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Taking a strategic view
Energy in the global metals and mining sector

Every company is an energy company[1]

Traditionally, companies in the global metals and mining sector have viewed energy as a necessary cost of doing business, an overhead item to be managed in line with the budget. But over the past several years, the very notion of energy has changed. Whether because of expense, unreliable supply, or environmental concerns, traditional sources are no longer a simple answer. Today, companies are presented with more options. Choice is certainly good, but it also requires that companies shift their thinking and begin to consider energy not as an expense but as an asset, one that can be managed strategically to create shareholder value and competitive advantage.

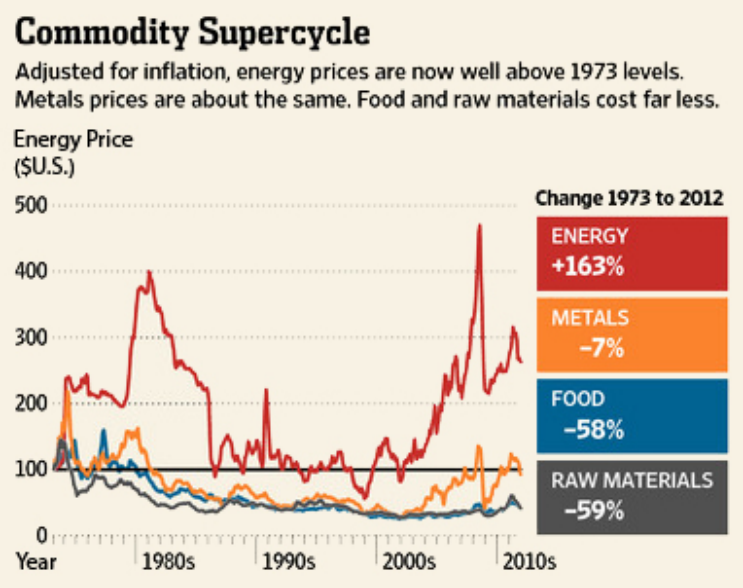
Realizing competitive benefits from energy consumption will have a positive impact on a company's overall performance. But it can be a challenge, especially for companies that for so many years have concentrated their energy strategies on reducing use. While conservation is important, it may mask longer-term benefits that can be derived from adopting other strategies. Understanding these options, the benefits, the risks, and the impact on every link along the value chain, is a complex process. However, companies that are able to thoroughly and realistically explore their options are best able to turn energy into a viable contributor of value.

Understanding the imperative

The global metals and mining sector has experienced much of this development in eras of relatively inexpensive and abundant energy. Coal, which was easily and inexpensively mined and abundantly available, became the overwhelming favorite for powering furnaces in integrated steel mills.

Today, companies in the metals and mining sector (like all industries) are under pressure to increase earnings, enhance profits, and maintain environmental compliance. Competing in global markets and operating as part of sophisticated and increasingly visible supply chains further complicates the task of winning. The price of energy, while volatile, has risen steadily during the last several decades. As shown in Figure 1, energy costs are outpacing other fundamentals, rising 163 percent over the last four decades.[2] Over the next several years, with anticipated economic growth in populous Brazil, India, and China, demand for energy is expected to remain high and volatile. Unstable economic conditions in Europe are another contributing factor to energy uncertainty. Leading companies in the metals and mining sector are being driven to continuously seek out innovative sources of economic advantage.

Figure 1: Energy costs are outpacing other fundamentals



Note: Indices are trade-weighted U.S. dollar prices deflated by change in U.S. consumer price index.
Source: IMF World Economic Outlook, and The Wall Street Journal, April 2012.

[1] Deloitte United States (Deloitte LLP). Deloitte Center for Energy Solutions. "Every company is an energy company. *and if it isn't, it will be soon". 31 March 2011. Joseph Stanislaw, Independent Senior Advisor, Energy & Sustainability, Deloitte LLP. Founder of the advisory firm The JAStanislaw Group LLC.

