Production Efficiency

Chaired By

Jim House
Vice President and Managing Director
Apache North Sea
PETF Progress to Date

Jim House, Apache North Sea
Production Efficiency Session Agenda

2.00 pm Jim House, Apache North Sea
   *Session Chair*

2.10 pm Simon Toole, Oil and Gas Authority
   *2014 Production Performance Review*

2.30 pm Phil Murray, Petrotechnics Ltd
   *Wasted Time or a Waste of Time – Solving the Inefficiency Challenge*

2.50 pm Alan Blacklaw, Nexen
   *Best Practice in Annual Shutdown*

3.10 pm Richard Swain, Perenco UK Ltd
   *Southern North Sea Rejuvenation*
UKCS Production Profile
PETF Overview

Formation of the PETF in June 2013
Cross industry group to address falling PE
Development of the 2016 80% target
PETF Activities to Date

• Extensively hypothesis analysis to define PE problem
• Cross industry workshops on shutdown performance
  - Identified need for industry best practice document
• Full analysis of basin wide unplanned losses
  - Now moving to implementation of strategies
• Annual Operator Production Benchmarking Reports
PETF 2015 Key Activities

- Planned Maintenance best practice document
  - July
- Offshore productivity workshop
  - Q3
- Cross industry compression train workshop
  - Q3
- Operator production performance benchmarking reports and engagement sessions
  - July
- Develop a new UKCS production loss reporting system for effective stewardship
  - Year end
Variation in Operator PE Performance
Key Messages

• UKCS PE is improving, but not quickly enough
• Further Operator accountability required
• PETF has successfully highlighted and brought attention to the issue
  - Key will now be implementation and subsequent barrels increase
2014 Production Performance Review

Simon Toole
Director of Licensing & Legal
Oil and Gas Authority
2014 Production Performance Review

Simon Toole
Production Efficiency
Why it is matters

Decline of 250,000 boe/d p.a.

Momentum in the trend.

Deteriorating Production Efficiency compounds natural depletion.

Improved Production Efficiency is needed to meet forecasts.

Restoring Production Efficiency gains 500,000 boe/d and £10 bln sales pa.

Unaddressed, will impact development and recovery from the UKCS.

Oil Price and BFA will underpin growth.
Where does Production Efficiency need to be?

Targets to drive performance

Top Quartile P.E. performance is:
- Oil installation: 80%-85%
- Gas installation: 90%-95%

<table>
<thead>
<tr>
<th>Year</th>
<th>UKCS P.E. Target (Actual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>(63%)</td>
</tr>
<tr>
<td>2012</td>
<td>60% - 65% (60%)</td>
</tr>
<tr>
<td>2013</td>
<td>65% (no worse) (64%)</td>
</tr>
<tr>
<td>2014</td>
<td>70% (65%)</td>
</tr>
<tr>
<td>2015</td>
<td>75%</td>
</tr>
<tr>
<td>2016</td>
<td>80%</td>
</tr>
<tr>
<td>2017+</td>
<td>85%</td>
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</table>
Production Efficiency
- Stability but little gain

PE at UKCS level up v. slightly on 2013
[“green shoots?”]

Production steady.
Some prior production returned.
Breakdown of UKCS Production Losses

- **2013**
  - Market Losses: 46.7%
  - Planned Plant: 19.6%
  - Reservoir Losses: 12.1%
  - Wellwork Losses: 6.2%
  - Export: 9.5%
  - Annual Shutdown Losses: 0.7%

- **2014**
  - Market Losses: 43.4%
  - Planned Plant: 21.2%
  - Reservoir Losses: 13.4%
  - Wellwork Losses: 8.0%
  - Export: 8.7%
  - Annual Shutdown Losses: 0.2%
Comparison of a ‘Best in Class Field’ vs UKCS Average
UKCS PE: Historical Lost Barrels

900 Million boe lost since 2004 due to fall in PE

Source: DECC/Oil & Gas UK
### The Prize
Production Efficiency Targets to drive Asset Performance

<table>
<thead>
<tr>
<th>PE</th>
<th>Production (MMboe/day)</th>
<th>Prize (boe/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90%</td>
<td>2.28</td>
<td>+760,000</td>
</tr>
<tr>
<td>80%</td>
<td>2.03</td>
<td>+510,000</td>
</tr>
<tr>
<td>70%</td>
<td>1.78</td>
<td>+260,000</td>
</tr>
<tr>
<td>60%</td>
<td>1.52</td>
<td>-</td>
</tr>
<tr>
<td>50%</td>
<td>1.27</td>
<td>-250,000</td>
</tr>
</tbody>
</table>

Based on 2012 data, an increase in PE from 60% to 80% would yield an extra half a million barrels a day, 34% more.

