Smarter Decisions and Standards for Integrated Operations & Maintenance

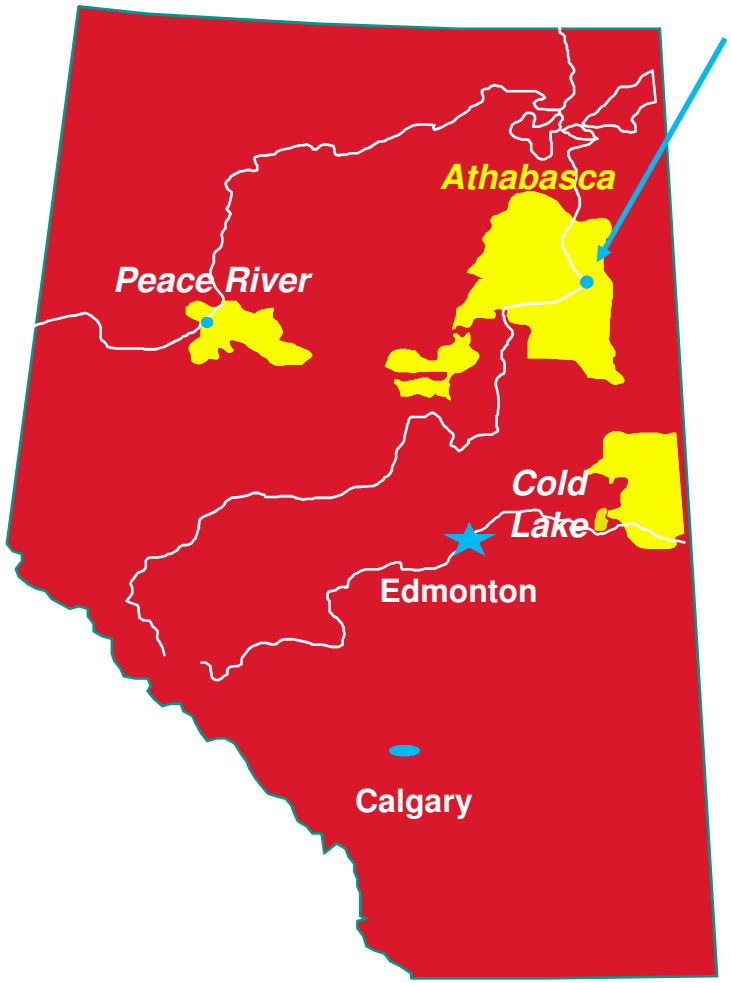
Semantic Days 2011
Framework and OpenO&M Initiatives

June 8th, 2011

Assetricity™

IBM

The New '*Black Gold*' Alberta Oil Sands – *A Vast Resource*

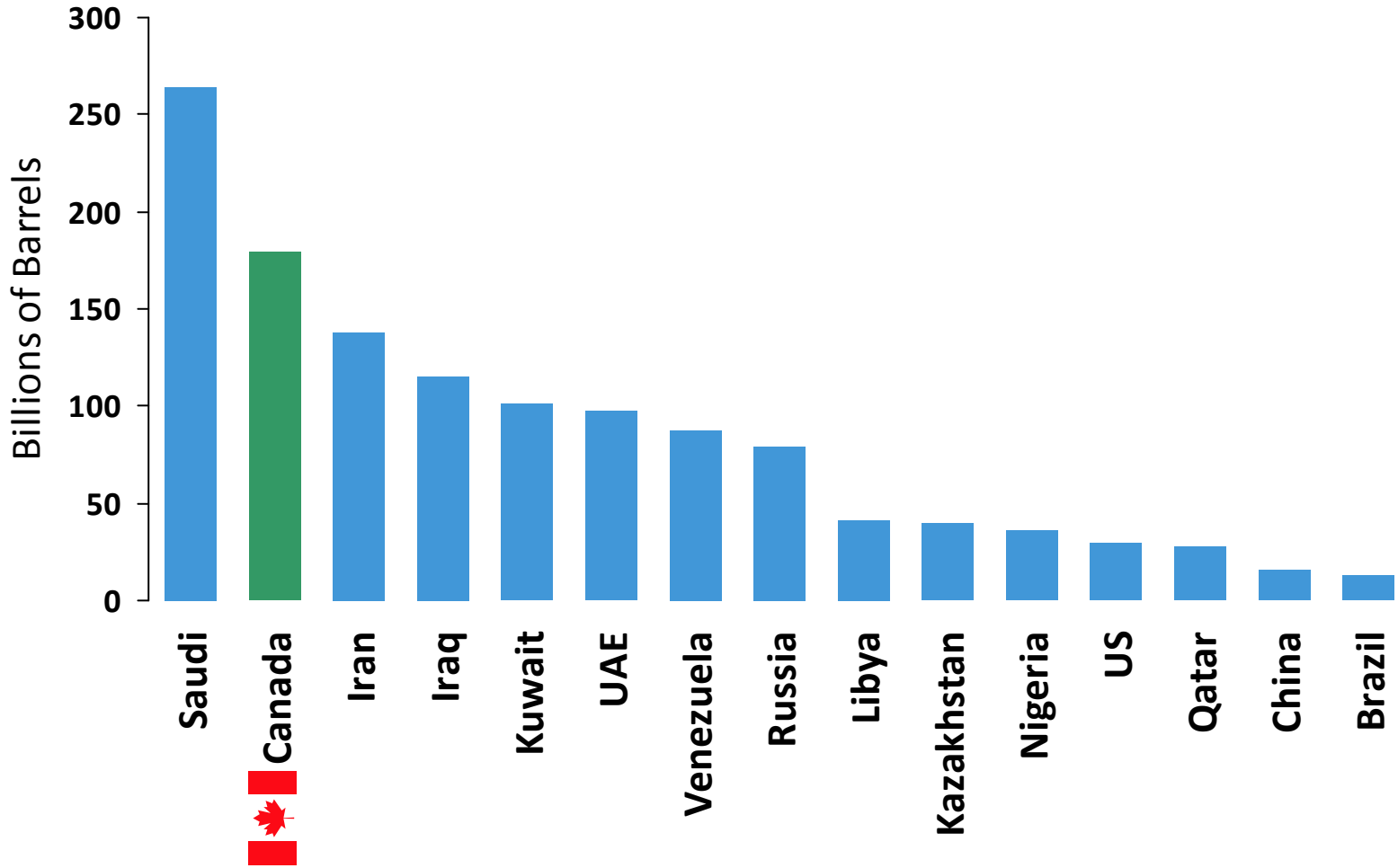


Alberta area oil sands & heavy oil deposits contain ~2.5 Trillion barrels of world's known petroleum reserves

Alberta deposits cover 77,000 sq km (~30,000 sq mi)