[2] International Monetary Fund (IMF). "World Economic Outlook: Growth resuming, dangers remain" Figure 1. World Commodity Prices, 1970–2011. April 2012. The Wall Street Journal. "U.S. News — CAPITAL: Price Check: The Costs of Essentials". 26 April 2012.

And yet, the physical reality remains that making finished metals from raw ore is an extremely energy-intensive process, accounting for up to 40 percent of the final product cost.[3] Never before has it been as important for companies to develop and implement new strategies to manage their energy needs.

Strategic management of energy is already beginning to happen in the metals and mining sector. Inefficient and environmentally unsound sources of energy are falling under close examination with the aim of making investments for greater efficiency. Where improvements are not feasible, systems are being phased out. The case of coal is illustrative. While coal will remain an important fuel for the sector, it is no longer as cheap as it once was, nor can it be used without environmental constraints. Companies that have relied on coal as an energy source are increasingly looking elsewhere. As a result, a major trend in energy is one of convergence, where traditional sources are being replaced by newer, cleaner, and more efficient means of production (see Figure 2). As outlined briefly below, each alternative comes with its own advantages and drawbacks.

- **Natural gas**. Gas is clean, cheap, and now, with the discovery of major deposits of shale bed gas, abundant, several steel companies have begun to convert their operations from coal fuel. Lower energy costs, specifically for natural gas, are driving new technology and investment in the steel industry in North America.[4] There are drawbacks: natural gas is less efficient than coal and hydraulic fractioning (or fracking) is a somewhat controversial method of extraction. As natural gas grows in popularity, the commodity may become more expensive. In fact, as liquefied natural gas (LNG), the commodity is already demanding high prices in Asian markets[5] that produce steel. Compressed natural gas (CNG) is also being considered for U.S. shale gas and may help the mining industry replace diesel as a fuel for vehicle and remote power generation.
- **Using more recycled material**. Making aluminum from recycled material requires a mere 5 percent of the energy required to make the same amount from bauxite ore.[6] Naturally, companies are seeing the benefits of using more recycled material. However, in the steel industry, a shortage of recyclable material is hampering recycling programs, a side effect of the long life of most steel products.
- **Energy recovery**. Otherwise-wasted heat can be used to produce energy, reducing overall consumption. Aluminum, for example, is formed at 900 °C but melts at 660 °C[7], so the excess heat from the second process can be used to help melt recycled material. In the steel industry, CO2 from fossil fuel consumption is being recaptured and remarketed.
- **Cogeneration**. By-products of production, such as off-gas in the steel sector, can be used to generate energy (using steam, electricity, or both). Several steel companies are currently deriving value from this process, in one case constructing a heat recovery coke and electric cogeneration plant. Difficulties can arise from issues related to location, sizing, grid interconnection, and local utility tariffs for standby generating capacity.
- **Self-generation**. Although expensive to implement, in-house generation can provide a reliable supply of energy for operations.
- **Transportation**. Companies are looking at reducing energy costs related to transportation. Some companies in the mining sector, for example, are using larger ships to haul their product.