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<tr>
<td>2014</td>
<td>Target 70% (Actual 65%)</td>
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<tr>
<td>2015</td>
<td>75%</td>
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<td>2016</td>
<td>80%</td>
</tr>
<tr>
<td>2017+</td>
<td>85%</td>
</tr>
</tbody>
</table>

**Update:**
Based on 2014 data (65% PE @ 2.22 MMboe/day SMPP), Prize for 80% PE is 334,000 boepd.

Ref. PETF mtg no. 1
MD Engagement Sessions

Engagement sessions held with top 16 UKCS producers

Andy Samuel, Simon Toole and Oil & Gas UK

Examined 2014 production performance, threats to PE improvement and opportunities for cross industry and regulatory action

Gap analysis against PETF key themes and emerging industry issues.
Asset Production Efficiency Return for 2014 submitted

OGA review of Production/Loss data & Production Efficiency (PE)

OGA feedback of PE results to all UKCS assets

More detailed discussion with selected assets. This may include an OGA request to implement & actively monitor a PE improvement plan

OGA review of any agreed plans with selected assets

Asset Production Efficiency Return for 2015 submitted

Feb 15  Mar / Apr  Apr / May  July / Aug  Aug / Sept  Feb 16

with OGUK?
Gas is a valuable resource
Flare systems – a safety device to support production ops
UKCS Flaring managed via a Consents process
  Expect Operators to manage consents diligently
    examples of consent limits being breached
      - sometimes only notified post breach
UKCS specific challenges:
  Ageing infrastructure
  Not all installations connected to gas export infrastructure
  Declining production
  UKCS PE decline in recent years
OGA committed to eliminating excessive flaring of gas
Oil / gas condensate fields
  Recent years: increasing trend of ratio of flare per unit oil production
  Decline in UKCS PE in the same period – coincidence?
Flaring

- Industry “Flare workshop” held December 2014

- Pro-active engagement with 18 Operators

- Provided a forum to address specific challenges and opportunities to reducing flaring in key areas:
  - The major contributors to flaring
  - What industry can do to reduce flaring
  - How can industry collaborate to manage flaring more holistically
  - What part technology can play in reducing flaring

- Constructive discussion on:
  - Operator experiences – good and bad
  - Best practices and shared learnings
Flaring

Post Workshop:

• Synergy with PE Task Force work to improve UKCS PE
  – Efforts focussed on delivering improvements in PE /plant stability should have knock on benefit in terms of reducing flaring
  - PETF a conduit to share best practices
• Importance of concise and timely communication between field Operators / export infrastructure Operators
  – Shutdown planning, handling unplanned events & understanding knock on implications for upstream operations & minimise potential flaring implications
• Technologies exist that can aid plant performance and reduce flaring
  – Condition monitoring / plant optimisation: aid stable operation
  – Flare gas recovery: being incorporated on several new facilities
• Operator “champions”:
  – Disseminate key “flare workshop” findings back into each company
  – Drive forward opportunities for change
OGA Requests

Quantify the benefits of improvement

Relentless focus on the detail

Agree a common calculation for PE

16 Operators deliver their Stewardship plans and improve transparency and share experience

Use the OGA stewardship discussions constructively- these are not the “naughty step” – they can empower you

Flare consents – can be the “naughty step”!
Wasted time or a waste of time – solving the inefficiency challenge

Phil Murray
CEO
Petrotechnics Ltd
Wasted Time Or A Waste of Time?

Phil Murray
CEO, Petrotechnics
2000
17%
The productivity puzzle

Under the bonnet

Britain’s stall in productivity is more serious than that of any rich-world peer. A closer look reveals different industries travelling at very different speeds

May 30th 2015 | From the print edition

North Sea oil

Offshore fog

Bloated costs and falling profits threaten the future of North Sea oil

May 28th 2015, 14.49 | From the print edition
Technology Alone Isn’t Enough
ABB Consulting
Aberdeen City Council
Addax
ADIL
Aker Solutions
AMEC
Apache North Sea
Apollo
Arrow
Arte – Vox pop
Astute
Atlas
AVEVA
Awilco Drilling PLC
Babcock International
BAKER HUGUES Bayergas
Bender UK Ltd
BG Group
Biardo Survival Suits BV
BP
Halliburton
Hannon Westwood
Harmonic Limited
Health and Safety Laboratory
Hess
HM Treasury
HMT
Hone All
HSE
IDAC
Idemitsu Petroleum UK
HIS
Imes Group
Infield Systems Ltd
International SOS/Abermed
Intonation
IOM3
ISNetworld
Johnston Carmichael
JW Holdings Ltd
Phil Murray
CEO, Petrotechnics