Athabasca Deposit
> 42,000 sq km
890 Billion barrels in place
20% within 250 ft. of surface
30 Bb Mineable; 142 Bb In-Situ

Proven Reserves



Source: BP Statistical Review of World Energy 2008

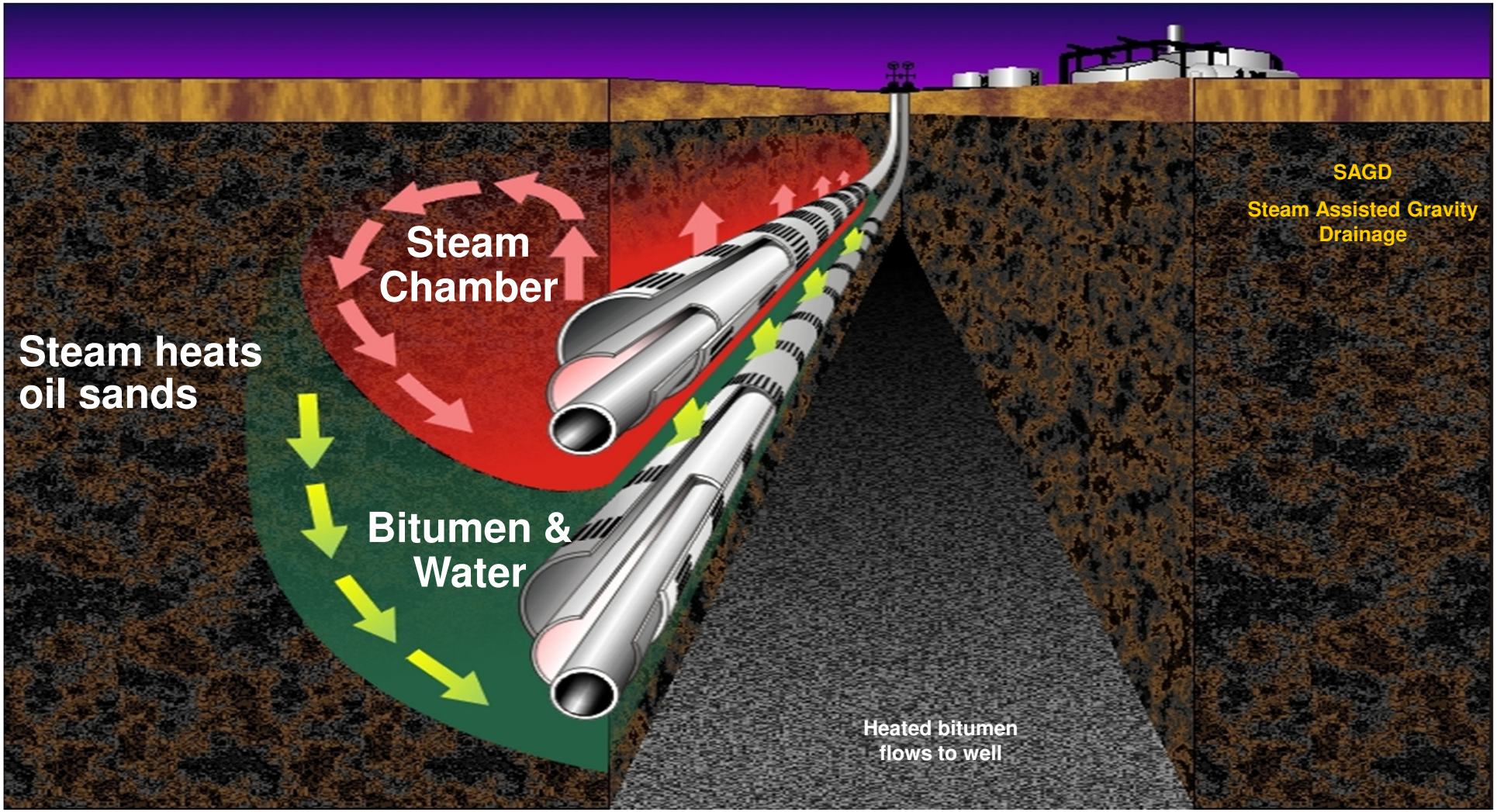
Oil Sands, The Resource

Bitumen - Easy to Find, Tough to Get Out!!

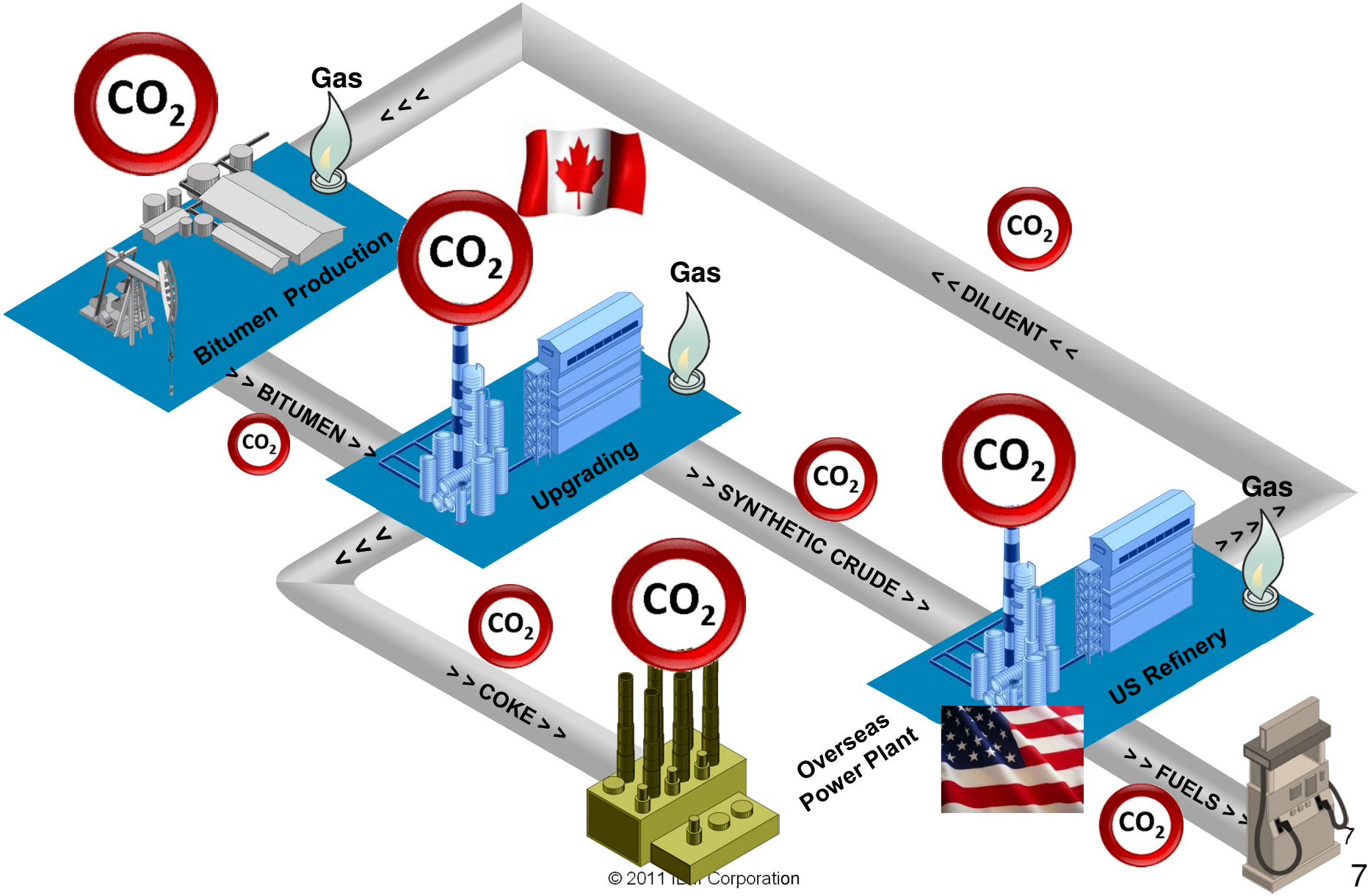
- Thick, sticky mixture of
  - Sand,
  - Clay,
  - Water,
  - Bitumen: 8 – 9 ºAPI

