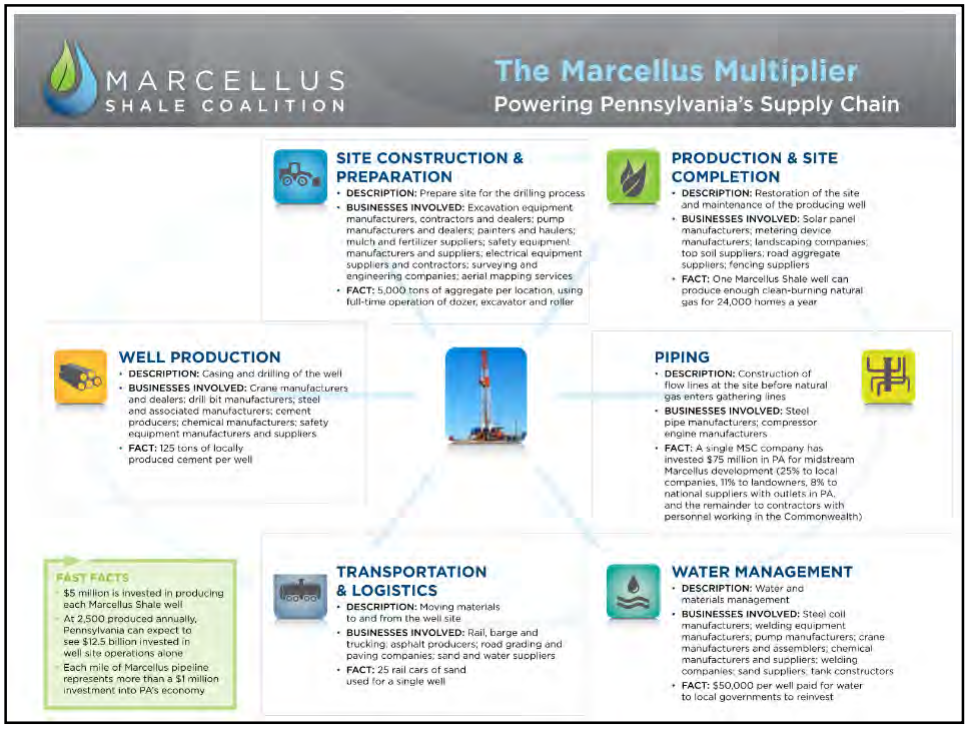
United Kingdom- Supply Chain Catagories

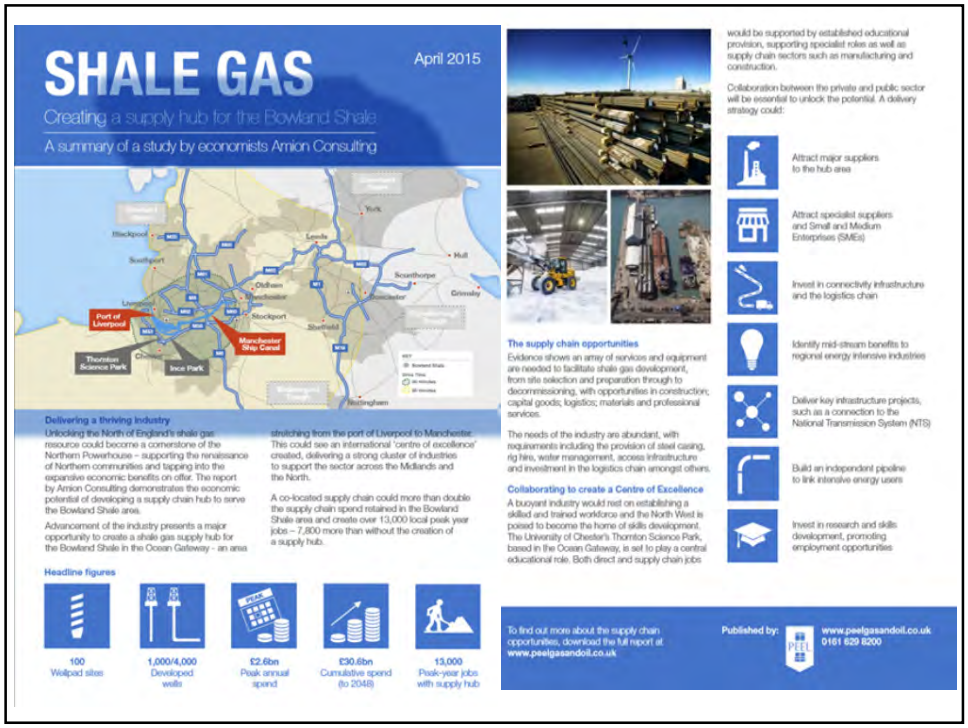
Aquisition and Exploration
- *Environmental and regulatory approval*
- *Surface leasing and permits*
- *Geophysical and geomechanical surveys*
- *Site excavation and preparation*
- *Drilling*
- *Evaluation*

Production
- *Confirming well viability*
- *Installing surface facilities*
- *Installing pipe infrustructure*
- *Preparing site for decomissioning*

Stimulation
- *Mobilising and demobilising drilling rigs*
- *Installing permanent wellheads*
- *Mobilising stimulation equipment*
- *Sourcing, delivering and receiving fluids*
- *Pumping fluids*
- *Treating, transporting water and wastewater*
- *Testing for recovery potential*

Drilling and Completion
- *Designing well pad requirements*
- *Mobilising drill rig requirements*
- *Installing infrustructure*
- *Cementing casing into bore*
- *Sourcing, delivering and receiving drilling fluid additives*
- *Drilling and installing production casing*


MARCELLUS
SHALE COALITION
The Marcellus Multiplier
Powering Pennsylvania's Supply Chain
SITE CONSTRUCTION & PREPARATION
• DESCRIPTION: Prepare site for the drilling process
• BUSINESSES INVOLVED: Excavation equipment manufacturers, contractors and dealers; pump manufacturers and dealers; painters and haulers; mulch and fertilizer suppliers; safety equipment manufacturers and suppliers; electrical equipment suppliers and contractors; surveying and engineering companies; aerial mapping services
• FACT: 5,000 tons of aggregate per location, using full-time operation of dozer, excavator and roller
PRODUCTION & SITE COMPLETION
• DESCRIPTION: Restoration of the site and maintenance of the producing well
• BUSINESSES INVOLVED: Solar panel manufacturers; metering device manufacturers; landscaping companies; top soil suppliers; road aggregate suppliers; fencing suppliers
• FACT: One Marcellus Shale well can produce enough clean-burning natural gas for 24,000 homes a year
WELL PRODUCTION
• DESCRIPTION: Casing and drilling of the well
• BUSINESSES INVOLVED: Crane manufacturers and dealers; drill bit manufacturers; steel and associated manufacturers; cement producers; chemical manufacturers; safety equipment manufacturers and suppliers
• FACT: 125 tons of locally produced cement per well
PIPING
• DESCRIPTION: Construction of flow lines at the site before natural gas enters gathering lines
• BUSINESSES INVOLVED: Steel pipe manufacturers; compressor engine manufacturers
• FACT: A single MSC company has invested $75 million in PA for midstream Marcellus development (25% to local companies, 11% to landowners, 8% to national suppliers with outlets in PA, and the remainder to contractors with personnel working in the Commonwealth)
FAST FACTS
$5 million is invested in producing each Marcellus Shale well
At 2,500 produced annually, Pennsylvania can expect to see $12.5 billion invested in well site operations alone
Each mile of Marcellus pipeline represents more than a $1 million investment into PA's economy
TRANSPORTATION & LOGISTICS
• DESCRIPTION: Moving materials to and from the well site
• BUSINESSES INVOLVED: Rail, barge and trucking; asphalt producers; road grading and paving companies; sand and water suppliers
• FACT: 25 rail cars of sand used for a single well
WATER MANAGEMENT
• DESCRIPTION: Water and materials management
• BUSINESSES INVOLVED: Steel coil manufacturers; welding equipment manufacturers; pump manufacturers; crane manufacturers and assemblers; chemical manufacturers and suppliers; welding companies; sand suppliers; tank constructors
• FACT: $50,000 per well paid for water to local governments to reinvest


SHALE GAS
April 2015
Creating a supply hub for the Bowland Shale
A summary of a study by economists Arnion Consulting
Delivering a thriving industry
Unlocking the North of England's shale gas resource could become a cornerstone of the Northern Powerhouse – supporting the renaissance of Northern communities and tapping into the expansive economic benefits on offer. The report by Arnion Consulting demonstrates the economic potential of developing a supply chain hub to serve the Bowland Shale area.
Advancement of the industry presents a major opportunity to create a shale gas supply hub for the Bowland Shale in the Ocean Gateway - an area stretching from the port of Liverpool to Manchester. This could see an international 'centre of excellence' created, delivering a strong cluster of industries to support the sector across the Midlands and the North.
A co-located supply chain could more than double the supply chain spend retained in the Bowland Shale area and create over 13,000 local peak year jobs – 7,800 more than without the creation of a supply hub.
Headline figures
100
Wellpad sites
1,000/4,000
Developed wells
£2.6bn
Peak annual spend
£30.6bn
Cumulative spend (to 2048)
13,000
Peak-year jobs with supply hub
The supply chain opportunities
Evidence shows an array of services and equipment are needed to facilitate shale gas development, from site selection and preparation through to decommissioning, with opportunities in construction; capital goods; logistics; materials and professional services.
The needs of the industry are abundant, with requirements including the provision of steel casing, rig hire, water management, access infrastructure and investment in the logistics chain amongst others.
Collaborating to create a Centre of Excellence
A buoyant industry would rest on establishing a skilled and trained workforce and the North West is poised to become the home of skills development. The University of Chester's Thornton Science Park, based in the Ocean Gateway, is set to play a central educational role. Both direct and supply chain jobs would be supported by established educational provision, supporting specialist roles as well as supply chain sectors such as manufacturing and construction.
Collaboration between the private and public sector will be essential to unlock the potential. A delivery strategy could:
Attract major suppliers to the hub area
Attract specialist suppliers and Small and Medium Enterprises (SMEs)
Invest in connectivity infrastructure and the logistics chain
Identify mid-stream benefits to regional energy intensive industries
Deliver key infrastructure projects, such as a connection to the National Transmission System (NTS)
Build an independent pipeline to link intensive energy users
Invest in research and skills development, promoting employment opportunities
To find out more about the supply chain opportunities, download the full report at www.peelgasandoil.co.uk
Published by:
www.peelgasandoil.co.uk
0161 629 8200

Bowland Shale Supply Hub

Development summary based on:

Developed (vertical/horizontal) wells	-	*100 pads (4000 horizontal wells)*
Annual Cost	-	*2.6bn pounds*
Average annual cost	-	*694m pounds*
Cumulative spend	-	*30.6bn pounds*

Supply chain scenario (peak year employment):

Stage	***Without Hub***	***With Hub***
Direct	*-2,179*	*-5,463*
Indirect	*-2,383*	*-4,683*
Induced	*-769*	*-3,002*
Total	***-5,333***	***-13,148***

Bowland Shale (UK) Vs Marcellus Shale (US)

Occupational Profile (Number of Direct jobs)

Marcellus Shale (US)	
General Office/Accounting, IT, Secretarial ect	-1,109
General Labour	-1,093
Heavy Equipment/Labour	-923
Drivers	-535
Semi-Skilled Tech	-328
Landmen/Realestate	-295
Supervisors	-251
Lawyers	-224
Engineers	-186
Geologists	-142
Welders/Helpers	-71
Timber logging	-71
Paralegal	-60
Cartographer/GIS	-49
Welders Specialists	-49
XRay	-76
Total	**-5,463**

Bowland Shale (UK)	
Drilling /Completions	-3,387
Hydraulic stimulation	-273
Petroleum Engineering/Geoscience	-492
Planning/QHSE/Environmental	-109
Operations Management	-601
Construction	-55
Office Support	-546
Total	**-5,463**

Additional Supply Hub upside

- The creation of a supply hub in the United States and United Kingdom are analysed to have created 2.5 times more jobs than without a hub.