Phone: 01224 337 226
Email: phil.murray@petrotechnics.com
Best Practice in Annual Shutdown

Alan Blacklaw
Production Operations Manager
Nexen
<table>
<thead>
<tr>
<th>Asset</th>
<th>First Oil – Year</th>
<th>Current Production Rate</th>
<th>Current Injection Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BUZZARD</strong></td>
<td>2007</td>
<td>200 KBOE</td>
<td>320 KB</td>
</tr>
<tr>
<td><strong>SCOTT, TELFORD &amp; ROCHELLE</strong></td>
<td>1993</td>
<td>45 KBOE</td>
<td>280 KB</td>
</tr>
<tr>
<td><strong>GOLDEN EAGLE</strong></td>
<td>2014</td>
<td>50KBOE</td>
<td>50KB</td>
</tr>
<tr>
<td><strong>ETTRICK BLACKBIRD</strong></td>
<td>2009</td>
<td>7.5 KBOE</td>
<td>15KB</td>
</tr>
</tbody>
</table>
Nexen P.E. Performance

DECC PE data available to 2013 (inclusive)
Nexen data available to 2013 (inclusive)
2011-15 Production Performance

![Graph showing production performance from 2011 to 2015. The graph includes actual gross production (boe), single events loss (unavoidable), single events loss (avoidable), and DECC P.E. (%) for each year.](image_url)
Key Facts:

Gas release event 26\textsuperscript{th} March

Rigorous investigation instigated

Root Cause identified as stress corrosion cracking of trunnion cap screws

Remediation work conducted on 120 valves

Comprehensive restart assurance process followed

Safe plant restart establish 28 days later

Industry alert issued May 2014

Impact: 9\% on PE, 1.5mmboe deferred production
Production Efficiency – Our key improvements 2011 - 2015

People
• Offshore – recruitment of additional 150 Nexen employees
• Onshore – Strong functional accountability and leadership drives performance
  • Eg strong TAR team – embedded offshore resources in onshore team

Process – Operational Excellence
• Production Short Interval Control – chase every barrel
• Production Loss Management – chase every barrel
• Robust TAR management process

Technology
• Digital Oilfield – efficient well surveillance
• Spotfire – clear data analytics
2015 Water Injection Performance

2014 Results:
Average - 340 KB/day
124 days with no water injection

Some 2015 headlines:
Average – 450 KB/day
Buzzard - 3 days no WI
Scott - 13 days no WI
Marginal Gain – 2015 Well Intervention

Focus on NPT reduction; creates early delivery of barrels

• Well Intervention efficiency
  – Historic NPT ~ 38%
  – Focus on Platform NPT reduction to <10%
    • Good planning & work execution
    • Collaboration between functions
    • Delivers – 30,000 gain
  – Expected Intervention Barrel Adds
    • 4.8 million BOE
    • 13,000 BOE/D
    • 5.6% of annual budget
Focus on planning and execution; creates more barrels = Key Result

- **Buzzard Wellhead Maintenance**
  - 2014 - lost production ~ 300 KBOE
  - 2015 – efficiency gain established
  - Reduced well S/I times ~6 days to ~3 days
  - Step up in planning & execution
  - Expected Gains
    - 140 KBOE
    - 385 BOE/D
    - 0.2% of our annual budget
    - ~1 day of production
Summary

- Production Efficiency – it’s a multi year journey
- Black Swans – they are out there; its how you deal with them
- Loss Management – Chase every barrel
- Workforce Engagement – communicate and bring them on the journey
- Asset Integrity – strong AI culture goes hand in hand with high PE
- Operational Excellence – easy to say, hard to achieve
SNS Rejuvenation

Richard Swain
Projects Development Manager
Perenco UK LTD
SNS Rejuvenation

Oil & Gas UK

June 2015
Richard Swain
Development Manager – Perenco SNS
Co-Chair of SNS Rejuvenation Joint Industry Project
(Co-Chair Nico Brunsmann, Operations & Development Director – Verus Petroleum)

“The information included in this presentation is provided in my capacity as Co-Chairman of the SNS JIP organisation and not in my capacity as a Perenco employee. Perenco does not accept any liability for the contents of this presentation”
Background

Infrastructure Access Group (IAG) 2012:

In 2012, the Infrastructure Access Group (IAG) verified:

- that infrastructure-related issues threaten future UKCS potential.
- Enhanced “area stewardship” around critical hubs, requiring greater collaboration between parties, could maximise economic recovery.

In Q2 2013, the NNS and CNS Rejuvenation Work Groups were established to review the potential practical application of IAG initiatives and transformational options.