Oil Sands: Mining

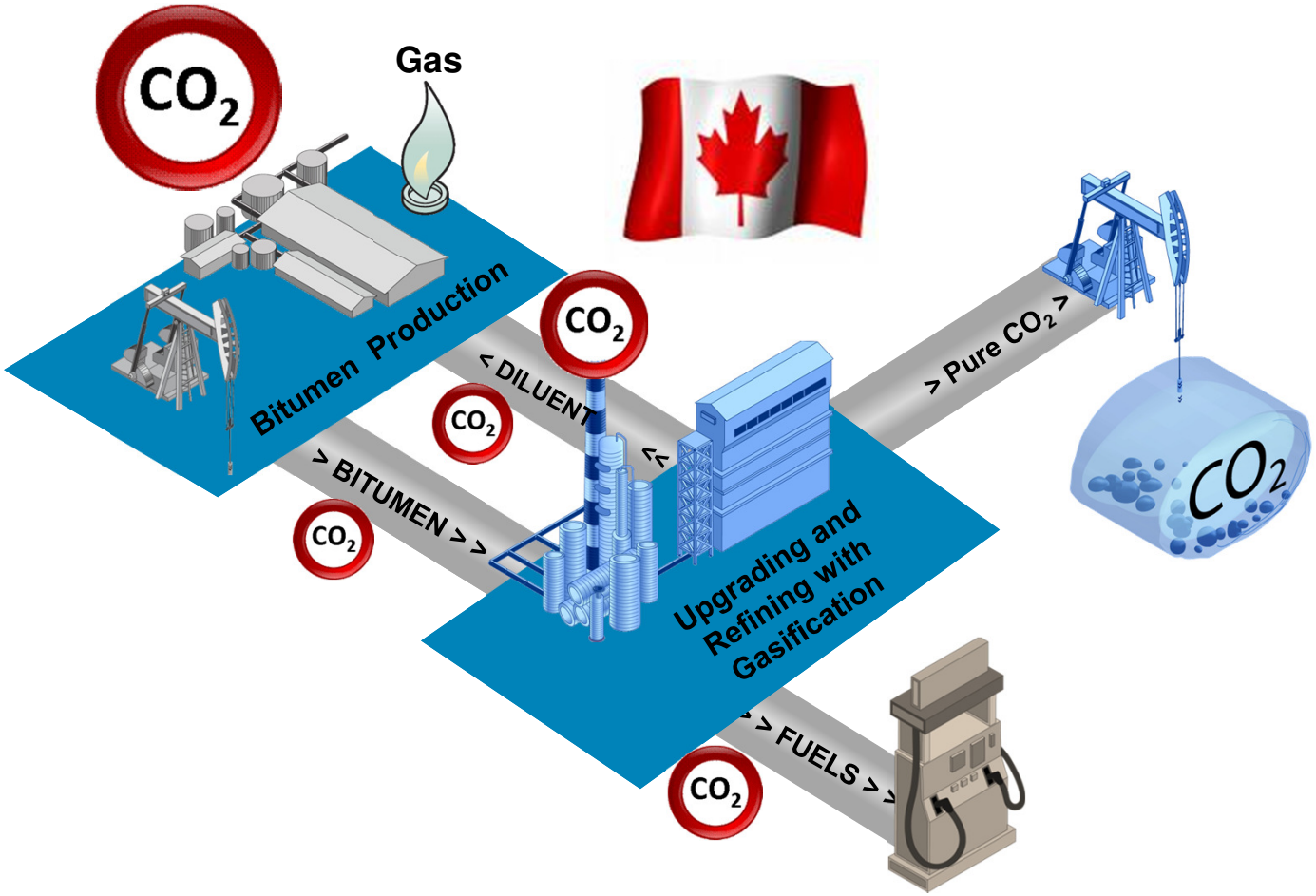
Oil Sands: In-situ



Historical Process - Coking - Bitumen to Fuels



The Future: Bitumen to Fuels with CCS



One step conversion to fuels with gasification and CCS - Benefits for All Canadians

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As We Were … and, Still Are..??

Lab

Marketing

Accounting

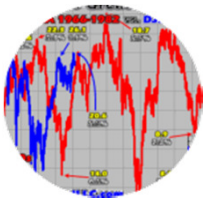
Reliability

Planning

Maintenance

Good Enough in the Past!!