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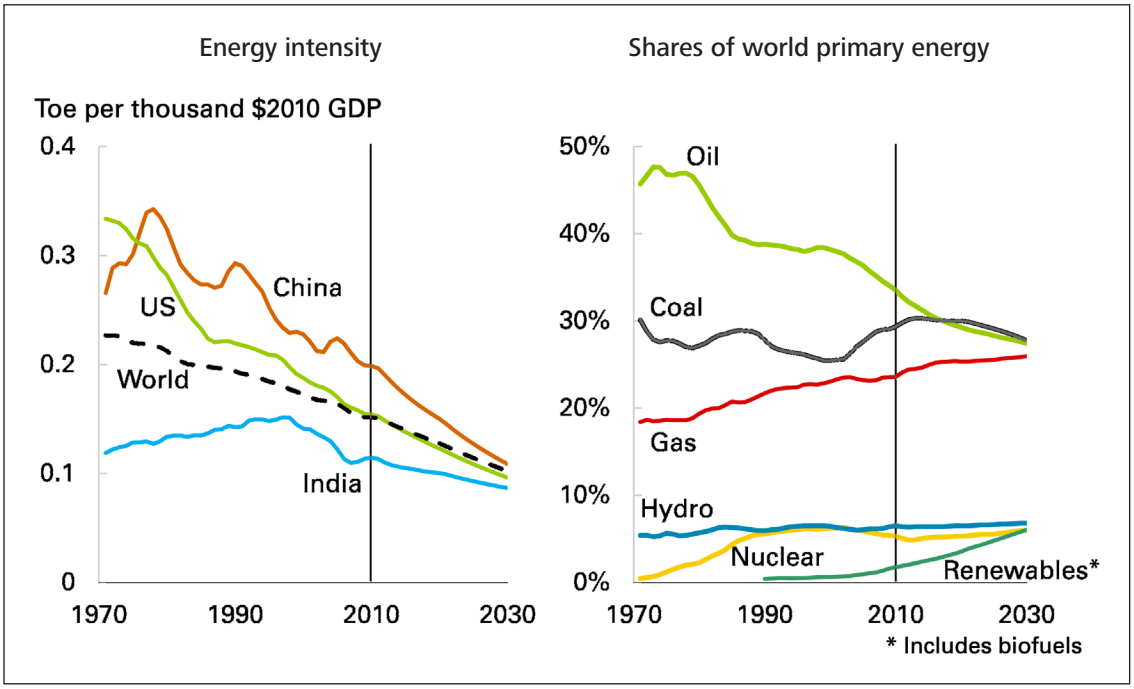
[3] Deloitte Touche Tohmatsu Limited (DTTL) Global Manufacturing Industry group analysis. World Steel Association. "Energy: Fact sheet". October 2008.
[4] Metals Bulletin. "US Steelmakers Look To Low-Cost Energy To Kickstart Industry". 10 May 2012.
[5] Reuters. "Tight gas markets likely through 2014-2015." 8 June 2012
[6] International Aluminum Association website. About Aluminum production - smelting. www.world-aluminium.org. Website accessed on 8 June 2012.
[7] Ibid.

- **Alternative energy sources**. Generally cleaner than traditional fuels, wind, biomass, solar, and other alternatives are also generally more expensive. However, prices have been declining and in some cases grid parity has been reached.
- **Relocation**. Another expensive option, relocation can nonetheless bring an operation closer to reliable sources of energy, more favorable regulatory environments, or both. Iceland's vast geothermal energy is attracting the interest of some metals companies. In 2009, roughly 84 percent of primary energy use in Iceland came from indigenous renewable resources with 66 percent from geothermal sources.[8] In Saudi Arabia, a large integrated aluminum facility is under construction. The mill will be the first in the Middle East and will be a technically advanced facility.[9] In addition, agreements with governments guaranteeing stable sources can boost a company's value.
- **Resource availability**. Water, another important resource for the sector, is also a factor not only in operations but in transport. From an operations perspective, increasing awareness of potential future water scarcity has made it another key strategic consideration. For transportation, access to waterways is an important consideration as it has been for many years. Part of Pittsburgh's appeal to the early steel makers in the United States was its position at the crux of three major rivers.

Figure 2: Convergence of energy[10]