- Expansion and performance of the onshore shale gas sector is predicated on development of an appropriately trained and skilled workforce.

- Supply hubs result in a physical clustering of activity which include SIGNIFICANT opportunities for small to medium business.

- Attracts international manufacturing and scale business volume development.

-Investment in infrustructure to accommodate high activity clusters including power generation and access improvments for regional communities.

*-Promotion of access to employment opportunities through integrated working with **Local Enterprise Partnerships and other public sector organisations to promote access to the jobs that will be created.***

The Beetaloo Effect' - A Compound, Robust Supply Chain

The compound effect potential of job and employment creation as a result of the 'Beetaloo Effect' on the Northern Territory will extend beyond the obvious employment fields of engineering, construction, and equipment operations. It will extend to supporting functions heavily in the fields of health and safety, environment, geology, administration, contracts and purchasing. The local community supporting industries that historically have grown exponentially as a direct result of the 40 plus year lifespan of shale gas plays in the United States extend to food and accommodation, entertainment, fuel, schooling, emergency services, tourism, transport, and greater competitive tension in daily consumables leading to lower cost of living.

NERA NATIONAL ENERGY RESOURCES AUSTRALIA

"...clusters drive a shared economic vision, through innovation, collaboration and competition and provide a vehicle for SMEs, start-ups and innovators to build resilience and capacity to compete in national and global markets."

Miranda Taylor – CEO of NERA

Local Enterprise Partnerships

There is a significant opportunity and potential to create a Northern Territory Supply Hub and 'Centre of Excellence' incorporating Research and Development within Charles Darwin University.

This potential can only be reached if the private sector takes the lead in building on existing economic assets and provides a major input in infrustructure and skills investment to realise the opportunity onshore shale gas development provides.

The generation of significant economic activity and employment, and the associated boost to regional investment, has potential to (based on UK/US studies) present major opportunities to support growth and contribute to initiatives such as the Australian Federal Develop The North Initiative.

Such opportunities are not a given. Allowing component labour and capital simply to be imported will, on the evidence of US and UK studies, reduce the potential economic benefits substantially.

Economic benefits of Shale (US)

'In parts of Pennsylvania, Chesapeake spent more on roads than the state Department of Transportation.' – Daily Review, CHK, Times Tribune

Between 2008 and 2012, America's oil and natural gas industry spent $174 billion each year investing in America's infrastructure. The oil and natural gas industry accounts for almost 15% of all industries' U.S. capital expenditure during that period, more than the utilities and transportation industries combined – 2016 State of American Energy

From 2007 to 2012, the U.S. average annual pay increased by $4,831. Over the same period, workers in the oil and natural gas industry saw, on average, an annual pay increase of $13,624. In 2012, the average annual pay in that industry was $107,198, which is $57,909 higher than the average annual pay across all industries. – 2014 BLS

Key Findings on Economic Impacts of U.S. LNG Exports from U.S. LNG Exports - Impacts on Energy Markets and the Economy study:

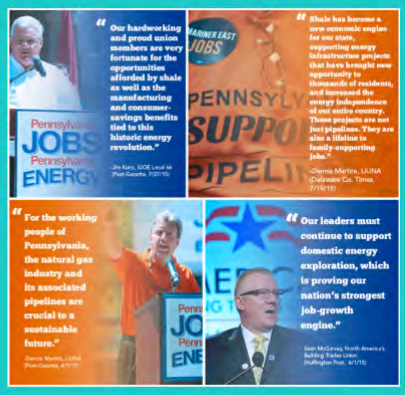
- *Net job growth of between 73,100 to 452,000 jobs on average between 2016 and 2035, including all economic multiplier effects*
- *Net effect on annual U.S. GDP of LNG exports is expected to be positive at about $15.6 to $73.6 billion annually between 2016 and 2035*

Eagle Ford	Economic impact	Direct	Indirect	Induced	Total
Core 15-county area	Output	$90,168,212,826	$10,893,464,660	$5,332,379,266	**$106,394,056,752**
	Employment, full-time	36,785	71,309	42,699	**150,793**
	Payroll	$6,311,816,751	$2,035,342,931	$1,289,319,720	$9,636,479,402
	Gross regional product	$52,608,595,765	$5,805,086,021	$3,402,243,230	$61,815,925,016
	Local government revenues				$3,741,688,868
	State revenue, including severance taxes				$3,774,006,283
Core and neighboring 21-county area	Output	$110,576,454,317	$19,363,931,284	$7,488,598,501	**$137,428,984,102**
	Employment, full-time	38,767	99,786	58,107	**196,660**
	Payroll	$6,718,204,896	$3,432,856,335	$1,927,647,160	$12,078,708,391
	Gross regional product	$57,330,415,830	$10,686,840,880	$4,777,170,284	$72,794,426,994
	Local government revenues				$4,073,239,614
	State revenue, including severance taxes				$4,098,369,070

	County	2013*	2023*
Core 15-county area	Atascosa	$3,309,321,673	$5,888,831,097
	Bee	$382,452,255	$1,473,241,220
	DeWitt	$4,947,708,860	$7,288,946,345
	Dimmit	$8,552,982,031	$12,341,837,612
	Frio	$684,849,735	$1,016,801,803
	Gonzales	$7,463,132,427	$11,369,005,382
	Karnes	$10,964,709,282	$16,752,660,184
	La Salle	$9,001,341,991	$13,574,778,927
	Lavaca	$1,607,274,019	$2,661,190,775
	Live Oak	$6,954,129,494	$8,646,546,519
	Maverick	$175,394,311	$260,171,485
	McMullen	$8,276,163,149	$12,518,235,902
	Webb	$5,008,394,112	$7,051,104,091
	Wilson	$1,444,745,649	$2,109,895,697
	Zavala	$661,926,101	$1,036,509,227
	Total 15-county†	**$69,434,525,089**	**$103,989,756,266**

Labour Unions:

A key partner in Pennsylvania energy development



Enclosure 3

Pangaea's NT work program

Baseline program

- *Landmark regionally extensive environmental baseline study completed by government preferred environmental firm*
- *Extensive regional baseline water studies complete*

Multi Industry NT Macro Integration

- ✓ Gas to market = % NTG and Traditional Ownership Royalties / **Revenue remains in NT**
- ✓ Regional Powergen Advancement = Residential, community and **multi industry growth**
- ✓ Wet season road access = 12 month revenue and **multi industry development opportunity**
- ✓ Rail Siding = Cattle, oil/liquid gas export to market, **multi industry regional logistics hub**

Deloitte Access Economics 2015

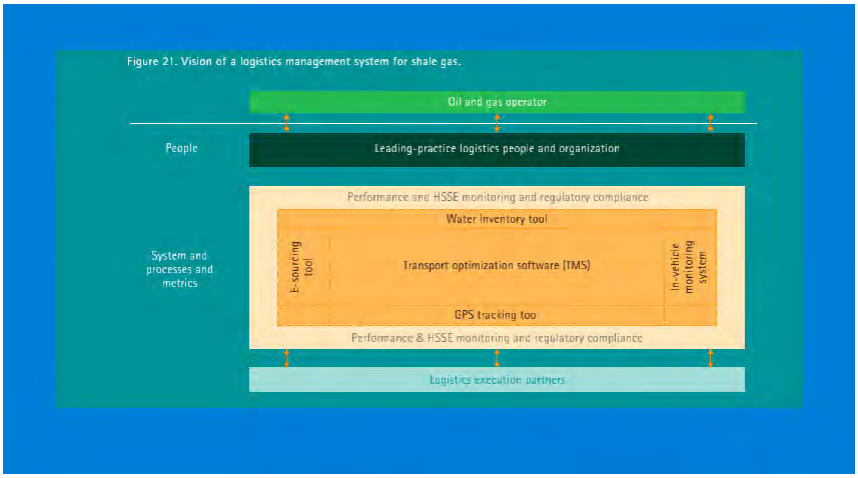
- $22.6b increase in GSP between 2020 and 2040
- Long Term employment boost of 6,300 full time positions in the NT
- Cumulative $961m increase in NTG revenues between 2020 and 2040
- Ability to truly underpin business Initiative and new business.

ACIL Allen 2017

- **$17.5b real output impact**
- **13611 direct and indirect FTE jobs in the NT over development lifecycle**
- **1240 person population growth per annum over lifecycle**
- **1.6b GST income increase over development period**

Enclosure 4

Breakdown of Opportunities by Industry



Logistics

Logistics (by exploration unit)	$1,361,210
Freight	$392,346
Haulage	$266,992
Core storage and handling	$276,208
Sand	$177,212
Fuel Charge	$59,921
Helicopter Charter	$83,147
Accomodation/meals	$105,384
Sector employment in 2015 (total/local)	15/15

Logistics (by appraisal unit)	$4,241,817
Freight	$392,346
Haulage	$266,992
Core storage and handling	$177,212
Sand	$2,906,720
Fuel Charge	$323,750
Helicopter Charter	$83,147
Accomodation/meals	$91,650
Sector employment from 2019 (total/local)	20/20

Logistics (by production unit)	$116,736,845
Freight	$392,346
Haulage (hot shots)	$266,992
Sand (including haulage)	$107,827,000
Fuel Charge	$4,694,500
Helicopter Charter	$83,147
Drive in / Drive out transport	$1,500,000
Accomodation/meals	$1,972,860
Sector employment from 2023 (total/local)	150/150

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Consulting

Consulting (by exploration unit)	$1,100,320
Environmental Consulting	$270,831
Pastoral Consulting	$511,350
Cultural Consulting	$161,411
Management Consulting	$30,915
Safety Consulting	$111,500
Cultural Awareness Training	$14,313
Sector employment in 2015 (total/local)	25/25

Consulting (by appraisal unit)	$1,100,320
Environmental Consulting	$270,831
Pastoral Consulting	$511,350
Cultural Consulting	$161,411
Management Consulting	$30,915
Safety Consulting	$111,500
Cultural Awareness Training	$14,313
Sector employment from 2019 (total/local)	50/50

Consulting (by production unit)	$1,574,507
Environmental Consulting	$270,831
Pastoral Consulting	$511,350
Cultural Consulting	$161,411
Community Engagement Consulting	$120,000
QHSC Consulting	$240,000
Media / Communications Consulting	$90,000
Political / Regulatory Consulting	$90,000
Management Consulting	$30,915
Cultural Awareness Training	$60,000
Sector employment from 2023 (total/local)	100/100

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Rail

Multi user logistics hub (rail siding)

Specific Rail Terminal - Wellsboro, Pa.