Trading



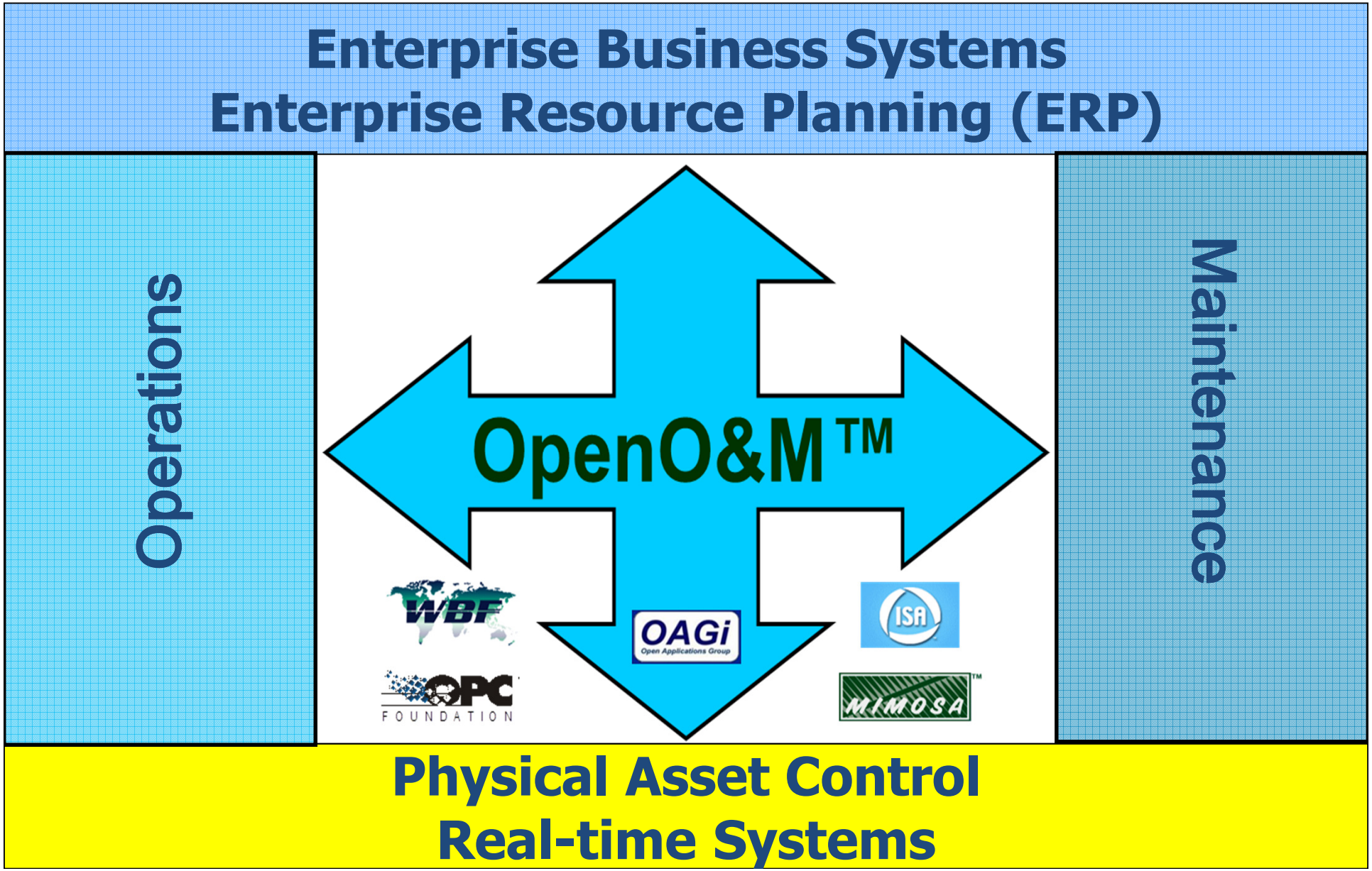
Control

Management

Supply & Distribution

But…, Does The Past Continue to be The Future??!!

What's Missing?



Current Operational Eco-system Options

Walled Garden

- Large suppliers proprietary eco-systems
- Suppliers make the rules
- Suppliers often set high barriers to entry
- High switching cost – O/O lock in
- O/O data is trapped in proprietary apps
- Innovation can be constrained

Open Source

- Can be chaotic
- Suppliers may be unknown
- Ambiguous support model
- Fragmentation often takes place
- Interoperability may become poor
- Critical infrastructure often precluded

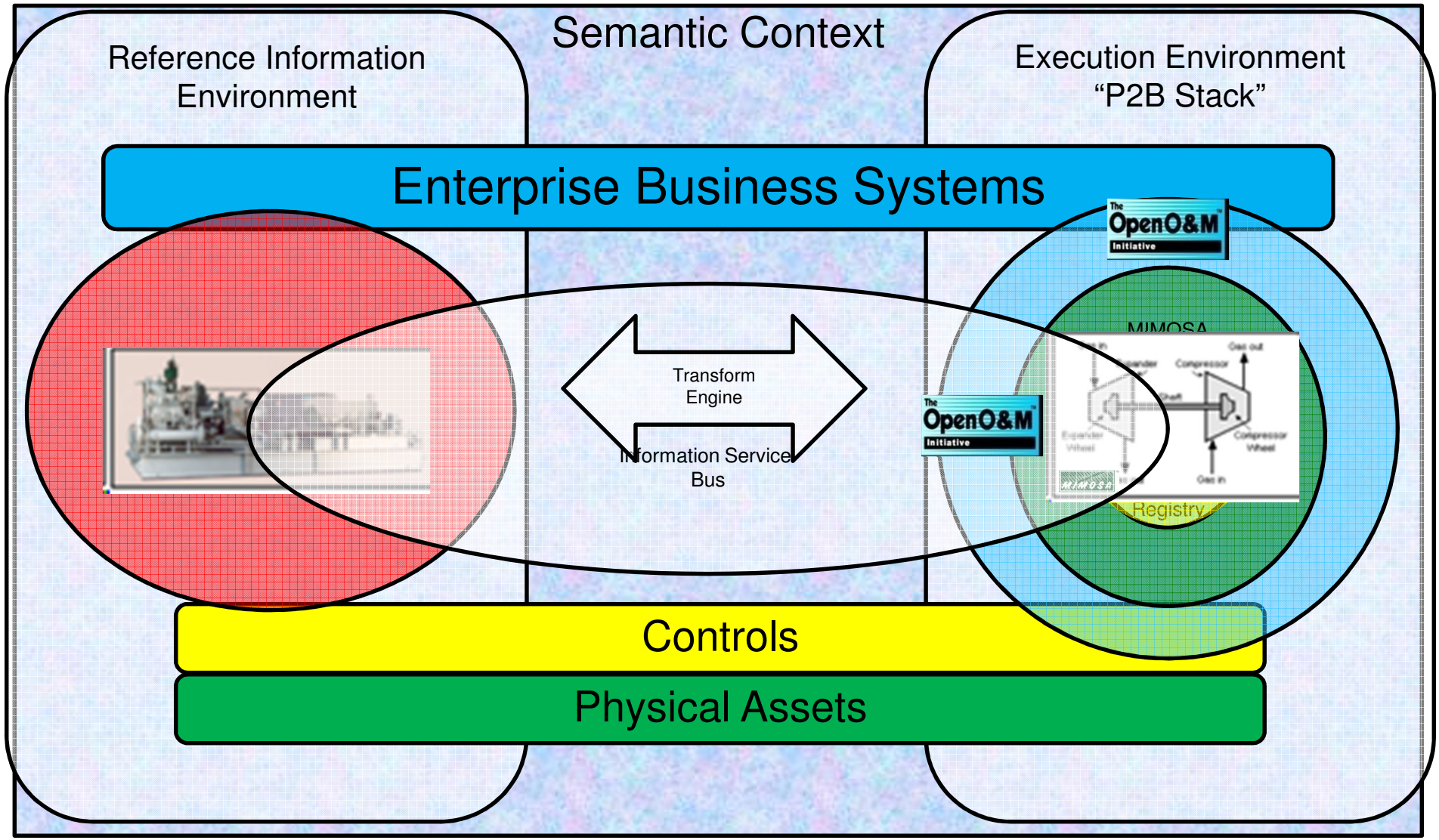
Industrial solutions are still heavily dependent on large scale custom integration services efforts. Individual Owner/Operators redundantly bare the development and sustainment cost for each of these efforts.

