

## Get Free Natural Gas Fuel For The 21st Century

# Natural Gas Fuel For The 21st Century

Hello -- my name is Don Bongaards and I am a retired engineer. This book is a sequel to my first book entitled A Sense of Urgency which described how the United States could free itself from its dependence upon imported oil and achieves economic growth and prosperity by phasing in hydrogen fuel as a substitute for gasoline. I have written this sequel to introduce some new ideas that can make the transition to hydrogen fuel more cost effective and practical -- like beginning the hydrogen phase in process using reformed natural gas while in the short run drilling for as much domestic oil and natural gas as possible. In the long run a thermo-chemical process can take over in 20 to 40 years to make hydrogen from

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water economically viable. At today's natural gas prices, reformed hydrogen could be sold at the gas station pump for about three dollars per equivalent gasoline gallon. Not bad when you consider that the currently available Honda FCX hydrogen fuel cell car can achieve more than 60 miles per gallon. Another reason for writing this sequel is to emphasize the point that global oil consumption has become a clear and present danger. We are acting like the proverbial frog that is sitting in a pot of warm water that is quickly coming to a boil. The exponentially increasing worldwide demand for oil is becoming more of a problem than is commonly thought. In spite of what you might have been told about hundreds of years supply of oil and other fossil fuels, the truth is -- it just ain't so. Countries like China and India are beginning to consume oil at an

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increasingly faster rate. The world currently consumes about 33 billion barrels of oil per year and the known reserves are less than 1,000 billion barrels. The problem is that the 33 billion barrels per year consumption rate is increasing at about 2 percent each year. If you do the arithmetic, the world will consume about 110 billion barrels of oil per year by the year 2070 -- less than 60 years from now. However, during this time we will have had a total consumption of about 3,500 billion barrels. Do you think that we will discover enough oil and oil sands to fill this demand? Do you think that we can convert enough coal into synthetic fuel? Do you think that we will have enough natural gas to substitute for gasoline? Do you think that oil shale will come to the rescue? How about electric cars that use wind and solar energy? Think again -- it isn't going to happen -- and I will explain

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why in this book. And -- by the way -- don't assume that the United States will fuel itself while the rest of the world runs out of fuel. Since the United States spends almost 700 billion dollars each year to purchase oil from other countries doesn't it make sense that this money would be better spent in the United States. How about forming a hydrogen fuel consortium comprised of 50 million social security investors and potentially save this vital program from extinction. While this might not be the only way to get the job done I am proposing it in this book as food for thought. From what I have just described with regard to current oil consumption demand, don't surprised if gasoline prices don't skyrocket in the not too distant future -- how about ten or more dollars per gallon! Let's begin building a hydrogen fuel infrastructure now to protect our children and grandchildren from an

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impending disaster!

Concerns over air quality and greenhouse gas emissions have prompted discussion as well as action on alternative fuels and energy efficiency. Natural gas and natural gas derived fuels and fuel additives are prime alternative fuel candidates for the transportation sector. In this study, we reexamine and add to past work on energy efficiency and greenhouse gas emissions of natural gas fuels for transportation (DeLuchi 1991, Santini et al. 1989, Ho and Renner 1990, Unnasch et al. 1989). We add to past work by looking at Methyl tertiary butyl ether (from natural gas and butane component of natural gas), alkylate (from natural gas butanes), and gasoline from natural gas. We also reexamine compressed natural gas, liquified natural gas, liquified petroleum gas, and methanol based on our analysis of vehicle efficiency potential. We compare the results against

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nonoxygenated gasoline.

**Substitute Natural Gas from Waste: Technical Assessment and Industrial Applications of Biochemical and Thermochemical Processes** provides an overview of the science and technology of anaerobic digestion and thermal gasification for the treatment of biomass and unrecyclable waste residues. The book provides both the theoretical and practical basis for the clean and high-efficiency utilization of waste and biomass to produce Bio-Substitute Natural Gas (SNG). It examines different routes to produce bio-SNG from waste feedstocks, detailing solutions to unique problems, such as scale up issues and process integration. Final sections review waste sourcing and processing. This book is an ideal and practical reference for those developing, designing, scaling and managing bio-SNG production and