Rail freight

Cement, Sand, Steel

Cement (per unit)

		Exploration	Appraisal	Production
Volume	ft3	4,226	4,081	23,102
Weight	kg	180,443	174,303	988,512
	Tonnes	180	174	**989**
Transport Unit *(indicative)*	sacks	4,232	4,088	23,184
Indicative	car	2	2	8

NB: based on 286,000lb per car

Sand (per unit)

		Exploration	Appraisal	Production
Volume	ft3	2,626	40,703	1,386,523
Weight	kg	446,449	6,919,962	235,725,169
	Tonnes	446	6,920	**235,725**
Transport Unit *(indicative)*	car	4	54	1818

Steel Casing/Tubing (per unit)

		Exploration	Appraisal	Production
Weight	kg	15,831,921	28,395,280	**491,503,675**
	Tonnes	15,832	28,395	**491,504**
Transport Unit *(indicative)*	car	123	219	3789

NB: Analogue – pending successful appraisal and delineation to meet market demand

Proppant

Proppant Supply Analogue

Proppant supply analogue by production unit

		Sand (per unit)		
		Exploration	Appraisal	Production
Volume	ft3	2,626	40,703	1,386,523
Weight	kg	446,449	6,919,962	235,725,169
	Tonnes	446	6,920	**235,725**
Transport Unit *(indicative)*	car	4	54	1818

Amount of proppant required for 48 wells

NB - does not include:
- *NT Natural advantages:*
- *Locally sourced*

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Earthworks

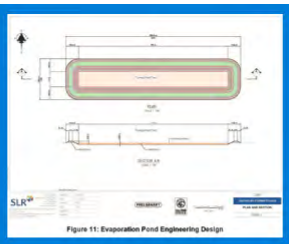


Figure 11: Evaporation Pond Engineering Design

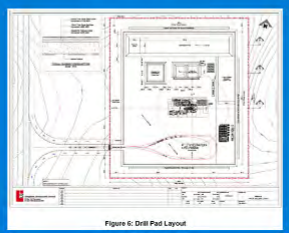


Figure 6: Drill Pad Layout

- Access tracks
- Pads
- Dams

Earthworks

Earthworks (by exploration unit)	$6,441,358
Drill pad access and civils	$4,334,874
Drilling Sump/pump	$230,010
Water	$545,630
FYFE Survey	$36,400
Road Maintenance	$135,965
Gates and Fencing	$12,201
Tiltmeter Seismic Prep	$241,945
Seismic Clearance	$696,851
Rehabilitation 2D and Tilt	$207,482
Sector employment in 2015 (total/local)	100/80

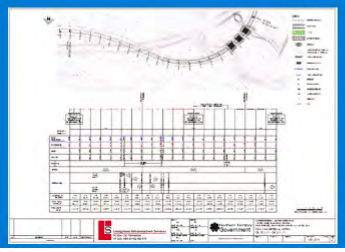
Earthworks (by appraisal unit)	$10,855,879
Drill pad access and civils	$4,894,874
Drilling Sump/pump	$230,010
FYFE Survey	$545,630
Road Construction	$36,400
Road Maintenance	$135,965
Tiltmeter Seismic Prep	$250,000
3D Seismic Clearance	$4,263,000
Rehabilitation 3D	$500,000
Sector employment from 2019 (total/local)	200/150

Earthworks (by production unit)	$32,663,014
Drill pad access and civils	$31,214,874
Drilling Sump/pump	$230,010
Surveys	$545,630
Road Maintenance	$172,500
Rehabilitation	$500,000
Sector employment from 2023 (total/local)	200/200

NB: Analogue – pending successful appraisal and delineation to meet market demand.

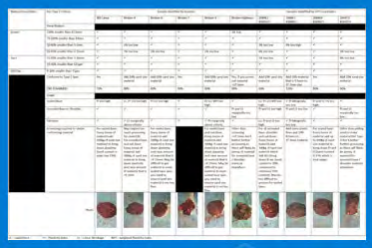
Construction

Road upgrades and improvements



Infield pipeline

Road / construction grade gravel opportunities



Regional power generation / distribution advancements

Single Wire

Solar

Construction

Construction/Engineering (by exploration unit)	$4,605,173
Road engineering	$360,000
Pipeline engineering	$150,000
Laydown area	$150,000
All weather access	$600,000
Safety management system	$30,000
Dam	$100,000
Crane service	$408,429
Camp and site office	$2,806,744
Sector employment in 2015 (total/local)	15/15

Construction/Engineering (by appraisal unit)	$9,196,099
Road engineering	$360,000
Pipeline engineering	$150,000
Laydown area	$150,000
All weather access tracks	$600,000
Gates and Fencing	$50,000
Water management	$2,176,170
Safety management system	$100,000
Crane service	$408,429
3D seismic mobile camp	$5,201,500
Camp and site office	$2,806,744
Major infrastructure project (pipeline/road etc)	$26,000,000.00
Sector employment from 2019 (total/local)	110/100

Construction/Engineering (by production unit)	$107,150,664
Road engineering	$360,000
Pipeline engineering	$150,000
Gathering facilities	$35,880,000
Laydown area	$150,000
All weather access tracks	$600,000
Gates and Fencing	$50,000
Water management (including haulage)	$65,153,920
Safety management system	$500,000
Crane service	$1,500,000
Camp and site office	$2,806,744
Major infrastructure project (pipe/road/rail/water/sand)	$26,000,000.00
Sector employment from 2023 (total/local)	120/120

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Manufacturing

Plug-and-Play manufacturing

The complete module is assembled at the factory from the components (locally manufactured or imported).

All modules, interconnecting piping and cable trays are mechanically fit-tested, and an end-to-end test of the control system is performed.

The module is then disassembled and transported (rail/road) to the well pad for assembly on site.

Manufacturing (by exploration unit)	$3,367,368
Well Tubulars (e.g casing, tubing)	$2,411,367
Well Tubular Accessories	$238,925
Drilling Bits	$501,156
Wellhead Equipment	$215,920
Sector employment in 2015 (total/local)	5/5

Manufacturing (by appraisal unit)	$5,545,261
Well Tubulars (e.g casing, tubing)	$3,540,884
Well Tubular Accessories	$352,000
Drilling Bits	$892,553
Wellhead Equipment	$215,920
Pad Production Equipment (e.g. tanks, seperators, flowlines)	$543,904
Sector employment from 2019 (total/local)	10/10

Manufacturing (by production unit)	$108,805,832
Well Tubulars (e.g casing, tubing)	$37,708,948
Well Tubular Accessories	$8,448,000
Drilling Bits	$16,024,800
Wellhead Equipment	$5,690,400
Pad Production Equipment (e.g. tanks, seperators, flowlines)	$13,053,684
Gathering Facility Equipment (e.g. compression, treatment units, metering)	$27,880,000
Sector employment from 2023 (total/local)	30/10

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Manufacturing (by production unit)	$108,805,832
Well Tubulars (e.g casing, tubing)	$37,708,948
Well Tubular Accessories	$8,448,000
Drilling Bits	$16,024,800
Wellhead Equipment	$5,690,400
Pad Production Equipment (e.g. tanks, seperators, flowlines)	$13,053,684
Gathering Facility Equipment (e.g. compression, treatment units, metering)	$27,880,000
Sector employment from 2023 (total/local)	30/10

Well Tubulars:
- *Conductor Pipe*
- *Surface Casing*
- *Intermediate Casing*
- *Production Casing*
- *Liners*
- *Production Tubing*

Well Tubular Accessories:
- *Pup Joints*
- *Landing Joints*
- *Float Equipment*
- *Centralizers*
- *Couplings*
- *Crossovers*
- *Nipples (Widgets)*
- *Plugs*

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Manufacturing (by production unit)	$108,805,832
Well Tubulars (e.g casing, tubing)	$37,708,948
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Sector employment from 2023 (total/local)	30/10

Drill Bits:

- *Tricone Bits*
- *PDC Bits*
- *Hammer Bits*
- *Core Bits*
- *Nozzles*

Wellhead Equipment:

- *Drilling Spools*
- *Flange Spools*
- *Casing Heads*
- *Tubing Heads*
- *Gate Valves*
- *Studded-crosses*
- *Tree Caps*
- *Adapter Flanges*
- *Blind Flanges*
- *Choke Valves*
- *Safety Valves*
- *Manifolds*

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Manufacturing (by production unit)	$108,805,832
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Gathering Facility Equipment (e.g. compression, treatment units, metering)	$27,880,000
Sector employment from 2023 (total/local)	30/10

Flowlines Separators Tanks Batteries

Pad Production Equipment	Total Cost Per Unit, A$
Tank Battery and Associated Equipment	399,000
Tanks	1,276,800
Seperators	5,985,000
Associated Equipment Package (piping, flowlines, chokes)	5,392,884
TOTALS	13,053,684

Manufacturing (by production unit)	$108,805,832
Well Tubulars (e.g casing, tubing)	$37,708,948
Well Tubular Accessories	$8,448,000
Drilling Bits	$16,024,800
Wellhead Equipment	$5,690,400
Pad Production Equipment (e.g. tanks, seperators, flowlines)	$13,053,684
Gathering Facility Equipment (e.g. compression, treatment units, metering)	$27,880,000
Sector employment from 2023 (total/local)	30/10

Gathering Facility Equipment	Total Cost Per Unit, A$
Compression Package	10,640,000
Glycol Dehydration	5,440,000
Associated equipment package (pipins, flow-lines, chokes etc.)	2,640,000
Line Heaters	2,160,000
Tanks (Water Storage)	1,760,000
Metering package	1,360,000
Gas coalescer	1,360,000
Seperators	1,320,000
Remote Terminal Unit (RTU)	560,000
Combustion Unit	480,000
Sand Trap (Seperator)	320,000
TOTALS	27,880,000

Drilling

Drilling (by exploration unit)	**$10,732,811**
Rig mobilisation	$5,092,081
Rig operation (includes Crew cost)	$5,640,730
Sector employment in 2015 (total/local)	**30/0**

Drilling (by appraisal unit)	**$11,046,958**
Rig mobilisation	$5,469,024
Rig operation (includes Crew cost)	$5,577,934
Sector employment from 2019 (total/local)	**60/0**

Drilling (by production unit)	**$60,184,000**
Rig mobilisation	$19,000,000
Rig operation (includes Crew cost)	$41,184,000
Sector employment from 2023 (total/local)	**100/80**

NB: Local employment range based on level of local industry / business capability development over time

NB: Analogue – pending successful appraisal and delineation to meet market demand.

Drilling Services

Drilling services (by exploration unit)	$8,270,451
Equipment rental (fishing, wellhead, fraccing)	$231,135
Wireline	$3,321,974
Mud logging	$485,558
Cementing	$1,539,608
Stimulation mobilisation	$265,000
Coring operations (including mobilisation)	$1,414,355
Core analysis - field	$526,256
Completion operations (including mobilisation)	$486,565
Sector employment in 2015 (total/local)	15/0

NB: Analogue – pending successful appraisal and delineation to meet market demand.