We need a significant paradigm shift – The Un-walled Garden

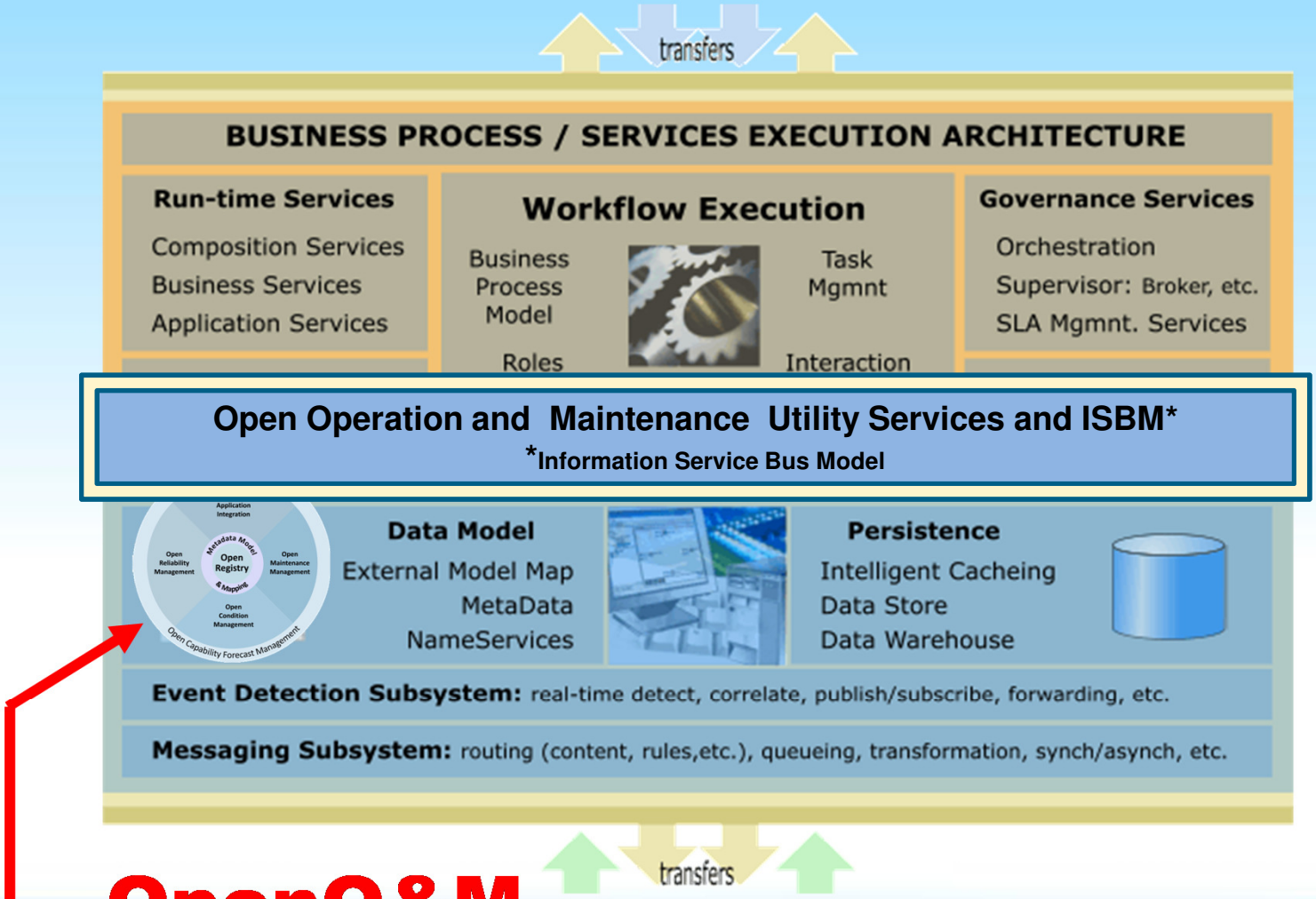
- A new industry solutions model where systems of systems interoperate in an industry eco-system based on open, supplier neutral standards
  - Collaboration between industry standards bodies – Bring proven standards together
  - Shared, supplier neutral industry information models – O/O Data is not trapped
  - Shared, supplier neutral industry utility services (SOA-2) driven by industry use cases
- Trusted public/private organization provide third-party certification & identification
- Owner/Operator Leadership and Governance
- Incremental, prioritized transformation – The Safe Technology Roadmap™
- A practical path to the Industrial Cloud

