

Oil & Gas Consulting Company



Company Profile Who we are

Nova Energy is a consulting group specialized in technical and economic analysis of projects, properties and companies.

We provide services from Integrated Asset Descriptions, as well as expert advice on divestment, mergers and acquisitions of oil and gas properties. Our staff comprises highly trained professionals with engineering, geological, geophysical, economic and computing skills.

Our strength comes from a business oriented focus built on individual excellence and the flow of knowledge between closely aligned multidisciplinary teams.

Integrating with experience What we do

Nova Energy has a focused expertise in Integrated Asset Descriptions, Field Development Planning and Asset Transactions all involving crossdisciplinary integration of geophysics, geology, petrophysics, engineering, finance and economics.

Vast and long standing experience, impeccable ethics and access to a multidisciplinary network of business associates guarantees the high-end quality of services, teams and individuals. Typical services include:

- Asset screening.
- 3D static and dynamic reservoir characterization.
- Field development planning.
- Harmonized asset reference planning.
- Unconventional reservoir analysis.
- Well deliverability assessment.
- Detailed well petrophysical analysis.
- Post implementation / investment reviews.
- Asset transactions advice.
- Expert witness and data room handling.

Our services can be applied on the following scenarios :

- Corporate Planning: including review of field multiple operational scenarios and selection of the Best Case.
- Completion assessment: Integrated well data interpretation provide assessment on future well deliverability.
- Entry to Business: Screenings, Data Room Handling and Expert Advice for Acquisition of oil and gas properties, Swaps and Mergers.
- Portfolio Management: Providing asset and company suitability ranking.
- Data Room handling: data collection and fast track review for data validation.
- Review and evaluation of property upside : including operating cost economies, operational changes, behind pipe and undeveloped reserve potential with the application of appropriate risk containment factors.
- Post Implementation Assessment: Detailed Post-Investment or Post-Mortem Reviews for asset assimilation / divestment or project monitoring, including quantification of operational improvements, upside, and recommendations for improving cash flow.

Strategies for integrated reviews How we work

True integration entails a bringing together of the minds of the several team players, in the form of either individuals or complete organizations aligned

together for a common achievement.

NOVA's Core Team has been vastly trained, by several decades of intensive exposure to multivariate discipline and organizational environments, to collaboratively benefit from the talents and insights from diverse project participants to deliver Integrated Asset Descriptions (IAD).

Beginning when the project is first visualized and subject to conceptual analysis, NOVA's Integrated Process workflow exploits business structures, practices, and processes from both NOVA's Core Team and from all its Third Party Associates.

IADs include several phases before Project Delivery and Closing Out and they all encourage the early contribution of knowledge and experience and requires proactive involvement of key participants. IADs could eventually continue throughout the full field life cycle until the project implementation has been achieved.



Strategies for integrated reviews How we work

Post – Implementation Reviews are also part of the Project Delivery Workflow and is customarily utilized to monitor performance after implementation.

This higher level of completion allows the Implementation phase to be shorter than the traditional, and the early participation of key stakeholders allows the shortening of the management review and buyout phases. The combined effect is that the project is defined and coordinated to a much higher level prior to implementation, enabling a more efficient and shorter execution period.

Examples of Internal Process Workflow



Business Model How we work

"An Integrated Project is built on collaboration. As a result, it can only be successful if the participants share and apply common values and goals." (A Working Definition - AIA California Council 2007).

The traditional project execution approaches contemplate separate silos of disciplines and responsibility that in practice yield to inefficiencies whenever there is a hand-off from one silo to another.

ESSENTIAL PRINCIPLES

To harness the collective capabilities, the integrated team and its management embrace our principles of:

- Mutual respect
- Harmonized Benefit

Additionally, projects delivered traditionally suffer because participants success are not necessarily related. Indeed it is quite possible for one or more of the project participants to "succeed" notwithstanding overall project failure.

Integrated Asset Descriptions represent a behavioral change in the industry by breaking down the discipline boundaries requiring higher level of cooperation and commitment among all major participants.

MANAGEMENT COMMITMENT

Integrated Asset Descriptions embodies, in varying proportion, many of the following attributes:

- Ring Fenced Team Configuration
- Early Gains Definition
- Enhanced Communication
- Clearly Defined Open Standards
- Appropriate Technology and Practices

Ethical Behaviour

Mutual Respect

Harmonized Benefit Police



Asset screening

Reservoir Characterization is the core and also the fast growing area of business for Nova Energy.

Our team has career length experience on global projects and is supported by the most comprehensive and up-todate software packages available in the industry.







Our experience indicates that major decisions on support of significant investments in field development, field rehabilitation or improved recovery operations often requires from a very fast although detailed study option to provide understanding of reservoir performance in order to assess future economic scenarios.

Our Asset Screening Service is an option to provide an enhanced insight into the key production drivers that control assess performance leading to rapidly leverage the existing data for competitive bidding submittals or business entry decisions.