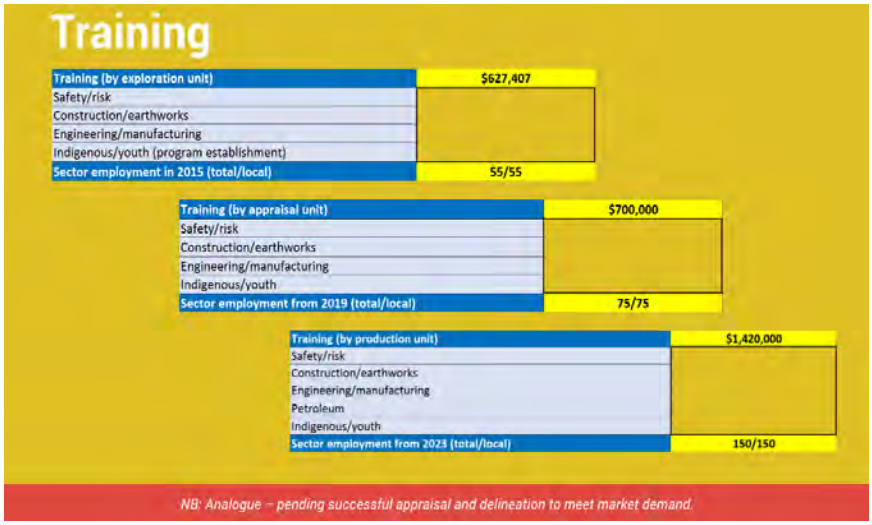
Drilling services (by appraisal unit)	$16,855,678
Equipment rental (fishing, wellhead, fraccing)	$1,099,631
Wireline	$4,463,259
Mud logging	$556,492
Cementing	$1,697,384
Stimulation	$1,085,400
Coring operations (including mobilisation)	$1,736,147
Core analysis - field	$526,256
Completion operations (including mobilisation)	$2,876,406
Camp services and supplies	$2,153,550
Operation services and maintenance	$661,153
Sector employment from 2019 (total/local)	20/0

Drilling services (by production unit)	$106,875,358
Equipment rental (surface,fishing, wellhead, fraccing)	$18,592,640
Wireline	$33,951,552
Mud logging	$5,056,000
Cementing (including freight)	$16,055,440
Stimulation	$19,680,000
Completion operations (including mobilisation)	$2,876,406
Inspections, Maintenance and supplies	$5,240,280
Operation services and supplies	$5,423,040
Sector employment from 2023 (total/local)	70/70

NB: Local employment range based on level of local industry / business capability development over time

Enclosure 5

Training and Employment Opportunities



Employment

EXPLORATION EMPLOYMENT ANALOGUE BY UNIT	(total/local)
Earthworks	100/80
Construction/Engineering	15/15
Manufacturing	5/5
Drilling	30/0
Drilling services	15/0
Logistics	15/15
Training	55/55
Consulting	25/25
Overall exploration unit employment (total/local)	260/195

APPRAISAL ANALOGUE BY UNIT	(total/local)
Earthworks	200/150
Construction/Engineering	110/100
Manufacturing	10/10
Drilling	60/0
Drilling services	20/0
Logistics	20/20
Training	75/75
Consulting	50/50
Overall appraisal unit employment (total/local)	535/395

PRODUCTION ANALOGUE BY UNIT	(total/local)
Earthworks	200/200
Construction/Engineering	120/120
Manufacturing	30/10
Drilling	100/80
Drilling services	70/70
Logistics	150/150
Training	150/150
Consulting	100/100
Overall production unit employment (total/local)	920/880

NB: Figures indicated are the total number of jobs available in a specified unit, they do not relate to a per annum employment growth rate.

The scale of development in the Bowland and Marcellus shale plays is a factor larger than the highest scenario considered for the Beetaloo at this time.

The level of employment is the same factor larger than the figures presented here based on the highest scenario considered for the Beetaloo at this time.

NB: Analogue – pending successful appraisal and delineation to meet market demand.

High School

Job Title	Description	Education
Driver	Operates trucks used to move equipment and supplies on and off highways in all types of conditions.	Year 10
Equipment Operator	Operates heavy equipment typically used in production operations, such as bulldozers, backhoes and excavations.	Year 12
Lease Hand	Performs general labor tasks. Must work outdoors in all weather conditions.	Year 10
Production Foreman	Oversees pumpers and other field personnel.	Year 12
Pumper/Well Tender	Looks after oil and gas wells, monitors the progress of the well and ensures all equipment is functioning properly.	Year 10
Derrick Hand	Handles sections of pipe from a platform on the rig derrick during drilling. Operates and maintains drilling mud systems and pumps. Records mud flows and volumes and takes samples. Operates and maintains	Year 12
Driller	Supervises and organizes the well drilling crew. Operates drilling rig controls and monitors drilling operations.	Year 12
Floor Hand/Roughneck/Rig Hand	Operates well drilling and service rigs. Assists with the connection and disconnection of pipes used in drilling performs general maintenance tasks around the rig.	Year 10
Roustabout	Performs pipe fitting and all-around mechanical tasks.	Year 10
Cement / Frac Crew	Assembles and operates hydraulic pumping systems to pump chemicals, gases, sand,	Year 10
Mud Logger / Hydrocarbon Data Analyst	Collects, analyzes, and records the solids, fluids, and gasses brought to the surface by the	Year 12
Service Rig Operator	Assembles and controls truck-mounted drilling and hoisting equipment used in the servicing of oil or natural gas wells.	Year 12
Truck Driver	Operates trucks used to move equipment and supplies on and off highways in all types of conditions.	Year 10
Wireline Operator	Performs various services on oil and gas well drilling and service rigs. Lowers specialized equipment into wells so that wireline crews can use measurement instruments to gather information about the formations	Year 12

NB: Analogue

TAFE / Trade

Job Title	Description	Education
Compressor Operator	Maintains and troubleshots natural gas compressors and equipment.	Certificate / Trade
Electrician	Installs and maintains electrical equipment.	Certificate / Trade
Vehicle Mechanic	Maintains and repairs automobiles, small and large trucks and diesel equipment.	Certificate / Trade
Diesel Mechanic	Mantains and repairs equipment, much of it diesel-powered.	Certificate / Trade
Welder	Performs a wide variety of welding tasks outdoors and in the shop.	Certificate / Trade
Surveyor	Determines property boundaries. Lays out oil and gas projects. Creates maps.	Certificate / Diploma
Surveyor's Assistant	Assists surveyor in determining property boundaries and laying out projects.	Certificate / Diploma

NB: Analogue

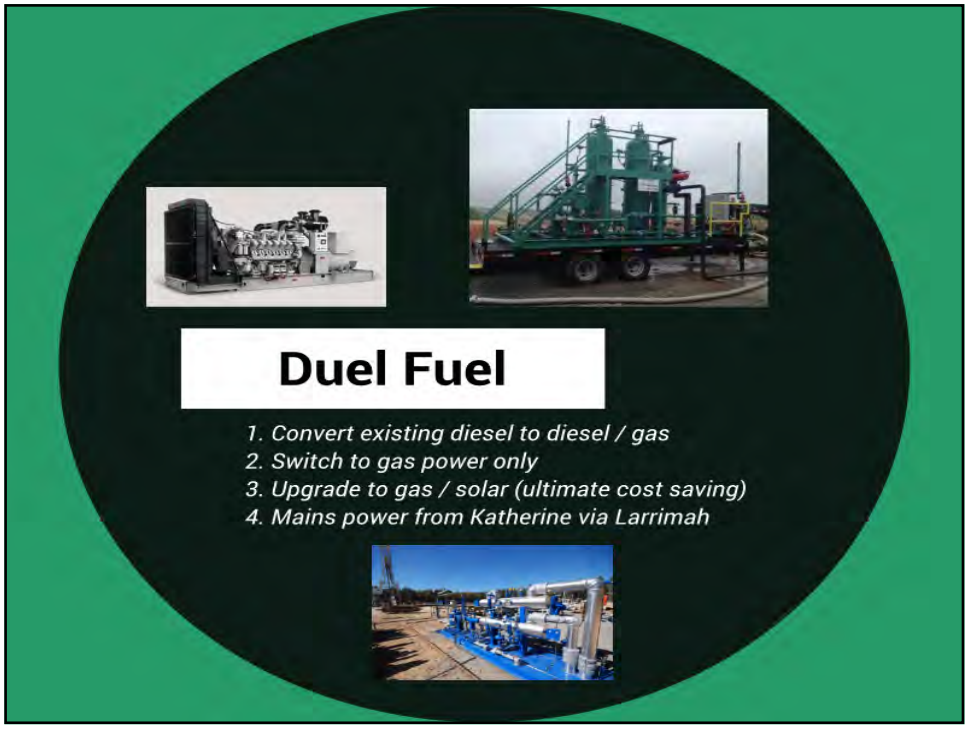
University

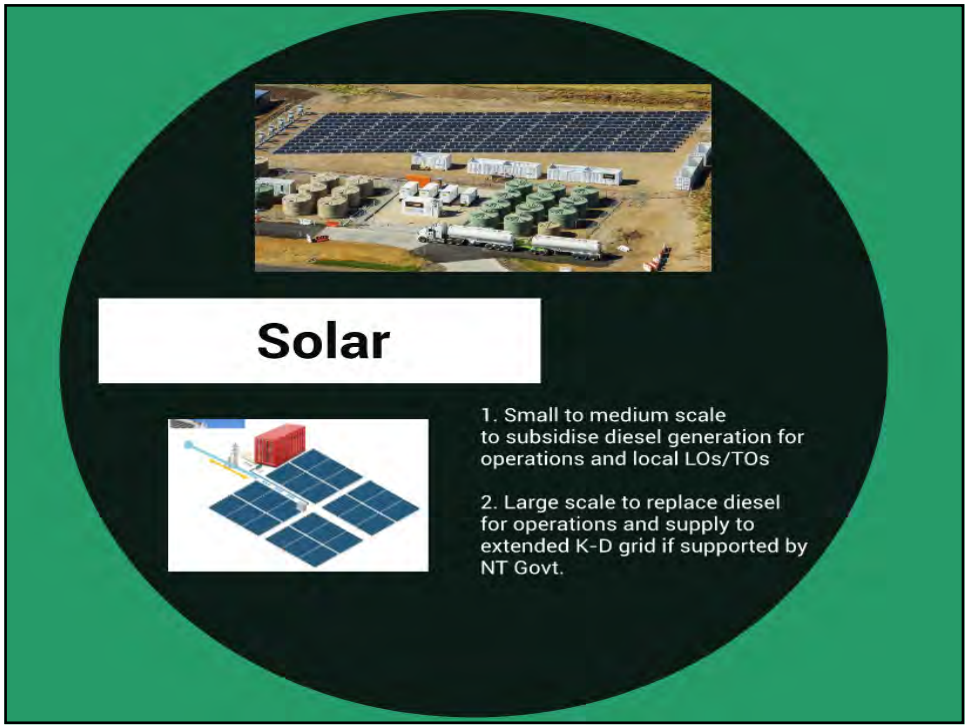
Job Title	Description	Education
Draftsman/Cartographer	Supports the work of engineers, architects by preparing drawings, maps and specifications.	Degree
GIS Specialist	Creates and maintains geographic information system (GIS) databases that enable companies to capture, store, analyze, and display information related to the location of oil and gas well sites, pipelines,	Diploma / Degree
Petroleum Engineer	Analyzes production for problems and makes recommendations for remediation or workovers.	Degree
Field Engineer	Supervises all aspects of drilling, completion, and workover operations.	Degree
Geo Tech	Collects and analyzes geological data for petroleum exploration. Often works in teams with geologists to determine where underground deposits of oil and gas may be.	Degree
Geochemist	Studies the liquid, gas, and mineral deposits contained in rocks. Provides valuable information about the rock formations encountered while drilling for petroleum.	Degree
Geologist	Surveys and interprets an area's geological rock structure. Assesses the prospects of producing oil and gas in that area.	Degree
Geophysicist	Studies the Earth using gravity, magnetic, electrical, and seismic methods to determine likely locations of oil and gas reservoirs.	Degree
Environmental Technician	Develops and implements Environmental and Erosion Sedimentation Plans. Has a complete understanding of environmental law and regulations and their application to the oil and gas industry. Develops and	Degree
Chemical Technician	Performs laboratory tests and tasks on soil and water samples.	Diploma / Degree
Soil Scientist	Conducts soil surveys. Recommends soil management programs. Helps design hydrologic plans. Manages soils for landscape design, mine reclamation, and site restoration.	Degree
Electronics Technician	Identifies electronics, measurement, and control needs. Maintains, repairs, calibrates, and evaluates field measurement and control equipment.	Diploma / Degree

