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for approximately 75 per cent of emissions, releasing 24 gigatonnes of CO² (GtCO²) into the atmosphere every year. Crude oil alone is responsible for approximately 47 per cent of this.

Industrial revolution

About 45 per cent of man-made emissions stay aloft, imposing themselves upon the earth's natural budget which had been happy to regulate itself at an estimated net annual flux balance of 770 GtCO². Human interference inflates the world's natural CO² reservoir by as much as 3.2 per cent a year. Carbon dioxide has a long lifetime and over 150 years, since the start of the industrial revolution, cumulative human additions are thought finally to have exceeded natural tolerance limits, triggering an exponential spiral of rather rapid global warming. Dire predictions abound on where this will lead: including sea level rises that will drown world coastlines; more frequent and larger storms; the cessation of the Gulf Stream; the disappearance of the ice caps; the release of immense quantities of methane trapped in permafrost; even a return to the conditions of the Archean Age of 3.8 to 2.5 billion years ago, where the atmosphere was unsuitable for life as we know it; and so forth. For proponents of the position that fossil fuel burning is directly feeding into global warming, the prognosis is further haunted by projections that an energy-hungry world expects to burn more and more fuel. One reliable estimate predicts that global energy demand will rise 50 per cent by 2030, with oil remaining the dominant fuel source.

The effects of global warming are tangible and measurable. If burning fossil fuels is raising global

Golden Opportunity for Black Gold

RAMI A. KAMAL outlines his personal suggestion for how the petroleum industry can benefit both itself and the world by taking the lead in combating global warming

Two opposing forces are at work on the petroleum industry, each powerful enough by itself to cause unprecedented change. On the one hand, the industry is in the fifth year of a crude oil price boom, considerably more powerful than its two predecessors of 1974 and 1980. This has already yielded additional worldwide earnings of up to \$1.53

trillion – great news for an already profitable global industry.

On the other hand, it finds itself increasingly on the defensive as a major contributor to anthropogenic carbon dioxide (CO²) in the atmosphere, which – backed by a growing body of scientific evidence – is widely believed to be the chief cause of global warming. Burning fossil fuels accounts

temperatures at observed rates – and if these are set to increase with growth in world energy needs – the negative effects will be measured within the span of a lifetime. This resembles a Hollywood thriller about an asteroid accelerating towards collision with the earth, rather than an issue we can sweep under the carpet for our descendants to deal with 10,000 years hence.

Immense problem

A body of scientific detractors will always feverishly argue that we have it all wrong, that global warming is a natural phenomenon that has happened many times before in the Earth's distant history, and that this latest episode has little or nothing to do with man-made CO₂ emissions. That is the beauty of science. But hundreds of scientists worldwide from academia, government and private firms have produced enough reasons to believe that human meddling with nature is indeed creating an immense problem. The

momentum is towards worldwide acceptance of an undesirable impact of anthropogenic CO₂ on global temperatures.

Rising sentiment

Even the US Government, though not a signatory of the Kyoto Protocol, outpends the rest of the world in research on mitigation and in incentives targeting CO₂ capture and storage. In March 2006, the e-weekly-edition of Worldwide Refining Business Digest reported: "The USA government, through the Department of Energy is accelerating its interest in CO₂ motivated enhanced oil recovery and seeks to work with the oil companies to develop capture projects from the utility industry".

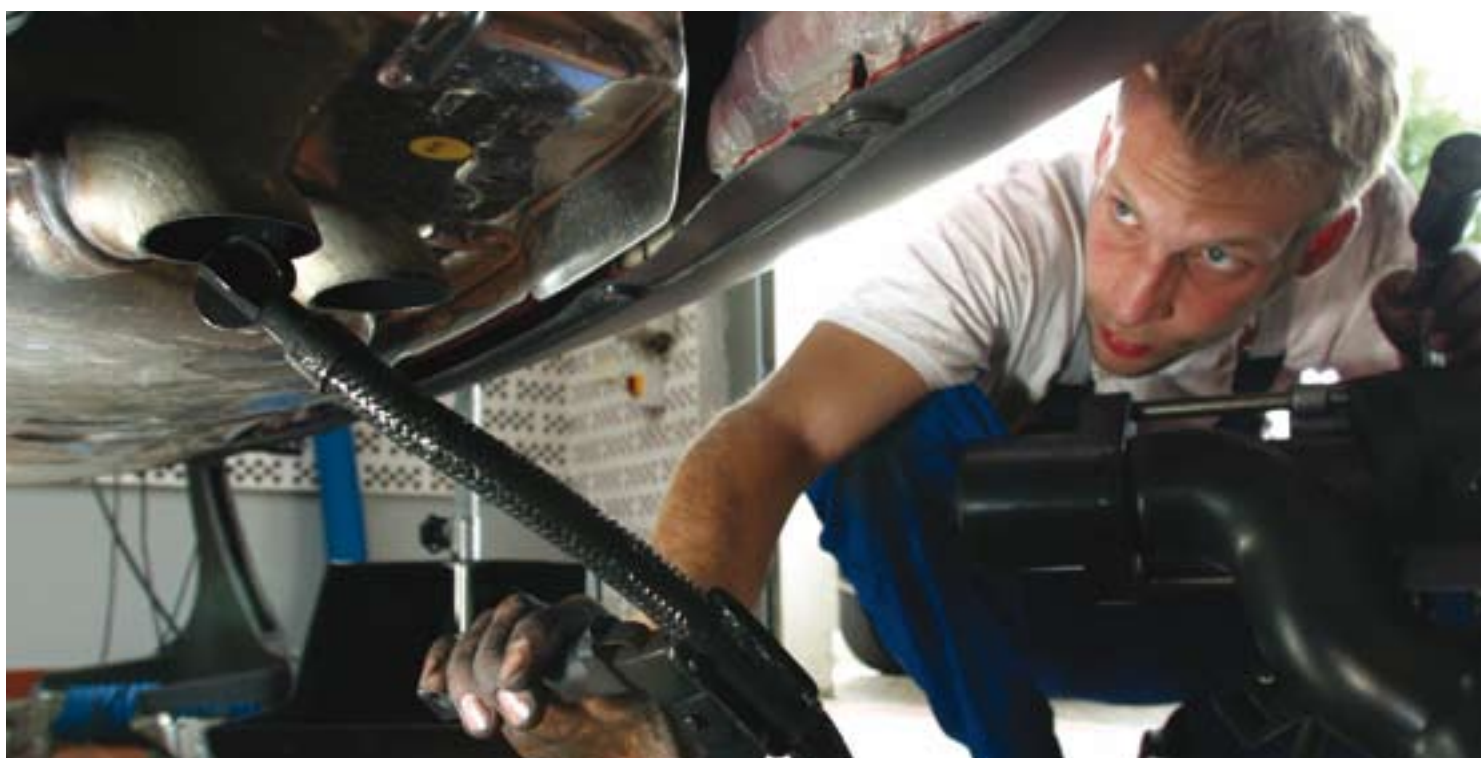
The petroleum industry must also pay heed to rising sentiment among its product end users about global warming and its role in augmenting the danger. Consumers and customers increasingly seek confirmation that suppliers act socially and environmentally