Context for Collaboration

The Safe Technology Roadmap™ for Interoperability



the openO&M™ initiative — strategic fit



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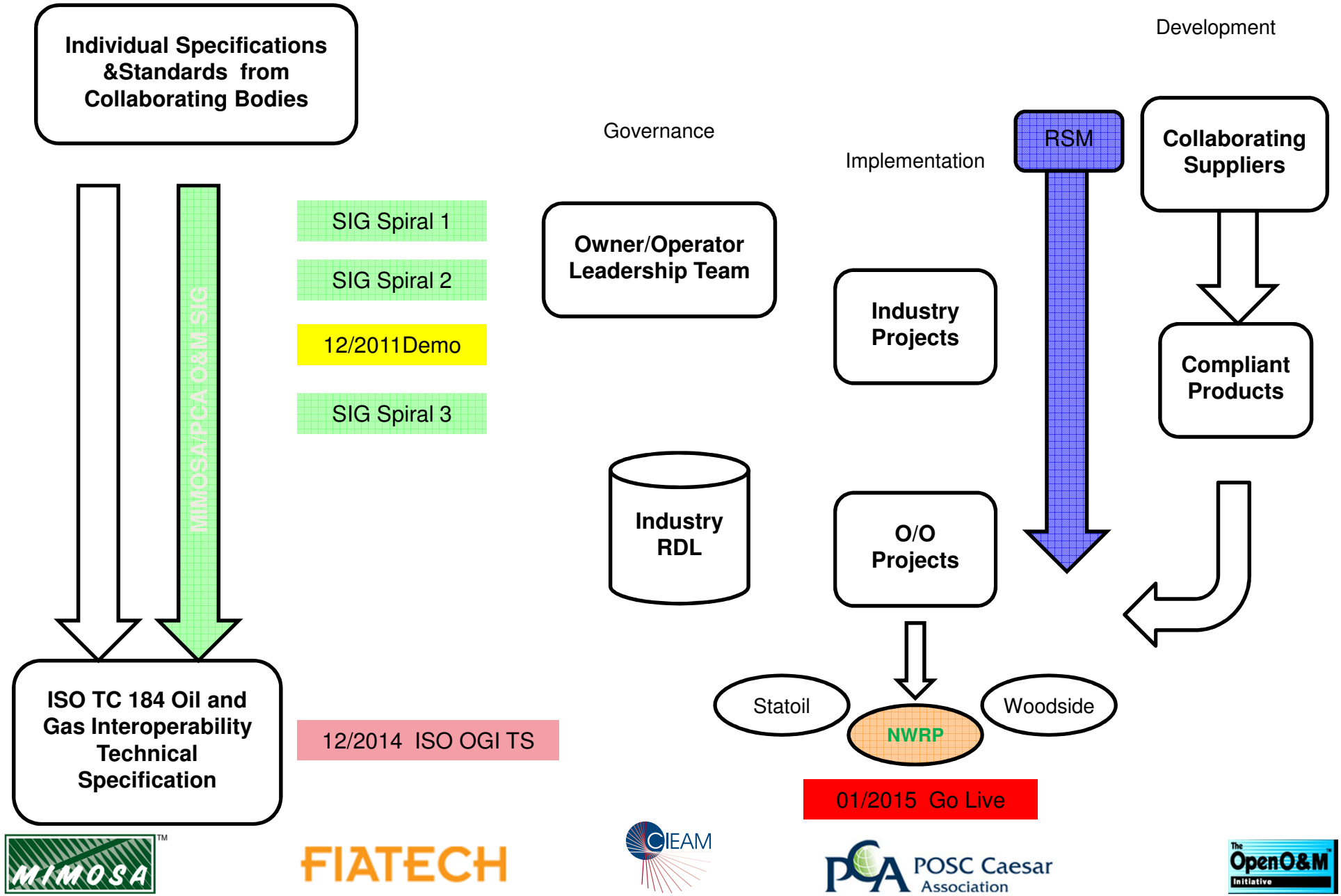
Key Use Cases

1. "handover" as-designed/built information from engineering, procurement, construction phase to O&M phase
2. recurring updates - send engineering upgrades to O&M systems
3. field engineering changes sent to engineering (bottom up)
4. on-line product data library updated with engineering reference information (asset based data)
5. operations & maintenance configuration changes (e.g. remove/replace transmitter)
6. preventive maintenance (PM) triggering
7. condition-based maintenance (CBM) triggering
8. early warning Notification
9. incident management – actual & near-miss information captured and escalated along the lines of accountability

Context for Collaboration With IBM/Reference Semantic Model



Framework and Integrated Operations & Maintenance for O&G Guiding Principles

- Architecture-Centric not Application Centric
  - Product Neutral
  - Operating Platform Neutral
  - Bus Neutral for Publish/Subscribe of Events
    - Control Flow Monitoring / CBM Events
    - OpenO&M Business Process Events
- Practical implementation approach
- Standards-enabled at all levels

Northwest Upgrading / Northwest Redwater Partnership Phase 0 Co-Phases with MIMOSA / PCA - O&M Special Interest Group

Implement and support an Interoperability Test Laboratory at IBM's Global Solution Center. The laboratory will consists of key applications types:

- Engineering applications and design tools
- IBM's IIC - Integration and Information Core/Framework Solution
- Document Management
- Assetricity's Open Operations and Maintenance Solution Products including:
  - The IOM-OG® REGISTER an enterprise O&M Registry Management System (OpenO&M Common Interoperability Register & MIMOSA CCOM)
  - The IOM-OG® TRANSFORM Model Based Information Transformation Engine (OpenO&M / ISO15926 / Other information models)
- Data Historians and Distributed Control Systems

Phase (0) Activities

Provide a transform standards based solution comprised of Web Service and Business Processes that will:

- Create and populate the IOM-OG Registry to be used to initialize multiple operations applications sourced from multiple engineering applications
- Develop work flow processes based on OpenO&M Use Cases that can bulk load and incrementally update target applications in the execution environment
- Focus on a small, O/O prioritized industry data set

Demonstrate:

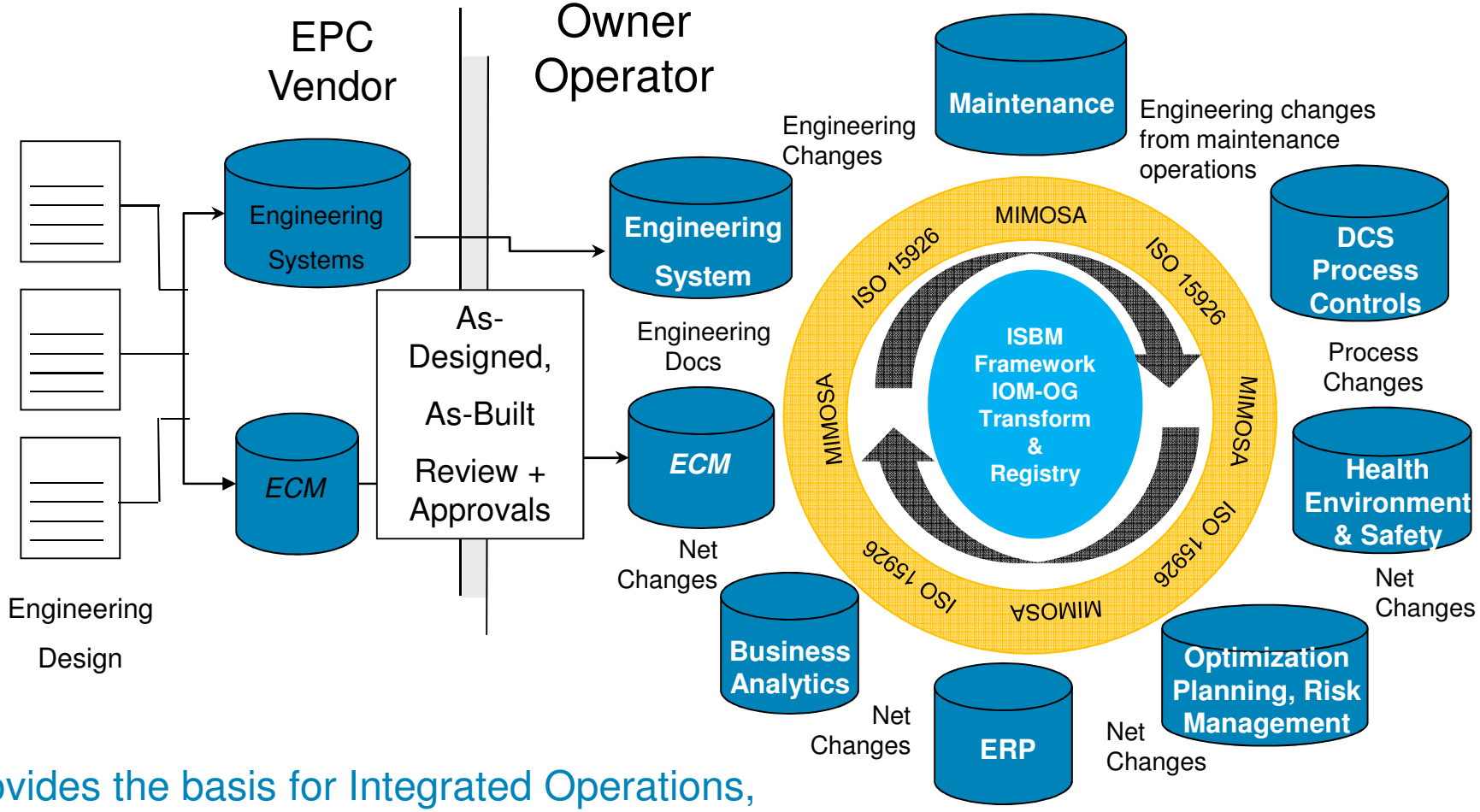
- How IBM's Reference Semantic Model and associated Graphic Symbols set can be ***initialized*** and ***incrementally*** updated via the OpenO&M Information Service Bus Model (ISBM) and the IOM-OG Transform.
- How a Real-Time Process Information Historians underlying real-time measurement tags can be configured from the IOM-OG Transform & Registry
- Demonstrate the how ECM/document management organization and hierarchy can be initialized leveraging the IOM-OG Transform & Registry