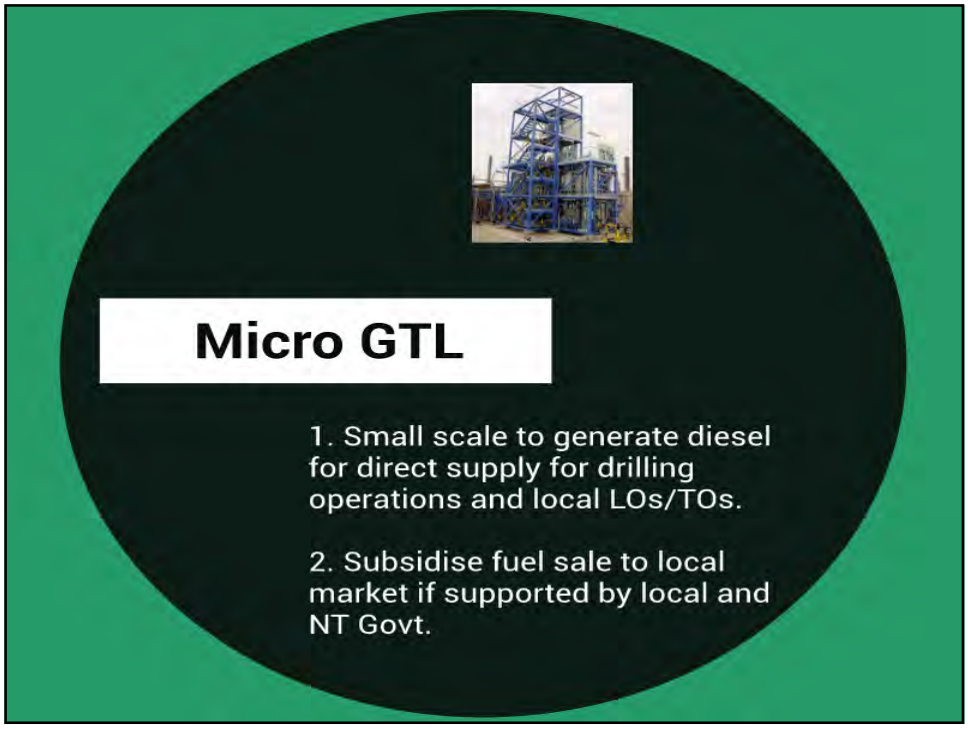
NB: Analogue

Enclosure 6

Business Development Opportunities


Duel Fuel
1. Convert existing diesel to diesel / gas
2. Switch to gas power only
3. Upgrade to gas / solar (ultimate cost saving)
4. Mains power from Katherine via Larrimah


Solar
1. Small to medium scale to subsidise diesel generation for operations and local LOs/TOs
2. Large scale to replace diesel for operations and supply to extended K-D grid if supported by NT Govt.


Micro GTL
1. Small scale to generate diesel for direct supply for drilling operations and local LOs/TOs.
2. Subsidise fuel sale to local market if supported by local and NT Govt.


Powering Local Communities
1. SWER connection to local LOs, towns and TO communities.
2. Subsidise power supply to local market, if supported by local and NT Govt.

POWER SUPPLY OPTIONS

1. Extend the Darwin-Katherine Grid to Timber Creek and/or Top Springs (NT Govt).

2. Construct SWER to 6 Aboriginal Towns currently reliant on diesel power generation (Vic/Daly LGA).

3. Sell subsidised surplus supply from micro GTL and Solar to Victoria-Daly Region.

SMALLER SCALE POWER SUPPLY OPTIONS

1. Construct SWER from operational field to Larrimah and Daly Waters (Roper Gulf LGA).

2. Run SWER along Western Creek Road to link in LOs.

3. Sell subsidised surplus power feed from Solar Power Plant to towns and LOs to substantially offset diesel cost.

4. In time extend the Darwin-Katherine Grid to Daly Waters and connect solar array into D-K grid (NT Govt).

Road Upgrade

1. Joint infrastructure development (Roper Gulf LGA and NT Govt).

2. Upgrade Western Creek Road's dirt road to bitumen from the highway through to Dry River Road.

Proppant Supply

1. Opportunity for locally sourced sand available within the development area.

2. More local jobs in the community

3. Minimises road movements of sand and other supplies

Supply Hub Opportunities

1. Increased rail capacity / siding / passing loop
2. Agribusiness
3. Pastoral
4. Beetaloo Sub-Basin gas logistics

Regional Medical Capability Growth

1. Enhanced medical, surgical and evacuation capabilities
2. Golden hour to surgical
3. Enhanced medical capability that is currently non-existent in regional NT

Accommodation Development Opportunities

1. Camp construction and Regional housing projects

2. Increased project based population growth and long term multi decade industry led population growth

3. A range of accommodation choices required based on several thousand direct and supporting industry jobs and 2.5x more under a Supply Hub model.

Logistics Volumes Model

Enclosure 7

Disclaimer

This logistics volumes model is an analogue based on Pangaea actual historic work programs and actual US authority for expenditure (AFE) datasets. The logistics volume model has informed the Pangaea Beetaloo Basin Development Model for Public Benefit.

Please close this model if you choose not to accept the terms of this disclaimer

Well Inputs

Well

Casing/Tubing

Description	Unit	Conductor 1	Conductor 2	Surface	Intermediate	Production	Tubing	Refer	Note:
Section									
From	[ft]	0	0	0	0	0	0		(a)
To	[ft]	98	361	1,148	5,873	11,319	11,319		(a)
Weight	[lb/ft]	94.0	84.0	68.0	36.0	23.0	4.7	(1)	(a)
	[lb]	9,252	30,315	78,084	211,417	260,335	53,199		
	[kg]	394,482	1,155,053	2,408,445	3,452,302	2,715,974	113,414		

Cement

Description	Unit	Surface	Pilot	Intermediate	Production	Refer	Note:
Section							
Outer Diatmeter (OD)	[in]	17.500	12.250	12.415	8.900		(a)
Inner Diamter (ID)	[in]	13.375	0.000	9.625	5.500		(a)
From	[ft]	0	4,485	0	0	(1)	(a)
To	[ft]	1,148	5,764	5,873	10,259	(1)	(a)
Wet Volume	[ft3]	107	1,047	249	647		(a,b)
	[bbl]	19	187	44	115		
Absolute Volume	[gal/sk]	3.62	3.62	3.62	3.62	(2)	(c)
Maximum Water-to Cemer	[gal/sk]	5.20	5.20	5.20	5.20	(2)	(d)
Yield	[ft3/sk]	1.18	1.18	1.18	1.18	(2)	
Sacks	[sk]	91	889	212	549		
Weight Per Sack	[lb]	94	94	94	94	(3)	
Weight	[kg]	3,880	37,905	9,039	23,408		

Completion Dimensions

Description	Unit	Verticals	Appraisal Hz w/Pilot	Development Hz	Refer	Note:
Well Type						
Completed Well Length	[m]	50	1,500	2,200	(1)	(a,e)
	[ft]	164	4,921	7,218		
Stage Length	[m]	61.0	61.0	61.0	(1)	(a,e)
	[ft]	200	200	200		
Number of Stages	[stages]	1	25	36		

Water

Description	Unit	Verticals	Appraisal Hz w/Pilot	Development Hz	Refer	Note:
Well Type						
Pad Preperation	[bbl]	2,000	17,500	17,500	(1)	(a)
Drilling	[bbl]	2,000	3,500	3,500	(1)	(a)
Stimulation	[bbl/ft]	50	30	30	(1)	(a,e)
	[bbl]	8,202	147,638	216,535		
	[ML/stage]	1.30	0.94	0.96		
	[ML/well]	1.30	23.47	34.43		
Total	[bbl]	12,202	168,638	237,535		

Proppant

Description	Unit	Verticals	Appraisal Hz w/Pilot	Development Hz	Refer	Note:
Well Type						
Proppant Use	[lb/ft]	1,500	1,500	1,500	(1)	(a,e)
	[lb]	246,063	7,381,890	10,826,772		
	[kg]	111,612	3,348,369	4,910,941		
Absolute Volume	[gal/lb]	0.044	0.044	0.044	(1,4)	(a,e)
	[gal]	10,827	324,803	476,378		
	[ft3]	1,447	43,420	63,682		

Fuel

Description	Unit	Verticals	Appraisal Hz w/Pilot	Development Hz	Refer	Note:
Well Type						
Average Fuel Consumptio	[gal/day]	1,000	1,000	1,000	(5)	
Operational Days	[day]	18	33	20	(1)	(a,e)
	[gal]	18,000	33,000	20,000		
	[bbl]	429	786	476		
	[m3]	68	125	76		
Diesal density	[kg/m3]	840	840	840	(6)	
Weight	[kg]	57,234	104,928	63,593		

Other

References

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5 Lake, Larry W, Petroleum Engineering Handbook (Society of Petroleum Engineers, 2006), pp.II 504. http://petrowiki.org/File:Devol2_1102final_Page_504_Image_0001.png
6 Department of Energy and Environment, Australian Government. Diesel Standards. http://www.environment.gov.au/protection/fuel-quality/standards/diesel