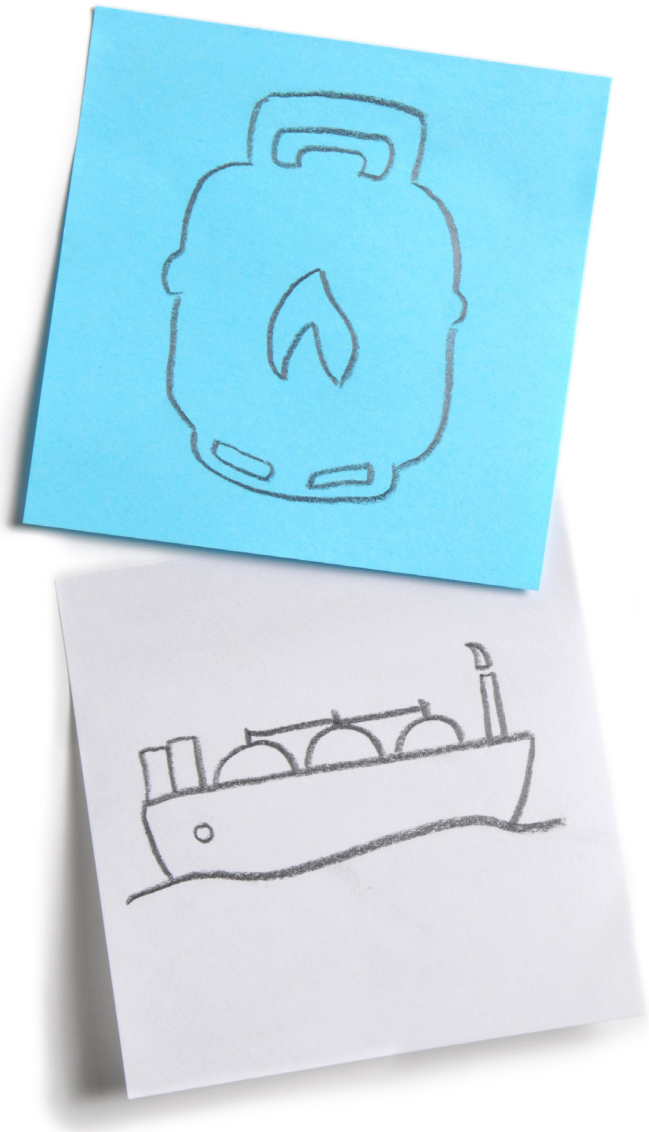


Source: BP. "BP Energy Outlook 2030". January 2012.

[8] Orkustofnun, National Energy Authority of Iceland web site http://www.nea.is/geothermal accessed on 4 June 2012
[9] Alcoa press release, "Ma'aden Alcoa Aluminum Joint Venture Pours First Concrete for Middle East's First Alumina Refinery at Ras al Khair". 3 February 2012
[10] BP. "BP Energy Outlook 2030". London, January 2012,

What option is the right option?

A company with new energy needs faces many complicated decisions regarding the nature of its supply. Adding capacity is a costly process, with precious little room for missteps. The risk of erring is high. With energy playing such an important role in overall performance, though, the benefits of choosing the right option can be substantial.



Taking the holistic approach

Like any asset, energy should be strategically managed to create business value. In fact, for many global metals and mining companies, energy may represent the area of greatest potential impact.

Adopting an energy strategy focuses on the ways organizations acquire and consume energy, and on how they assess and influence the financial impact of their energy use. As Figure 3 illustrates, an effective energy management strategy considers:[11]

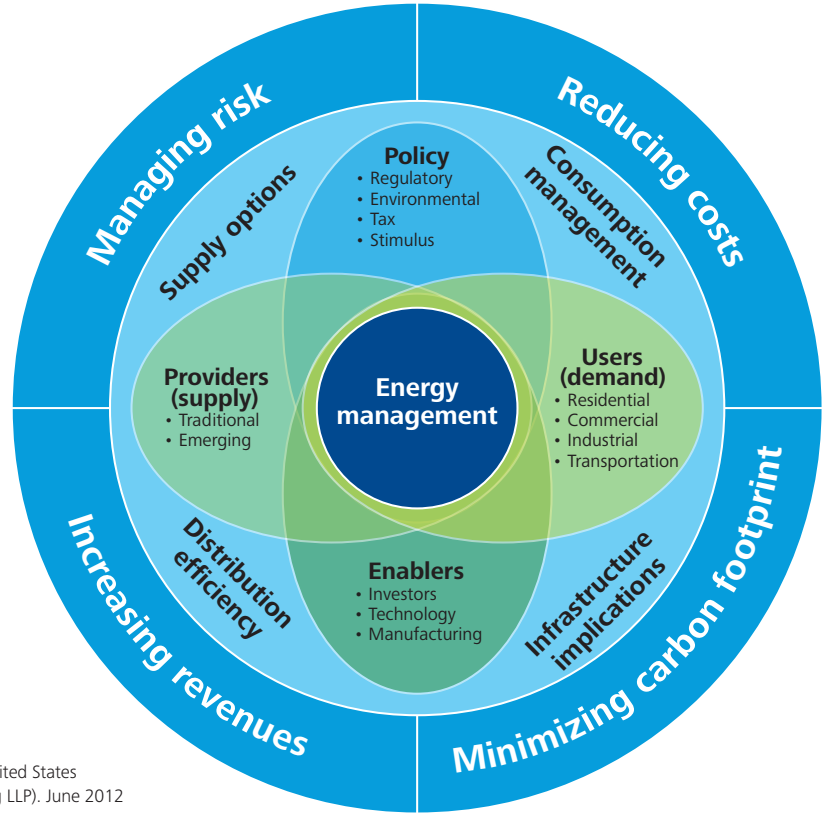
- **Supply**—The sources and cost of energy, both traditional and emerging
- **Demand**—How much energy a company needs to use and how efficiently it uses it
- **Enablers**—Including investment, technology and manufacturing
- **Policy**—With consideration to environmental regulation, taxation and stimulus