Components of Resource Visualizations and Property

- Structural Modeling
- Petrophysics
- Geology
- Reservoir Visualization
- In-Place Resource Volumes

- Production Allocation Forecast
- Incremental Projects
 - Uncertainty Assessment
 - Strategic Planning and Field Development
 - Property Valuation

Field Developement Planning

The successful application of Field Development Planning (FDP) for oil and gas reservoirs requires an accurate understanding of key intrinsic reservoir architectural and field operational drivers that allow the performance prediction under different scenarios.

Integrated Asset Descriptions (IAD), are fit-for-purpose analytical planning tools that originates with the creation of multiple static and dynamic 3D subsurface models that honor the one, two or three dimensional data from well bores, seismic surveys and eventually, outcropping data.

IADs are leveraged by cross-discipline interactions that lead the generated models to fit multi-dimensional reservoir definitions enabling to narrow the many business and operational uncertainties involving reservoir management. NOVAs staff has worked over many years on improving its streamlined IAD Workflow. This workflow is enabled by the rapid diagnose of field and well behavior parameters based on a detailed analysis and QC of field data base.

Once the reservoir performance key drivers are categorized, 3D static and dynamic models are oriented to contain these uncertainties and future scenarios are forecasted. Possible upside and downside cases are generated to derive the Harmonized Project Portfolio that builds the Best Case Scenario for the asset hydrocarbon recovery.

This approach allows for answers to complicated problems to be expressed under specific operational actions encompassing from the detailed definition of individual completions to detection of operational improvements.

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Components of Field Development Planning

- Structural Modeling
- Petrophysical Modeling
- Stratigrafic Modeling
- Sedimentological Modeling
- 3D Integrated Stochastic Modeling
- Realization Analysis
- Property Upscaling

- Strategic Planning and Field Development
- Reservoir Dynamic Simulation
- Uncertainty Assessment
- Scenario Modeling
- Reserve Categorization
- Reserve Maturation and Replacement
- Asset Reference Plan

Single Well Evaluation Services

The emphasis in logging and formation evaluation has shifted into nonconventional reservoirs, improved geosteering in ERD and horizontal wells, as well as characterizing and evaluating deepwater laminated turbidites, lowpermeability carbonates, fractured tightgas reservoirs (sandstones and gas shales) and heavy oil/tar sands.

This emphasis has produced new and improved technologies and methods that provide additional and more accurate information for downhole reservoir characterization.

Components of Single Well Integrated Evaluation

- Log Analysis
- Rock Typing
- Pressure Analysis
- Wellbore Image Interpretations
- Flow Unit Determination
- Well Deliverability Assessment
- Non Conventional Reservoir Evaluations

The integrated analysis, of core and log data, borehole imaging, downhole pressure monitoring devices and fluid characterization at reservoir conditions can span the analytical capabilities of traditional well interpretation enhancing completion design with significant impact on the project management.

The evaluation process workflow applied by our company integrates data from multiple sources and different support volumes to provide the basis to link geology and reservoir engineering. The ultimate goal of the single or multiwell process is to build realistic 3D wellbore property distribution to help to predict future performance and support completion operations.







Multi Well Evaluation Rock Typing & Flow Unitization Approach

Rock Typing provides a consistent approach for integration of reservoir properties from various scales, identifying their intrinsic rock capacities of fluid flow and storage.

It ultimately leads to the definition of Flow Units that consists of reservoir subdivisions defined on the basis of similar pore type attributes. Inflow performance for a flow unit can be predicted from its inferred pore system properties, such as pore type, pore size and pore geometry.

Components of Flow Units Determinations

- Depositional Rock Typing
- Petrographic Rock Typing
- Hydraulic Rock Typing
- Port Size determinations
- Multi Well Log Analysis
- Flow Unit Identification
- Lateral Congruency Assessment



Rock Typing workflow considers the description of different kinds of Rock Types known as:

- Depositional: macroscopic-scale, original rock properties present at deposition
- Petrographic: rock properties at microscopic-scale, i.e rock texture, composition, pore system, diagenesis.
- Hydraulic: represents the physical rock flow and storage properties as controlled by the pore texture.







Unconventional Plays Integrated Reviews

The assessment methodology (IADs) and production practices of conventional reservoirs vary from those used for unconventional resources (i.e Ultra-Deep Fractured, Fractured Gas Shales, Coalbed Methane and Tight Gas sands). Predicting productivity of offsetting well locations in a non conventional reservoir environment are one of the key challenges to enhance well placement strategy and to meaningfully differentiate the quality of a each drainage point.

In many cases, none of the conventional reservoir architectural drivers correlate strongly to well performance. There may be not a unique reliable spatial predictor of conventional reservoir variables (even if the measurements and tests required to estimate these variables have been executed) to enhance prediction of performance on unconventional environments.

However, Shale Petrophysics that includes the exhaustive integration of Core Lithofacies, Geochemically derived TOC Content, Free and Adsorbed Gas Analysis and Critically Stressed Fracture Analysis have proven to have established the basis to predict well performance at the well scale. At a play scale though, performance may nonetheless display a wide variability; and it is often the case that such variability cannot easily be predicted in advance or even correlated to conventional measurements (e.g. porosity, thickness, structural position, etc.).