Notes

a Parameters are assumed the same for all wells, and are not indicative of actuals.
b It is assumed the entire annulus is cemented for all sections.
c Assumed value -Data taken from 'Maximum and Minimum Water-to-Cement Ratios'
d Assumed Class G cement - Data taken from 'Properties of Neat Cement Slurries for Various Classes of API Cements.'
e US analogues have been used

<== End Sheet ==>

Logisitic Outputs

Description	Unit										Referenc Note:	
Assumptions												
Production Assumptions												
Well IP	[TJ/d]	5									(1)	(a,b)
Decline Factor	[%]	60%									(1)	(a,c)
Development Assumptions												
Low	[TJ/d]	100									(2)	
Medium	[TJ/d]	400									(2)	
High	[TJ/d]	1,000									(2)	
Unit Breakdown		Unit			Ramp Up			Steady State				
		Exploration	Appraisal	Development	100 TJ/d	400 TJ/d	1000 TJ/d	100 TJ/d	400 TJ/d	1000 TJ/d		
Verticals	[wells]	4	2								(1)	
Appraisal Horizontals w/Pi	[wells]		2								(1)	
Development Horizontal	[wells]			48	12	48	120	6	20	48	(1)	(d)
Logistic Assumptions												
Rail Car Weight	[lbs/car]	286,000	286,000	286,000	286,000	286,000	286,000	286,000	286,000	286,000	(3)	(e)
Cars per Train	[cars/train]	82	82	82	82	82	82	82	82	82		(f)
Road Truck Tanker Capac	[litre/tanker]	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000		(g)
Trailer Limit (B -Double)	[tonnes/trailer]	50	50	50	50	50	50	50	50	50	(4)	
Trailer Limit (Road Train)	[tonnes/trailer]	40	40	40	40	40	40	40	40	40	(4)	
Road Train Capacity	ankers/road train]	3	3	3	3	3	3	3	3	3	(4)	
	[trailers/B-Double]	2	2	2	2	2	2	2	2	2	(4)	
	[trailers/road train]	3	3	3	3	3	3	3	3	3	(4)	
	[litre/road train]	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000		
	[tonnes/B-double]	100	100	100	100	100	100	100	100	100		
	[tonnes/road train]	120	120	120	120	120	120	120	120	120		
Calculations												
		Unit			Ramp Up			Steady State				
		Exploration	Appraisal	Development	100 TJ/d	400 TJ/d	1000 TJ/d	100 TJ/d	400 TJ/d	1000 TJ/d		
Casing/Tubing												
Weight	[kg]	15,831,921	28,395,301	491,504,156	122,876,039	491,504,156	1,228,760,390	61,438,020	204,793,398	491,504,156		
	[tonnes]	15,832	28,395	491,504	122,876	491,504	1,228,760	61,438	204,793	491,504		
Transport Unit	[rail car]	123	219	3,789	948	3,789	9,472	474	1,579	3,789		
	[trains]	2	3	46	12	46	116	6	19	46		
	[B-doubles]	159	284	4,916	1,229	4,916	12,288	615	2,048	4,916		
	[road trains]	132	237	4,096	1,024	4,096	10,240	512	1,707	4,096		
Cement												
Volume	[ft3]	7,476	7,220	40,896	10,224	40,896	102,240	5,112	17,040	40,896		
Weight	[kg]	318,759	307,844	1,743,711	435,928	1,743,711	4,359,277	217,964	726,546	1,743,711		
	[tonnes]	319	308	1,744	436	1,744	4,359	218	727	1,744		
Transport Unit	[sacks]	7,476	7,220	40,896	10,224	40,896	102,240	5,112	17,040	40,896		
	[car]	3	3	14	4	14	34	2	6	14		
	[trains]	0	0	0	0	0	0	0	0	0		
	[B-doubles]	4	4	18	5	18	44	3	8	18		
	[road trains]	3	3	15	4	15	37	2	7	15		
Water												
Volume	[bbl]	48,808	361,680	11,401,701	2,850,425	11,401,701	28,504,252	1,425,213	4,750,709	11,401,701		
Weight	[litre]	7,759,916	57,502,498	1,812,725,788	453,181,447	1,812,725,788	4,531,814,470	226,590,723	755,302,412	1,812,725,788		
	[ML]	7.8	57.5	1,812.7	453.2	1,812.7	4,531.8	226.6	755.3	1,812.7		
	[GL]	0.0	0.1	1.8	0.5	1.8	4.5	0.2	0.8	1.8		
Transport Unit	[car]	60	444	13,974	3,494	13,974	34,934	1,747	5,823	13,974		
	[trains]	1	5	170	43	170	426	21	71	170		
	[tanker]	259	1,917	60,430	15,108	60,430	151,073	7,554	25,179	60,430		
	[road trains]	87	639	20,144	5,036	20,144	50,358	2,518	8,393	20,144		
Proppant												
Volume	[ft3]	5,789	89,734	3,056,760	764,190	3,056,760	7,641,899	382,095	1,273,650	3,056,760		
Weight	[kg]	446,449	6,919,962	235,725,169	58,931,292	235,725,169	589,312,922	29,465,646	98,218,820	235,725,169		
	[tonnes]	446	6,920	235,725	58,931	235,725	589,313	29,466	98,219	235,725		
Transport Unit	[car]	4	54	1,818	455	1,818	4,543	228	758	1,818		
	[trains]	0	1	22	6	22	55	3	9	22		
	[B-doubles]	5	70	2,358	590	2,358	5,894	295	983	2,358		
	[road trains]	4	58	1,965	492	1,965	4,911	246	819	1,965		
Fuel												
Volume	[bbl]	1,714	2,429	22,857	5,714	22,857	57,143	2,857	9,524	22,857		
Weight	[litre]	228,935	324,324	3,052,464	763,116	3,052,464	7,631,161	381,558	1,271,860	3,052,464		
	[ML]	229	324	3,052	763	3,052	7,631	382	1,272	3,052		
Transport Unit	[car]	2	3	24	6	24	59	3	10	24		
	[trains]	0	0	0	0	0	1	0	0	0		
	[tanker]	10	13	122	31	122	303	16	51	122		
	[road trains]	4	5	41	11	41	101	6	17	41		
Totals												
Total Transport Units	**car**	**192**	**723**	**19,619**	**4,907**	**19,619**	**49,042**	**2,454**	**8,176**	**19,619**		
	trains	**2**	**9**	**239**	**60**	**239**	**598**	**30**	**100**	**239**		

Other

References

1 Internal Pangaea modelling
2 ACIL Allen Consulting (2017). The Economic Impacts of a Potential Shale Gas Development in the Northern Territory. Final Report to Scientific Inquiry into Hydraulic Fracturing in the Northern Territory.
3 Union Pacific. Heavy rail cars. https://www.up.com/aboutup/reference/maps/allowable_gross_weight/index.htm
4 Australian Trucking Association - Description of truck configurations (2016). http://www.truck.net.au/sites/default/files/TAPs%20-%20description%20of%20truck%20configuration%20September%202016.pdf

Notes

a Parameters are assumed the same for all wells, and are not indicative of actuals.
b A conservative IP rate has been assumed. ACIL Allens report assumes greater than 5 mmscf/d.
c A conservative decline factor has been assumed. ACIL Allens report shows the Marcellus at around 50%.
d A 'Unit' is an internal Pangaea defintion for an area. For 'Ramp Up' a basic equation used to calculate required wells. For 'Steady State', internal modelling by Pangaea has been used.
e It is assumed that the G&W rail line between the Beetaloo and Darwin will have rail cars built to handle axle loads at this weight.
f Assumed to use Genesee & Wyoming Australia bulk iron ore train to whyalla. https://en.wikipedia.org/wiki/Heaviest_trains
g Tank trucks are described by their size or volume capacity. Large trucks typically have capacities ranging from 5,500 to 11,600 US gallons (20,800 to 43,900 L; 4,580 to 9,660 imp gal).
In Australia, road trains up to four trailers in length (known as Quad tankers) carry loads in excess of 120,000 L. https://en.wikipedia.org/wiki/Tank_truck

<== End Sheet ==>

Pangaea (NT) Executive Director Tim Radburn Speech to Katherine Business, Pastoral and wider Community

Firstly,

We acknowledge the traditional owners and custodians on whose land we host this event. We pay our respects to elders past, present and future.

I also thank Alistair Campbell owner of Shockless Electrical Services for Chairing the event on behalf of Geoff Crowhurst and Katherine Mining Services Association.

PANGAEA & THE NT WAY

Good afternoon and thank you for coming along to our discussion today on the public benefits of the Northern Territory's onshore shale gas industry. This should be viewed not only as Territory building, but also in all respects a true Nation building project with numerous public benefits, not least of which is supporting a lower cost of living outcomes and higher standards of living for all Australians for many generations to come.

My name is Tim Radburn and I am the Executive Director of Pangaea Resources (NT).
I was born in Goulburn NSW, cold, wet sheep farming country.
I served as an Officer in the Australian Defence Force (Special Forces) leading soldiers in multiple operational tours of Afghanistan and Iraq working diligently towards achieving strategic objectives working through by and with local communities, indigenous communities and governments alike.

Together with my NT Way Team of locally employed partners and contractors - We have been exploring for oil and gas in the Beetaloo Basin since 2013.

Like you – I love the Territory. I love the relaxed way of life, the globally unparalleled natural unspoilt beauty of the environment, the decent hardworking people that define the Territory, the entrepreneurial Australian spirit that is the backbone of outback Australia and the family business community values that makes this place so special on a global scale.

We are proud to say – that we view and indeed insist on a Territory First approach to the development of the onshore gas industry here and have done so since commencing operations in the Beetaloo region 5 years ago.

We are a proud family owned and operated Australian business and along with our minority JV partners, who are global industry leaders in technically lead subsurface excellence, we operate like a family business, we look after our people first, we lead from the front and we promote a culture of family values through all our business partnerships and stakeholder relations.

Since 2013, we've been Building the Territory together with our local stakeholders through what we define as operational best practice '*The NT Way*'.

"The NT Way" is our operating philosophy that prioritises our family values:

- We Act ethically and honestly
- We look after our mates
- We solve problems together
- We're accountable
- We put the best ideas forward; and
- We fight through adversity

By doing business together the NT Way - We've developed real partnerships in the community and I believe we have built and retained our social license by:

- Working **through** and truly developing local businesses;
- Working **by** and hand in hand with cattlemen; and
- Working **with** and alongside Traditional Owners.

It's been a lot of hard-work, and it's been expensive – it's no secret, we've invested over $100 million dollars in exploration programs to date and are excited about the prospects of the future.

By working together in a truly integrated manner with local communities, government, regulators and all stakeholders, we've been successful. Just down the road, near Daly Waters – in the Beetaloo Basin, we've found enough gas to power Australia for the next 100 years whilst also supplying export market demand.

What is at stake for the people of the Northern Territory and the whole of Australia is the implications of locking up that gas forever and throwing away the key. That decision is only weeks away so let me explain to you the alternative in terms of hard digestible facts that are irrefutable when you look at the modelling that has been done by the best minds in the business.

INVESTMENT AND JOBS

Within the next short 5 year period alone, our industry could begin investing into the Territory as much as $1.35 billion a year and create as many as 1,470 local jobs.