responsibly, and they make selections based on image and identity. This will be reflected in demand for fuel and energy products, and petroleum producers and suppliers must adequately address it if they are to protect oil markets as the transport fuel of choice.

Reduce emissions

The industry is rapidly arriving at a crossroads. The CO₂ challenge is unlikely to disappear. It must be fully addressed if the hydrocarbon economy is to be sustained. Industries which rely on petroleum fuel products are increasingly being challenged, through regulation and policy, to reduce emissions, and this is shaping their future acceptability. Indecision – perhaps through misinformation, ignorance, or a failure to read public sentiment – may signal the beginning of the end of an industry that has fueled the world for 150 years.

Sometime, probably soon, the petroleum-producing arms▶



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of the industry will be subject to the uncomfortable dictation of rules, regulations and taxation on all oil use, as international bodies make frenzied attempts to control the production of CO²-emitting fossil fuels. The process has already started. In September 2004 California adopted the world's first law to require limits on greenhouse gas emissions from passenger vehicles, giving car manufacturers a decade to reduce CO² emissions by 30 per cent in all new vehicles sold in the state. The coal industry has already taken preemptive action by announcing ambitious and brave plans for zero emissions by 2020. The petroleum industry finds itself lagging uncomfortably behind.

Meanwhile human innovation and technology will rally to developing cleaner energy sources. Again, this process has long since started; one example is research on hydrogen fuel cells.

Global citizenship

The price boom gives the petroleum industry, petrochemical industries and petroleum product end user industries with their combined resources a golden opportunity to vie for leadership in the struggle to protect the Earth's fragile environment. They need not have their backs to the wall. There is a way out.

To maintain petroleum's ascendancy as the world's choice fossil fuel for decades to come, petroleum producers, refiners and related industries are called on to:

- Create a cooperative body to formulate policies and monitor direction on commitments to reduce petroleum-sourced CO² emissions to the atmosphere. This should have the vision and clout to create such challenging goals as a zero CO² emissions from petroleum by the 2020 target.

- Divert some of their recent windfall income to finance research and development technologies for CO² capture and storage and cleaner and more efficient combustion. Oil companies should also seriously support R&D into capturing CO² from vehicles, so as to maintain the petrol pump culture unscathed.

- Focus on widely deploying enhanced oil recovery with carbon dioxide (CO²-EOR) with the intent of long term sequestration of the injected CO². The world now has over 30 years of experience of CO²-EOR, and it can recover an additional 2 to 15 per cent of oil-in-place. At today's prices, this extra oil will add handsomely to the petroleum producers' coffers and help finance research and development in CO² mitigation. Carbon trading could add even more revenue, if most of the CO² is skillfully kept underground in the depleted

petroleum reservoirs. These two new sources of wealth would comfortably pay back the capital outlays in item 2 above.

- Demonstrate global citizenship by supporting regional applications of renewable energy such as solar energy; and such industrial uses for captured CO² as carbon fiber, carbon black, carbon for the petrochemical industries, and the widespread use of CO² to treat municipal and industrial waste water.

This is the time for such a four-pronged strategy. Developing, fabricating and implementing capture technologies can be costly, so the industry should capitalise on its current income windfall. As the price of a barrel of crude edges towards \$100, oil producers must push hard gracefully to avoid their own demise. The petroleum industry can rebound from its current defensive position and bask in the glory of good global citizenship for generations to come. This would not just save the world but also create hundreds of thousands of additional jobs, businesses and exciting opportunities, while the industry generates more income. A no-brainer? ■

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