It is critical to develop a deep understanding not only of each of these areas as they apply to energy, but also of the interdependencies among them and how these are affected by day-to-day operations in the business. An energy management strategy must be enterprise-wide. Different regions will be affected differently. An enterprise-wide strategy allows a company to improve results by scaling energy improvements across multiple operations. It can also enable strategic decisions that transcend organizational boundaries, such as shifting production to locations where energy is more plentiful and affordable.

Creating insight is the first enabling step to creating value, and it starts with understanding the global market for energy.

[11] Deloitte United States (Deloitte Consulting LLP). Deloitte Debate – "Energy and Business: Is energy an expensive overhead cost or a strategic lever?" October 2011.

Figure 3: Energy management strategic framework



Source: Deloitte United States (Deloitte Consulting LLP). June 2012

Understanding energy markets

Geopolitics, exploration, infrastructure, asset retirement, legislation, economic development, and renewable technologies are among the many trends that create volatility in energy markets. Early insight into, and awareness of, these considerations can create opportunities for leading companies to flourish.

Environmental policy provides an excellent example of just how much there is to understand. In the United States for example, how much coal generation will be retired, retrofitted, co-fired, or augmented with on-site solar or wind power? How much natural gas capacity will really be added? How will that affect natural gas and power prices? What does the future hold for renewables and what is the realistic impact of that future on coal, gas, nuclear, and oil thermal generation? What will be the effect of the state-by-state adoption of renewable portfolio standards (RPS)? If a company owns assets in multiple jurisdictions, how does it limit portfolio risk? And, finally, how will this affect global metals and mining businesses? Outside of the United States the picture becomes more complicated when trying to include the impact of emissions regulations and trading markets in some countries and regions.

At the heart of the right decisions in these cases (and others like them) is getting commodity volume and pricing right and the ability to evaluate options through scenario analysis. For example, a company may choose to investigate the regulatory effects of shifting global supply chain elements to more favorable regulatory environments. It may model the supply chain with trading and RECs to discover how they fit in the supply chain. These and other steps can help identify opportunities and help manage risk.

Working with the power of analytics

The application of technology and deep modeling techniques helps global metals and mining companies reveal business performance opportunities where previously there were only sunk costs. In some cases, these revelations can translate into significant shareholder value. Consider, for example, a large multinational mining concern that was able to identify an U.S. $8 billion value to energy, which meant that any reduction in energy use could be translated directly into realized shareholder value.[12]

The data to be analyzed must come at multiple layers from across the company's portfolio. This not only permits the identification of relationships among data but also helps in the evaluation of various scenarios, enabling management through foresight.