Let's not forget however the nation building Northern Gas Pipeline Project already underway with 403km of a total project 622km 12inch buried gas pipeline linking the Amadeus Gas Pipeline (NT) with the Carpentaria Gas Pipeline (QLD). This project has already:

- Employed in pipeline construction a Northern Territory workforce of 350
- Employed in pipeline construction a Queensland workforce of 280
- Employed in facilities construction a Northern Territory workforce of 190
- Employed in facilities construction a Queensland workforce of 60
- Initiated the Tennant Creek Social Employment Project
- Initiated the Project Ready Training Program with outstanding outcomes such as:
    - 44 local Indigenous graduates with Cert II in Resources and Infrastructure Work
    - 14 graduates through the Myuma Spinifex training program
- 125 Territory based business contracts awarded
- 25 Indigenous business contracts awarded

Yesterday, the Managing Director of Jemena, Paul Adams stated:

'An onshore gas industry in the NT would allow Jemena to keep delivering jobs, training and economic benefit to local communities.

The Northern Gas Pipeline project – the largest of its kind in the country – to date has created more than 960 jobs, awarded 205 contracts to local businesses and organisations across the Territory and Queensland (worth over $22 million in the NT alone in 2017) and supported grassroots community organisations through our sponsorship program.
The project's strong jobs figures are a testament to the community's ability, interest, and desire to be part of this nation building project.

Jemena believes Australia's north has a very real role to play in helping to resolve what has been described as 'Australia's gas supply crisis'.

An onshore gas industry in the Territory would allow Jemena to progress plans to expand and extend the pipeline to the east coast. This project would quadruple the size of our Northern Gas Pipeline workforce to around 4,000 across Northern Australia and mean more investment in local contractors and local communities for the longer term'

This 20 plus year onshore gas project, will provide significant positive benefits for the community, support multiple industries across the region and provide jobs at all levels of the workforce – from young rouseabouts with Year 10 certificates to senior engineers and locally based corporate executives.

All levels of the Territory workforce will be positively impacted.

These local job opportunities will provide the motivation for young people to work hard at school and actively seek to participate in the social fabric of the community because they will tangibly be able to see a prosperous future for themselves and their families.

The entire family nucleus will benefit as the job security, broader local economic development and cost of living improves.

Sustainable job security ultimately provides the baseline for a positive stable home family environment and we believe in this from the core of our business to the passion we have towards veteran reintegration and employment, and indigenous training and employment programs.

ECONOMIC REPORTS & MODELLING

The International Energy Agency has forecasted that Asia's demand for LNG will almost triple over the next 20 years, creating a huge economic opportunity for the Territory to capitalise on if the moratorium is lifted this year.

Just yesterday, the International Energy Association (IEA) identified the number-one step Australia can take to deliver secure and affordable energy: Remove bans on unconventional gas projects across Australia.

More gas supply will put downward pressure on energy prices and smooth Australia's transition to a low-emissions future.

Economic Reports by ACIL Allen also reported that Onshore Gas will increase employment, increase government revenue and increase population growth.

Deloitte Access Economics reported that onshore gas will provide up to 6,300 jobs and a $22 billion boost to the NT Economy over 20 years.

Today, I will be sharing with you the Pangaea Beetaloo Basin Development Model for Public Benefit (The NT Way) of which have multiple printed copies available here and will also be submitted to the Scientific Inquiry into Hydraulic Fracturing in the Territory and available on that website.

The detailed forecast analogues are based on similar international shale gas regions including the US Marcellus and Eagle Ford Shales and United Kingdom's Bowland Shale – and the multi-industry community benefit that comes with this development.

Our forecasting and operating model has been endorsed by the Urban Development Institute of Australia (NT).

The compounding effect of the long term development of the Beetaloo basin will stimulate new local jobs and business opportunity. Industries that will directly and indeed immediately benefit include but are not limited to:

- Earthworks
- Construction
- Engineering
- Manufacturing
- Drilling
- Drilling Services
- Logistics
- Training; and
- Consulting

These industries will directly support jobs on all education levels from Year 10 certificates, up to TAFE and Trades all the way through to University professionals.

Workers with Year 10 Certificates will be able to get jobs such as but not limited to:

- Truck Drivers
- Operators
- Labourers
- Foreman
- Well Tenders
- Drillers
- Rig Hands
- Roustabouts
- Cement Crews

- Loggers
- Service Rig Operators; and
- Wire line Operators

Workers with TAFE and Trade qualifications will be able to work as but not limited to:

- Compressor Operators
- Electricians
- Vehicle Mechanics
- Welders; and
- Surveyors

Professionals with university degrees will be employed as but not limited to:

- Geologists
- Geophysicists
- Draftsman
- Petroleum Engineers
- Field Engineers
- Geo Techs
- Geo Chemists
- Environmental Technicians
- Chemical Technicians
- Soil Scientists; and
- Electronics Technicians

The Industry will also indirectly support other industries and businesses like local hospitality providers, fuel, schooling, emergency services, tourism, transport – the list goes on and on. There is also significant opportunity to create a Territory Supply Hub and Centre of Excellence incorporating Research and Development with Charles Darwin University.

But before we get into the detail - consider the immediate public benefit potential of.

- 1,470 jobs created within 5 years
- Over a billion dollars invested within 5 years
- 100 years of energy

That's almost fifteen hundred jobs...
A billion dollars of investment for the Territory.
And enough gas to power Australia for 100 years...

Consider the immediate public benefit to the local community.
Fifteen hundred jobs and the increased personal local spend that brings.
Fifteen hundred families and the implication of services to support them.
Fifteen hundred homes and the implication of construction to build them.

Or viewed another way.
Three thousand parents contributing to the community.
Three thousand kids going to local schools, playing football, playing netball.

Three thousand kids, studying hard at school for great paying sustainable local jobs.

Think about the positive economic and social impact we can make together developing Territory...

INDIGENOUS COMMUNITY

The entire onshore gas industry of Australia and Pangaea has an absolute commitment to **continue** standard operating practice of developing local indigenous partnerships, initiatives and work/training programs. Pangaea has committed to continue our privately funded annual Indigenous training and employment program. It is ready to go and to start back up where it left off before the moratorium was brought in. It is worth noting that we trained 20 local indigenous community members before the current government imposed the moratorium and forced us to cease this important program.

Two and half years ago, we partnered with Mark and Bill Sullivan from MSC Consulting, and other local Katherine regional businesses, Northern Land Council, Traditional Owners and Senior Elders - our objective was simple, to create a new bench mark in Indigenous Employment and Training targeting the nexus of community indigenous youth who are looking for assistance in not only the administration of getting work ready but the mentoring provided through the program by their elders and peers to be equipped to professionally approach the workplace with CV in hand, qualifications at the ready, first aid certificates, employment references and job placement leads.

All of our participants graduated Job Ready with Certificates in Resources and Infrastructure operations. All of them were offered work, two of them gained employment with a local pastoralist – but then Labor announced their moratorium before we had the opportunity to employ them all through the still 'shovel ready' project of sealing the Western Creek Road.

Last week Jennifer Hewitt in the Australian Financial Review said "....inter-generational social disasters like the high levels of alcoholism, drug use and domestic violence in Indigenous communities won't be solved by more funding of general services, let alone increased welfare payments." ...I agree with this statement.

By working together through the *NT Way* we can support real job training that leads to the dignity of a real sustainable job which ultimately benefits the family nuclease.

We believe this is as true for the local community, the Australian Military Veteran community and the Indigenous community equally.

We are ready to provide training and real jobs. We call this "*A Fair days' pay for a fair days' work*." *The NT Way*.

FACTS ON GAS

Here are some facts:

Gas fuels 24% of all energy uses – powering industry, heating/cooling homes and generating electricity across Australia (APPEA).

Natural gas is the cleanest viable source of base-load and peaking power in Australia (APPEA)

Natural gas is an essential commodity for modern Australia. Natural gas is needed for power generation and is an indispensable feedstock for manufactured products such as fertilisers, plastics and chemicals (APPEA).

In 2014 Dr. Allan Hawke reported said that “the environmental risks associated with hydraulic fracturing can be managed effectively subject to the creation of a robust regulatory regime.”

Australia’s Chief Scientist and Engineer Dr Alan Finkle, said Hydraulic Fracturing “If properly regulated, it’s completely safe.”

Gina McCarthy head of the US EPA said “There’s nothing inherently dangerous in fracking that sound engineering practices can’t accomplish.”

And in 2013 US President Obama said that through hydraulic fracturing in the US “produces more natural gas than ever before – and nearly everyone’s energy bill is lower because of it. The natural gas revolution has led to cleaner power and greater energy independence. We need to encourage that.”

In September last year, the Prime Minister Malcolm Turnbull told Michael Gunner that the fracking moratorium is “putting our energy security and Australian jobs at risk”

In January, the country’s most senior business groups The Australian Industry Group and The Business Council of Australia said in a joint statement that “The substantial resources of Shale Gas in the NT constitute an enormous opportunity for local and national economic development and security. This opportunity can and should be pursued responsibly.”

Justice Rachel Pepper said in Draft Final Report of the Scientific Inquiry into Hydraulic Fracturing in the Northern Territory:

“It is the Panel’s opinion that, provided that the recommendations made in this Report are adopted and implemented, not only should the risk of any harm be minimised to an acceptable level, in some instances, it can be avoided altogether.”

The Northern Territory Environment Protection Authority chairman Paul Vogel said he found ‘no deficiencies’ in the inquiry’s environmental findings, also stating ‘I think it’s been a very candid and comprehensive assessment and analysis of the environmental impacts, risks and issues’.

Damian Barrett, Research Director with the CSIRO agreed with the Justice Rachel Peppers panel's overall conclusion saying that:
"It is possible to reduce the risk associated with shale gas development to levels that are acceptable to most people in the community,"

So what are we waiting for?

The Science on hydraulic fracturing is in pending the final report due in March.

The Tennant Creek to Mt Isa Pipeline is being built.

Domestic and international markets are ready to go and there is a demand for the Northern Territory Onshore gas now.

Investors are lined up.

Local Contracts and partnerships are lined up.

Work packages and community commitments are ready to be released and agreed to.

We are ready to stimulate all employment and economic sectors of the Northern Territory now.

CONCLUSION

The Territory government needs to abolish their onshore gas moratorium immediately on receipt of Justice Rachel Pepper's final scientific report - and get on with supporting regional industries that support whole of community and multi demographic jobs, local businesses and the Territories development for decades to come.

Today we get to make a choice.

Today, we can fight for the Territory, fight for jobs and fight for the Communities safe and sustainable future.

Or - we can surrender to the FIFO Greenies and emotionally charged irresponsible government moratorium positions that is destroying the economy, destroying business sentiment and destroying population growth. The FIFO Greenies have divided the community and the government with lies, false allegations and irrational arguments based on manipulation, deception and no consideration for their actions and the social degradation that will come as a result of it.

I've made my choice, if the moratorium is lifted in April and we can get back to work my family and our business will permanently move to the Territory and commit to it in its fullest.

We and the great many local supporters of the onshore gas industry in the Territory are fighting for Territory jobs across all sectors, for regional growth, for small to large business opportunity and for generational diversification and population retention.