That is why, in many instances, non conventional plays have alternately been described as "statistical" plays in which an operator must drill a large number of wells and can expect fairly repeatable results if enough wells are drilled. Under that scenario the economic development of unconventional resources is often questionable.

This hurdle can be minimized by an integrated interpretation of largescale architectural reservoir attributes (Reservoir compartmentalization, fractures, and faulting) obtained from leading edge seismic processing and interpretation technics.

The obtained geological framework and the resulting elements from single well petrophysics define the areas of higher concentration of reservoir properties and other building elements of the reservoir systems such as seals, and baffles controlling fluid distribution and flow in the reservoir.

Unconventional Shale Plays Integrated Reviews



Prospect Evaluation

- Tectonic history
- Structural framework
- Stratigraphic framework
- Stress regime
- Pore pressure regime
- Petroleum system
- Geochemistry

Resource Potential

- Structural framework
- Stratigraphic framework
- Sweet spot distribution
- Hydraulic rock properties
- Fracture Network
- Volumetrics (HC in place)
- Distributary drainage
- volumes

 Uncertainty and
- probability assessment

Reserves Evaluation

- Geomechanical properties
- Stress anisotropy
- Fracture system
- permeabilityWell placement
- Fracture stages
- HF hydraulic capacity
- Well performance

Unconventional Shale Plays Shale Plays Petrophysics

Petrophysical characterization of Shale plays at well-scale is the basic step for resource assessment.

The integrated workflow includes exhaustive core analysis, naming lithofacies identification, geochemical analysis for TOC content, naturally fracture systems description, as well as geomechanical properties for Hydrofracs feasibility. Core to log calibration allows the identification of shale rock properties at well-scale, in order to extrapolate the analysis to wells lacking core data based on refined stratigraphic correlations.

Components of Shale plays Petrophysics

- Total Organic Carbon Analysis
- Free Gas Analysis
- Adsorbed Gas Analysis
- Productivity Analysis

Data Loading Data QC/QA Environmental Corrections

Total Organic Carbon Analysis	Free Gas Analysis	Adsorbed Gas Analysis	Productivity Analysis
Delta Log R (Passey) Density Log (Schmoker) Core data Artificial NN	Volumetric Analysis Volume of Kerogen Effective Porosity Water Saturation	Langmuir Isotherm Langmuir Parameters Correct for Res. Temp. Correct for Res. Press. Correct for TOC	Formation Permeability Fracture Network (FN) FN Connectivity
TOC Content	Kerogen Volume Effective Porosity Water Saturation	Adsorbed Gas Content	Productivity Drivers
Total Gas Content (TGC)			Estimated Ultimate Recovery (EUR)

Naturally-fractured Reservoirs Assessment

A fractured reservoir is defined as a reservoir where naturally originated fractures are involved in fluid flow increasing reservoir permeability. In order to achieve the correct assessment of fractured reservoirs, natural fracture analysis is the key critical aspect to take care of. Nova's experience has identified an integrated workflow that connects information from several scales, specially 3D seismic, wellbore data and cores where available.

Geological description of fractured reservoirs has a final goal that consists in creating a 3D Discrete Fracture Network, which allows to identify the main characteristics of the fractured environment, leading to be the support for dynamic simulations. Evaluation of the fracture connectivity leads to quantify wellbore deliverability, allowing multiple scenarios to be simulated and choosing the best case for future field development.







Components of Naturally Fractured Reservoirs Assessment

- Detailed Structural Modeling
- Dual-porosity Petrophysical Modeling
- Outcrop and Image log fractured systems
- 3D Discrete Fracture Network
- Fractured system connectivity

- 3D Integrated Stochastic Modeling
- Reservoir Dynamic Simulation
- Uncertainty Assessment
- Scenario Modeling
- Strategic Planning and Field
- Development

Post-Mortem Assessment

Detailed Post-Implementation (i.e Post-Acquisition or Post Mortem) reviews are a new initiative by NOVA and are intended for asset assimilation (including quantification of operational improvements), upside identification and risk assessment, and recommendations for improving performance.

The post Implementation review process is based on an integrated and systematic program of data accumulation and analysis that is collected after the implementation of the decision and provides greater visibility to shareholding and high level management on how successful past investments have been, and whether the projects have achieved the goals as expected.

Additionally the purpose of a post completion review is threefold:

To support continuous improvement in the capital investment and implementation process. This process is oriented towards the future.

> Components of Post Acquisition Reviews

- Post Mortem Reviews
- Post Investments Reviews
- Post Acquisitions Reviews
- Restoration of Value
- Purchase Price Review

To allow for the identification and implementation of corrective actions on the project under review or in similar projects. This is an opportunity to review not only the current cash flows of a project at the date of review, but also to review the updated future cash flows of that project.

To allow for the review of current procedures and the design of better ones to improve future decisions, to guarantee better implementation and better conformance.

Our Post Implementation Review services can be applied on the following scenarios:

- Restoration of Value.
- Purchase Price Review
- Well Post Mortem.

Acquisition Val

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• Well Rehabilitation Exercises.

COMBINED PORTFOLIO REVIEW





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