Phase 1,2,3 rolled out over the next 3 years

Implement the rest of the OpenO&M Used Cases based on NWRP requirements defined in Phase 0 as follows:

- Field/Maintenance Changes to Plant/Facility Engineering
- O&M Asset Configuration Updates i.e. changes to procured assets
- Preventative Maintenance Triggering
- (Semi-)Automatic Triggering of Condition Based Maintenance (CBM)
- Early Warning Notifications based on CBM determinations
- Incident Management/Accountability
- Up-to-Date Product / Equipment Data Library

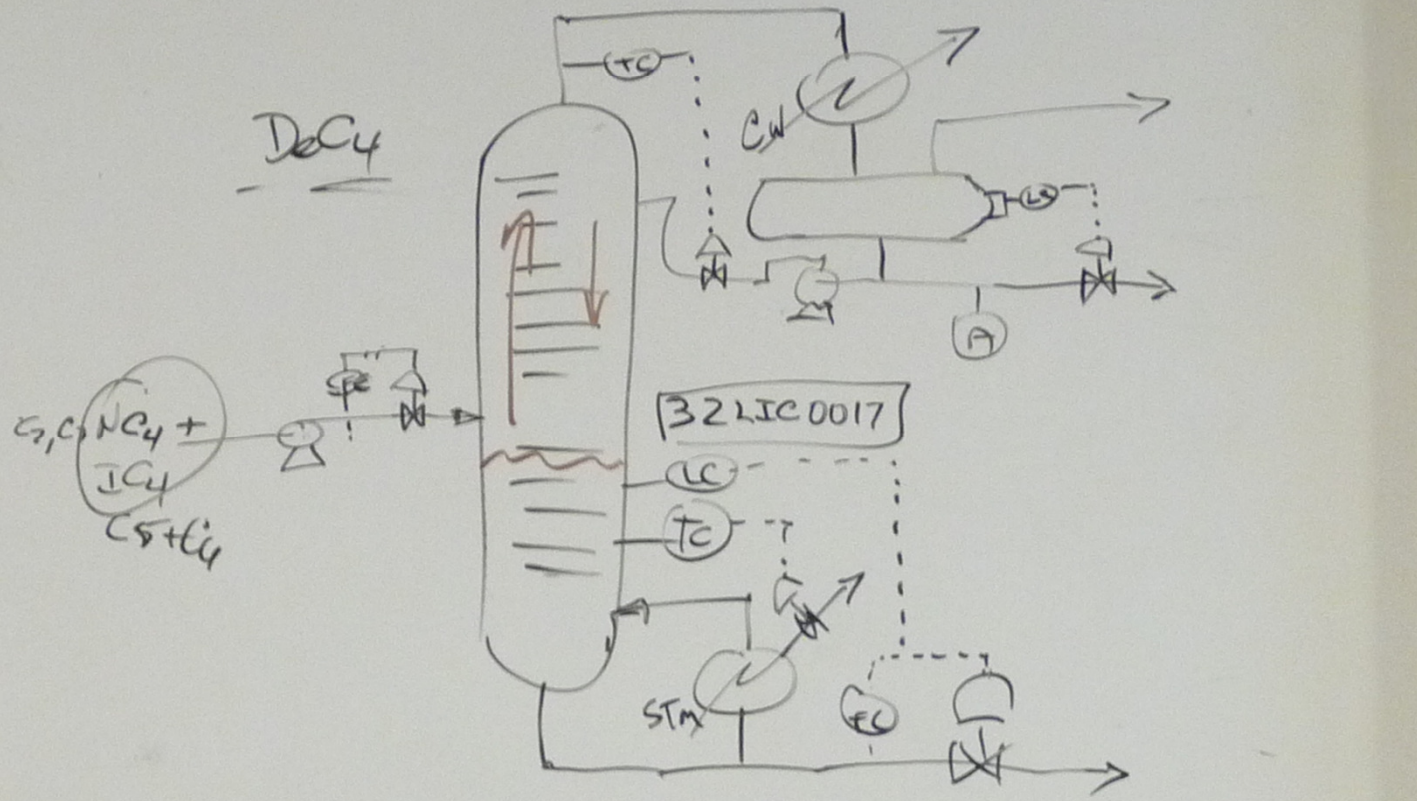
Industry Standards Based Integrated Operations and Maintenance for Oil and Gas



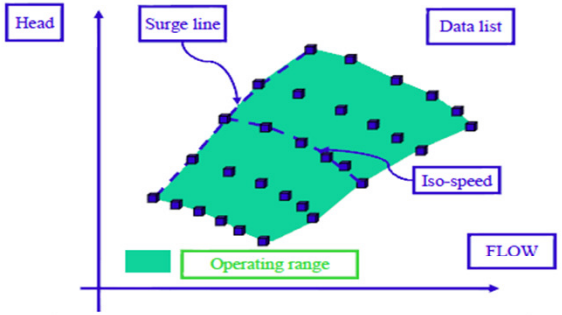
Provides the basis for Integrated Operations, Maintenance & Engineering Interoperability leading to Operations Readiness