Armed with analytics, companies can pinpoint areas of opportunity both inside their own operations and along the supply chain. The ability to manage large volumes of data quickly can create first-mover advantage and can reveal both risk and opportunity. Consider, for example, the value in better understanding the potential impact of proposed regulations on future energy prices, or in preparing predictive analysis of changes to CO2 emission standards, or in uncovering hidden value or exposing over-valuation in a merger or acquisition scenario. How would analyzing this information positively affect capital investment decisions? For an example of an effective analytics tool, please see page 8 "Introducing MarketBuilder."

Using analytics to compare performance at multiple layers across an operation can expose opportunities for scale and leverage that might otherwise remain hidden prior to normalizing data by filtering out operational noise such as weather, seasonality, and geography. Often this can be as simple as confirming the expected or finding unexpected data that unlocks value.

Investing in energy — getting the best from the portfolio

Most companies have established methods for estimating and collecting costs and benefits when constructing project business cases. For many, however, the difficulty lies in identifying the optimal portfolio of projects given a firm's constrained resources. A number of factors cloud the vision, including the inability to measure benefits and compare divergent projects, link funding decisions to corporate strategy, eliminate inefficient and time-consuming processes, reduce politicking or "gaming" the process, or quantify risk.

While the benefits of energy market and operational insight are numerous, it is also necessary to develop a framework that can evaluate both the tangible "hard" financial metrics along with the intangible "soft" benefits. When faced with numerous diverse project requests, the leading approach to efficient capital allocation is portfolio optimization.

[12] Based on project with a Deloitte member firm client in the Americas region. December 2011.

Portfolio optimization requires that all the attributes of a project be aggregated into a single, standardized metric, or numeraire, to compare and prioritize. Project attributes include risk, strategic value, project interdependencies, regulatory mandates, alternative project or program funding levels, and multi-year project horizons. Other financial metrics such as cash flow, earnings, economic value, liquidity, and asset efficiency may be included.

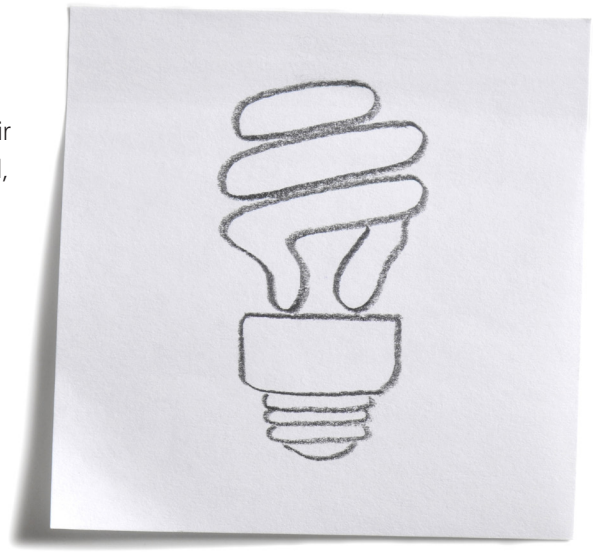
Many projects create soft benefits beyond the financial. Examples might include improved safety standards, reduced environmental impact, enhanced customer service, maximized system reliability, or new infrastructure for future growth. Having said this, measuring soft benefits can be difficult, subject to bias, and contentious. Quantifying strategic value is necessary to calibrate the full breadth of program benefits with corporate strategy.

Many organizations are employing multi-attribute decision analysis (MADA), a formal method for quantifying and valuing project benefits to aid their decision-making process. MADA provides practical, accurate, and defensible methods for quantifying and integrating multiple competing decision criteria. Unlike most scorecard techniques that produce sheets of qualitative scores and bubble charts, MADA aggregates hard financial benefits with soft project benefits into a single numeraire (again, a key step toward optimization).

A company's current level of project investment performance may be anywhere from basic to world class. Unless a company is already using leading-practice tools and processes, it is worth considering whether it is time to move up the capability maturity ladder. Capital efficiency depends on picking the right tools and processes for the right job

Moving forward with a better approach to energy use

Given the degree of uncertainty afflicting the supply, cost, and regulation of energy, the issue is sure to be top of mind for companies in the global metals and mining sector for several decades to come. However, energy need not be one of the costs of doing business. Instead, energy can be viewed as an asset that brings competitive advantage and shareholder value to those organizations that manage it properly.