Pangaea and its Northern Territory Stakeholders and great many industry supporters stand together for science, fact, integrity and immediate development of the North.

The science is in, it's time to lift the Moratorium and let us get back to work Northern Territory Government. Let the private sector help you and your government build the Territory Together – Because this is and has always been '*The NT WAY'*.

Thankyou.

Yours sincerely,

WILEM

16 February 2018

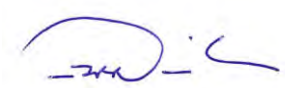
To whom it may concern,

As a Territorian and Business operator in the Northern Territory I would like to express my support for the onshore shale gas reserves in the Beetaloo basin to be developed. I feel that the industry has the experience and expertise to operate with little risk to the environment or the community. I believe that there is enough scientific data now available for regulatory authorities and operators to be able to put in place stringent and safe operating parameters that would be viable for the industry, whilst having the utmost protection for the environment.

Having lived in the Territory my whole life and being a large employer of Territorians as well as raising my own family here, I am passionate about the future growth and well-being of the Northern Territory. I have not seen the Territory Economy in such a dire position as we find ourselves in at the present. With such a small population it is even more difficult to generate enough revenue to allow the government to have a decent budget to not only provide the basics but to stimulate the economy and improve the standard of living in the Northern Territory. The projected incomes generated from this onshore development would be significant for government, the business community and would benefit all Territorians.

Pangaea Resources and the other gas companies wanting to develop the basin are very experienced, professional and safe operators. With a scientific bipartisan approach with government, it is my opinion that this gas reserve should be developed in the Northern Territory.

Yours Sincerelv



Brooke David
Director

WILEM PTY LTD
ATF WILEM INVESTMENT TRUST
ABN 60 990 593 369

GPO BOX 1332
DARWIN NT 0801

Letter of Support

To Whom It May Concern,

I've been in business in the Northern Territory for over 30 years. During this time I have witnessed the inevitable opportunities and hardships that come with doing business in a remote market. At the moment I feel that the most obvious opportunity, extraction and sale of onshore gas, is being unnecessarily delayed. With the current supply issues faced by our countrymen on the eastern seaboard, there is significant economic opportunity knocking on our door.

The most recent draft report handed down by Justice Pepper clearly states the ability to safely and effectively manage the risks associated with the extraction of shale gas. In addition to this report a large body of evidence exists from both Australia and overseas demonstrating that environmental risks can be managed with effective regulation of the industry.

As a Territorian I share the concerns of the general public in respect of potential environmental harm and have taken the time to listen carefully to all sides of the argument as well as conduct my own research. I have come to the conclusion that hysteria is being prioritised over the science. The evidence based science needs to be disseminated succinctly to the community in order to secure ongoing support. At the end of the day we are a dynamic, forward thinking, hardworking community that deserves the opportunity to enjoy the spoils of the well managed and regulated extraction of our resources.

In summary, I would like to see us get on with onshore gas extraction with industry being appropriately regulated to manage those risks that may have the potential to cause environmental harm.

Regards,

John (Foxy) Robinson AO

STATEMENT FROM JEMENA MANAGING DIRECTOR, PAUL ADAMS

An onshore gas industry in the NT would allow Jemena to keep delivering jobs, training and economic benefits to local communities.

The Northern Gas Pipeline project – the largest of its kind in the country - to date has created more than 960 jobs, awarded 205 contracts to local businesses and organisations across the Territory and Queensland (worth over $22 million in NT alone in 2017) and supported grassroots community organisations through our sponsorship program.

The NGP's strong jobs figures are a testament to the community's ability, interest, and desire to be part of this nation-building project.

Jemena believes Australia's north has a very real role to play in helping to resolve what has been described as "Australia's gas supply crisis".

An onshore gas industry in the Territory would allow Jemena to progress plans to expand and extend the pipeline to the east coast. This project would quadruple the size of our NGP workforce to around 4,000 across Northern Australia and mean more investment in local contractors and local communities for the longer term.

15 February 2018

MiBro.
(NT) Pty Ltd

To Whom It May Concern

I would like to preface my letter of support by saying that it is imperative that the onshore gas opportunity should be safe and that the risks associated with onshore development of shale gas reserves should be carefully managed and controlled, providing no real risk to the environment. The decision should be based on science, not emotion.

I've been in business in the NT since the mid 80's, experiencing the highs and low of a growing, developing ever changing community. The Northern Territory (NT) is a small community, very remote by world standards. The costs of living and doing business will always be higher than the major cities but are more than balanced by a real quality of living up here.

I see resources as a key platform for the future of the NT. Being small and remote will continue to provide challenges in providing services, the equal of those enjoyed in Southern States and Major cities. Resource developments like onshore gas regionalizes opportunities, creates jobs, pathways and independence for remote communities.

The opportunity for the NT community to enjoy the benefits of a well-managed resource (shale gas) is essential to the future development of the NT. This decision should be based on science and not rejected on emotive arguments. The recent release of the Draft Pepper report supports the earlier findings of previous reports in 2014, 2015 and 2016. Those being that the risks can be managed.

I have taken an active interest in this opportunity, firstly to try to be well informed as a long term Territorian and secondly looking to expand business and create opportunities. I have spoken with the principles of Pangaea Resources and I am satisfied that this is not a decision just about money, it is a decision that creates wealth, jobs and opportunities for many people, primarily focused at people living in very regional areas. I have taken the time to speak with pastoralists on one hand and drillers on the other hand, those that I have spoken to are supportive of the opportunity that on shore gas will provide for 40 or 50 years to come.

As a long term Territorian, I support the opportunity of mining onshore gas.

Kind regards
Mick Burns
Territorian and Businessman

VTG | WASTE & RECYCLING Pty Ltd

PO Box 36617 Winnellie NT 0821
T 08 7909 8888
E admin@vtgwaste.com.au

19 February 2018

Support for Onshore Gas Northern Territory

To Whom It May Concern

The Directors of VTG Waste & Recycling believe it essential that any onshore gas opportunity is safe and that the risks associated should be carefully managed and controlled to ensure no real risk to the environment. Any decision should be based on science, not emotion.

We have been living, working and conducting business in the NT for a combined period of more than 100 years and see resources as a key platform for the future of the NT.

The opportunity for the NT community to enjoy the benefits of a well-managed resource (shale gas) is essential to the future development of the NT. A decision to proceed should be based on science and not rejected on emotive arguments. Consecutive reports in 2014, 2015, 2016 and now the Pepper Report conclude that the risks can be managed.

As long term Territorians, we have taken an active interest in this opportunity, firstly to try to be well informed and secondly looking to expand our business in the Territory. After meeting with the principles of Pangaea Resources we are satisfied that this is not a decision just about money, it is a decision about opportunities that creates wealth, jobs and a future in the NT for many people, primarily focused at people living in very regional areas.

As a long term Territorian, we support the opportunity of mining onshore gas.

On behalf of VTG Waste & Recycling Directors

Sincerely,

Mark Sweet
Managing Director

22 February 2018

Mr Tim Radburn
Pangaea

Via email: tim.radburn@pangaea.net.au

To whom it may concern

Support Letter - Pangaea

On behalf of the Halikos Group, I would like to provide my support for the Pangaea Project. It is vital though, that any onshore gas opportunities are undertaken in a safe way and that any risks should be carefully managed and controlled ensuring that there is no risk posed to the environment.

The Halikos Group has been operating in the Territory for over 30 years. We have witnessed tremendous growth and also lows in our community. We feel this project, could alleviate some of the current pressures felt by our economy and provide a number of positive outcomes for the Territory. As a member of the business community, I believe it is important that we invest in opportunities in various sectors. I see resources becoming a key area for the growth of the Territory in the future. Developments, whether it be commercial, residential or resources offer tangible benefits to a community such as employment, career pathways and indigenous training opportunities.

The opportunity for the NT community to enjoy the benefits of a well-managed resource (shale gas) is vital to the future development of the NT. I am of the view that this decision should be based on science and not rejected on emotive arguments. I note the release of the Draft Pepper report supports the earlier findings of previous reports in 2014, 2015 and 2016 outlining that the risks can be managed.

As a long term Territorian who has been heavily involved in the business community, I support the opportunity of mining onshore gas.

Yours faithfully

Shane Dignan
Managing Director
Shane.dignan@halikos.com.au

20th February 2018

To whom it may concern,

RE: Letter of Support for Onshore Gas Industry and Pangaea Resources Projects

Developing the Northern Territory and becoming independent from Federal Government handouts will only be achieved with such projects as proposed by Pangaea Resources and the utilisation of NT resources. Tourism alone will not achieve this but supporting a safe, viable and sustainable on shore gas industry will contribute the lions share in reducing the current deficit.

Long term community benefit is well proven in the QCLNG and APLNG projects for thousands of regional residents providing upgraded infrastructure, better health services, increased local commercial opportunity and the like, Territorians want and deserve this as well. Remote and regional NT communities are isolated enough geographically, imposing social and commercial opportunity isolation on top of this is not fair or necessary. To gain this opportunity our children typically attend boarding school and mostly don't return due to limited opportunity. Supporting Pangaea Resources and similar projects will change this with professional career opportunities and increased long term job prospects available close to home in the NT.

I live on the family cattle station half way between Katherine and Mataranka, my eldest step daughter attends boarding school in Adelaide and is unlikely to return to the NT as she wants to be an Environmental Engineer, my step son is due to start boarding in three years time and will most likely follow the same path. By supporting the development of an on shore gas industry the NT's youngest residents will have a positive future at home, support community growth and contribute to the ongoing development of the north.

In closing I, and many other locals, fully support and thank Pangaea Resources for having the vision and leadership capabilities to make the NT an area of wealth, prosperity and for providing a future for the next generation.

Yours Faithfully

Jerry Amato
0407590650

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19 February 2018

RE: Support for Onshore Gas Northern Territory

To Whom It May Concern,

The Directors of VTG Technology are all long-term Territorians who take an active interest in the environment health and sustainability, balanced with prosperity of the Northern Territory. Without hesitation, we believe that any exploration projects and that in particular of the potential onshore shale gas opportunity must be safe and that the risks associated are carefully managed and controlled to ensure our environment is not subjected to risk for future generations. Any decision should be based on science, not emotion.

We have been living, working and conducting business in the NT for a combined period of more than 100 years and see resources as a key platform for the future of the NT.

The opportunity for the NT community to reap the benefits of a well-managed resource (shale gas) are essential to the future development of the NT. A decision to proceed should be based on science and not rejected on emotive arguments. Consecutive reports in 2014, 2015, 2016 and now the Pepper Report conclude that the risks can be managed.

As long-term Territorians, we have taken an active interest in this opportunity, firstly to try to be well informed and secondly looking to expand our business in the Territory. After meeting with the principles of Pangaea Resources we are satisfied that this is not a decision just about money, it is a decision about opportunities that can create wealth, jobs and a future in the NT for many people, primarily focused at people living in very regional areas.

As a long term Territorian, we support the opportunity of mining onshore gas.

On behalf of VTG Technology company Directors

Sincerely,

Scott Wright

General Manager