DeButanizer Fractionator

FlowSheet (PFD)



Compressor map: reference curves from manufacturer



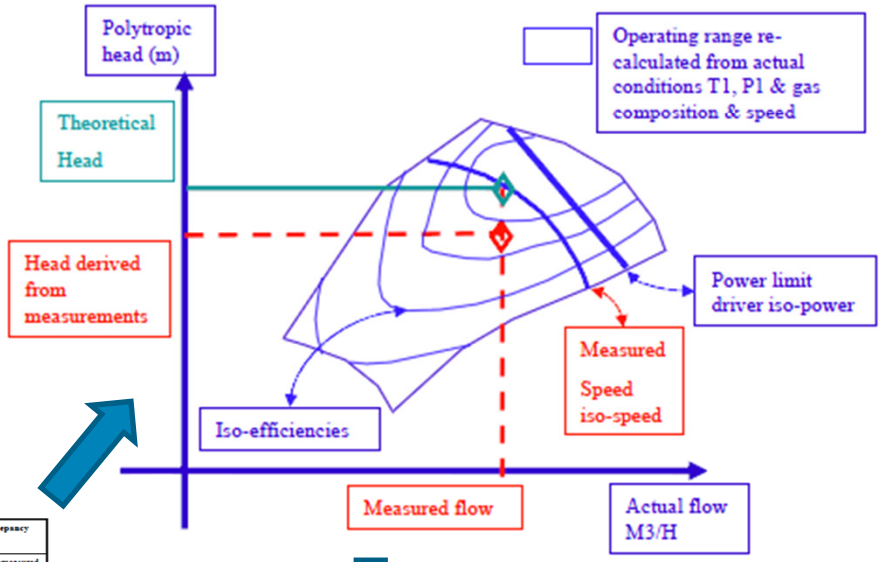
Point list	Speed (rpm)	Flow (acm/h)	Head (m)	Efficiency (%)
Surge line	Speed-1	Flow	Head	Eff
Point 2	Speed-1	Flow	Head	Eff
…	Speed-1	Flow	Head	Eff
Point n	Speed-1	Flow	Head	Eff
Surge line	Speed-2	Flow	Head	Eff
…	Speed-2	Flow	Head	Eff

The user may give any number of values per curve, the user may have only one iso-speed

Interpolation grid is independent of the number of data

Reference "design" values: Pinlet ref, Tinlet ref, orifice geometry data, maximum power.

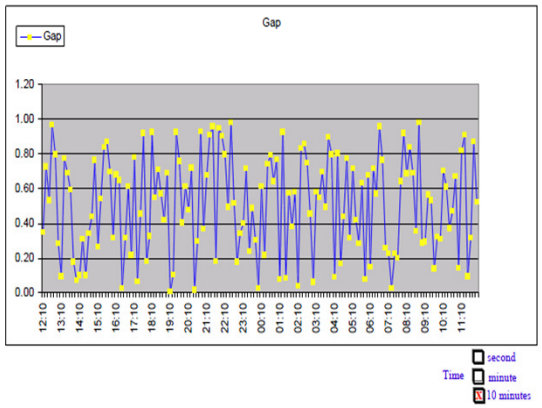
Performance curves 3 Polytropic head



Value	Measurement	Obtained by other measurements	formula
Volumic Flow	Direct By FT	PDT on orifice	F=Orifice formula, all values in IS
Speed	Speed	-	-
Pressure ratio	Not direct	P1 P2	PR=P2/P1
Temperature ratio	Not direct	T1 T2	TR=T2 in K / T1 in K
Enthalpy and Z	Not direct	Gas comp, P1 T1 P2 T2	Z1, Z2, H1=Cp1*T1, H2=Cp2*T2 by Hysys
Specific volume	Not direct	Gas comp P1 P2 T1 T2	V1 = Z1RT1/P1, R constant of gas V2 = Z2RT2/P2
Isentropic exponent	Not direct		N1 = ln(P2/P1)/ln(v1/v2)
Polytropic work factor	Not direct		F=(h2-h1)/[(n1/(n1-1)*(p2v2-p1v1)]
Polytropic exponent	Not direct		N=ln(PR)/ln(N1)
Polytropic head	Not direct		Wp=f*n/(n-1)*(p2v2-p1v1)
Polytropic efficiency	Not direct		Etap = Wp / (h2-h1)
Gas power	Not direct		Pwr = v1*F*Wp/Etap
Normalized flow	Not direct	F, P1, T1	Fstandard = F*(T1/288.15)*(1/P1)

Theoretical values

Values	Measured value req'd	Measured value req'd	Theoretical value from interpolation or formula	Discrepancy
Polytropic Head	Speed N	Flow F	Interpolated Head Hp_theor	Head-measured – Head-interpolated
Polytropic Efficiency	Speed F	Flow F	Interpolated efficiency Etap_theor	Efficiency_measured – efficiency_interpolated
Power	-		Pwr = v1*F*Hp_theor/Etap_theor	Power measured – power theoretical
Enthalpy	T1, P1, gas_comp		H1=Cp1*T1 Cp1 by Hysys H2_theor = Hp_theor/Etap_theor + H1	
Discharge temperature			T2_theor = H2_theor/Cp2_theor Cp2_theor by Hysys (iterative)	
Discharge pressure			Iterative calculation: First iteration: values derived from measurement. V1=Z1*R*T1/P1, Z1 and R by Hysys v2_theor=Z2_theor*R*T2_theor/P2_theor Rv = V1/V2_theor N=ln(P2_theor/P1)/ln(v1/v2-theor) F=(h2-theor-h1)[(n/(n-1)*(P2_theor*v2_theor-P1*v1)] N=ln(P2_theor/P1)/ln(Rv) P2_theor=Hp_theor*(n-1)/(v2_theor*n*f) +p1*V1/v2_theor	
Theoretical P and T ratio:			P2_theor/P1 and T2_theor/T1	
P1 from P2 measured	T1, P2, T2, gas_comp		Iterative calculation: First iteration: values derived from measurements. V2=Z2*R*T2/P2, Z2 and R by Hysys v1_theor=Z1_theor*R*T1_theor/P1_theor Rv = V1_theor/V2 N=ln(P2/P1_theor)/ln(v1_theor/v2) F=(h2-h1-theor)[(n/(n-1)*(P2*v2-P1_theor*v1_theor)] N=ln(P2/P1_theor)/ln(Rv) P1_theor= Hp_theor*(n-1) /(v1_theor*n*f) +p2*V1_theor/v2	



Recent Oil and Gas Industry Upstream Event Held In Houston

<u>Keynote Speakers</u>

Dr. Lee Hunt – President IADC

USCG Rear Admiral Landry

Dr. Thore Langeland – Manager IO, OLF

<u>Theme</u>

It is a small, interconnected world and we need to collaborate to develop and deploy the needed solutions.