Introducing MarketBuilder

Deloitte MarketBuilder is an analytical tool that helps companies better understand the complex, interrelated nature of energy commodities and their global markets. With over two decades of data legacy, MarketBuilder models energy commodity markets to provide fundamental analysis and price / volume scenario development. It enables global metals and mining companies to easily build, modify, and visualize integrated energy supply chains for both commodities and regions, which supports informed decision making.

The MarketBuilder tool has been designed to represent the full market structure of the supply, demand, and transportation chains as well as the operation characteristics of the commodity in question. To derive a market-clearing price for each commodity, it computes the supply/demand intersection and can do so at many points in the future, up to 40 years, depending on the commodity. It iterates these calculations as it represents the nature of each market component competing with other components, with the objective of maximizing profitability. By contrast, most other market approaches use linear programming, which optimizes a single objective rather than representing many competing objectives.

Unlike purely scholastic methods, this approach helps analyze long-term relationships that can be masked in the short term by day-to-day market volatility. MarketBuilder does not rely on historical price data, which typically does not represent future markets that may have significant differences in key market drivers, such as supply, demand, transportation, and regulatory changes.

MarketBuilder models are integrated in the way that power, oil, natural gas, and coal markets are integrated. It uses sound economic methods to account for the spatially and technically diverse nature these markets. Doing so produces a thorough model of cross-asset characteristics, such as prices, basis differentials, flowing quantities, new capacity and reserve additions. What's more, MarketBuilder integrates other market components such as emissions, regulatory issues, renewables, shale discoveries, etc. in a way that carefully represents the way these elements are integrated in actual markets.

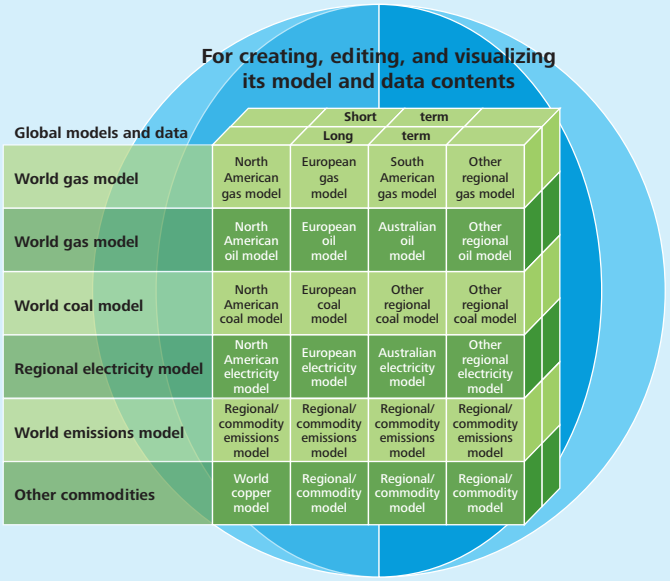
For example, the World Gas Model is an integrated model of world supply, transportation, shipping, liquefaction, regasification, infrastructure, and demand. It simulates local and regional interactions among resource supply, field processing, outbound pipelining liquefaction, shipping, regasification, distribution, demand, and inter-fuel competition. It subdivides the world into major regions connected by actual and proposed marine shipping routes and pipelines. It models competition with oil and coal in each consuming region, producing a prediction of infrastructure most likely to be constructed in the future. Markets for emission credits and their effects on energy markets are also included.

The sheer quantity of data used is staggering. Some highlights:

- 821 regions and sub-regions
- 708 demand nodes
- 7,566 full forward price schedules worldwide
- 22 liquefaction regions
- 34 regasification regions
- 748 existing and prospective LNG shipping routes
- 1,910 transportation links, including pipeline routes and LNG routes
- 5,538 total nodes worldwide

The other MarketBuilder models are similarly thorough, including those shown in Figure 4.

Figure 4: Deloitte MarketPoint models and data



Source: Deloitte United States (Deloitte Consulting LLP). June 2012

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