An SNS JIP workgroup kicked off in Q4 2014
SNS JIP (16 Participants)

JIP Participants
1. Alpha
2. BP
3. Centrica
4. ConocoPhillips
5. Dana
6. DEA
7. E.ON
8. Fairfield
9. Faroe
10. GDF Suez
11. Hansa Hydrocarbons
12. North Sea Midstream Partners
13. Perenco
14. Shell
15. Sterling Resources
16. Verus Petroleum

JIP is supported by
1. Oil & Gas UK
2. OGA/DECC
SNS Infrastructure – a complex network
The SNS Workgroup agreed to deliver the following:

1. A comprehensive summary of the current resource base, prospectivity and an assessment of infrastructure in the SNS.

2. Prioritisation of areas/themes to focus on based on the potential value of the different resources (Tight Gas, off spec gas, etc).

3. A comprehensive description of the challenges and barriers to commercial development of the SNS opportunities.

4. Proposed solutions to the problems preventing the development of these resources, including a set of objectives with due regard to what can be achieved commercially and politically.

5. Integrated proposal of what industry and Government can do to help and enable maximum recovery in the SNS.
Status of Phases:

- Phase 1 – Completed
- Phase 2 – themes identified from phase 1 under review and will be progressed (Ongoing)
- Phase 3 – work area options and proposals
Phase 1

• LR Senergy was appointed as Independent Third Party (ITP) to collect, analyse and present aggregated data according to the agreed Confidentiality Agreement
• Data collated via spreadsheet completion and face to face interviews
• Data was reviewed and analysed
• Final report was produced and reflected back to JIP participants in April 2015
Phase 1 Output

- Phase 1 is completed with a final report delivered by LR Senergy showing the results below:

<table>
<thead>
<tr>
<th>Resource</th>
<th>TRV/TCF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing Assets (Hubs/Fields)</td>
<td>4.3</td>
</tr>
<tr>
<td>Undeveloped Resources (Associated with Producing Assets)</td>
<td>2.9</td>
</tr>
<tr>
<td>(In-fill well opportunities)</td>
<td></td>
</tr>
<tr>
<td>Undeveloped Resources (Discoveries)</td>
<td>2.9 un-risked</td>
</tr>
<tr>
<td>(40 Discoveries identified average size 130Bcf)</td>
<td>(2.5 risked)</td>
</tr>
<tr>
<td>Known Prospects (79 Prospects – ave. un-risked size 160Bcf)</td>
<td>5.9 un-risked</td>
</tr>
<tr>
<td></td>
<td>(2.1 risked)</td>
</tr>
</tbody>
</table>

- A further 11.7 TCF (un-risked) over and above the current 4.3 TCF reserves from existing assets is a considerable prize
Phase 1 Output cont’d
Examples of data analysis

Geology
Size of discoveries
Reservoir types
Reasons for stranding
Recovery factors

Developments per year

Figure 5.2 SNS developments

Figure 3.6 All Undeveloped Discoveries, base case/PSO unrisked GIP

Remaining life
Distance to Infrastructure
Facilities integrity/prod efficiency
Compression availability/backout
Liquids handling
Well integrity

34.0
24.0
18.0
14.0
4.0
2.0

0 10 20 30 40

Reservoir types

Leman
Westphalian
Namurian & Dinantian

1,343

361

32

5

3
To unlock the future potential of the SNS basin, there are multiple, complex hurdles to be overcome on both a technical and commercial level. It is only by completing every piece of the jigsaw that full potential will be unlocked and developments will progress.

The report highlighted the many and complex reasons for Development uncertainties or potential reasons for stranding.
Themes Identified from Phase 1

6 key themes emerged for forward prioritisation:

• **Tight Reservoir recovery** sharing - Technical ‘best practice’ workshop

• **Collaboration/Area Solutions** - Several area opportunities identified in the report

• **Infrastructure** - Focus on risk of early CoP of critical infrastructure

• **Commercial** - Fiscal, licensing & ownership, access to infrastructure

• **Development Costs** - Recognising the increasing development costs in SNS

• ** Decommissioning** collaboration - Ensure alignment with other decommissioning
Key Messages

- There is significant remaining resource in the SNS
- Longevity of existing infrastructure is a real issue
- The SNS rejuvenation workgroup is the only forum where the 16 Operators meet on a regular basis
- The key to maximising economic recovery is collaboration
THE OIL AND GAS INDUSTRY CONFERENCE

Maximising Economic Recovery in the UK - The Next 40 years
Production Efficiency
Panel Session

Chaired By

Jim House
Vice President and Managing Director
Apache North Sea