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utilization systems. Engineering students will find this to be a comprehensive resource on the application of fundamental concepts of bio-SNG production that are illustrated through innovative, recent case studies. Presents detailed scientific and technical information Describes up-to-date concepts, processes and plants for efficient anaerobic digestion and gasification of wastes and syngas utilization Compares gasification with anaerobic digestion for different situations Proposes alternative strategies to increase efficiency and overcome energy balance limitations Includes benchmarking data and industrial real-life examples to demonstrate the main process features and implementation pathways of bio-SNG systems from dry and wet waste, both in developed and developing countries

Handbook of Natural Gas Transmission and Processing

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Hearing Before the Subcommittee on  
Oversight and Investigations of the  
Committee on Interstate and Foreign  
Commerce, House of Representatives,  
Ninety-sixth Congress, First Session,  
March 27, 1979

Natural gas issues

Technical Assessment and Industrial  
Applications of Biochemical and  
Thermochemical Processes

Technical, Economic and Environmental  
Potential

Natural Gas and Hydrogen

As the case for Climate Change  
mitigation becomes ever more  
pressing, hydrogen has the  
potential to play a major role in a  
low-carbon energy future.

Hydrogen can drive the vehicles of  
tomorrow and also heat homes and  
supply energy to businesses. Much



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recent discussion in energy policy circles has considered ways in which greatly expanded electrification can meet the demand for low-carbon mobility and heating. Such narratives centre on the widespread use of renewable energy sources with occasionally surplus renewable electricity being used to produce hydrogen, for example by electrolysis. While such developments have a beneficial role to play, this book focuses on an alternative paradigm. This book considers a more evolutionary path involving the continued extraction and use of fossil fuels, most notably natural gas, but in ways that greatly reduce greenhouse gas emissions. In this way much established

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industrial capacity and know how might be transitioned to help deliver the low carbon future that the world so desperately requires. Presenting up-to-date energy policy recommendations with a focus on hydrogen from fossil fuels, the book will be of considerable interest to policymakers and energy researchers in academia, industry and government labs, while also offering a valuable reference guide for business developers in low-carbon energy, and for oil and gas industry analysts.

Handbook of Natural Gas Transmission and Processing gives engineers and managers complete coverage of natural gas transmission and processing in the

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most rapidly growing sector to the petroleum industry. The authors provide a unique discussion of new technologies that are energy efficient and environmentally appealing at the same time. It is an invaluable reference on natural gas engineering and the latest techniques for all engineers and managers moving to natural gas processing as well as those currently working on natural gas projects. Provides practicing engineers critical information on all aspects of gas gathering, processing and transmission First book that treats multiphase flow transmission in great detail Examines natural gas energy costs and pricing with the aim of

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delivering on the goals of efficiency, quality and profit

The climate of our planet is changing at a rate unprecedented in recent human history. The energy absorbed from the sun exceeds what is returned to space. The planet as a whole is gaining energy. The heat content of the ocean is increasing; the surface and atmosphere are warming; mid-latitude glaciers are melting; sea level is rising. The Arctic Ocean is losing its ice cover. None of these assertions are based on theory but on hard scientific fact. Given the science-heavy nature of climate change, debates and discussions have not played as big a role in the public sphere as they should, and

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instead are relegated to often misinformed political discussions and inaccessible scientific conferences. Michael B. McElroy, an eminent Harvard scholar of environmental studies, combines both his research chops and pedagogical expertise to present a book that will appeal to the lay reader but still be grounded in scientific fact. In *Energy and Climate: Vision for the Future*, McElroy provides a broad and comprehensive introduction to the issue of energy and climate change intended to be accessible for the general reader. The book includes chapters on energy basics, a discussion of the contemporary energy systems of the US and

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China, and two chapters that engage the debate regarding climate change. The perspective is global but with a specific focus on the US and China recognizing the critical role these countries must play in addressing the challenge of global climate change. The book concludes with a discussion of initiatives now underway to at least reduce the rate of increase of greenhouse gas emissions, together with a vision for a low carbon energy future that could in principle minimize the long-term impact of energy systems on global climate.

Natural Gas the Modern Fuel  
User's Guide to Natural Gas  
Purchasing and Risk Management

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Fuel for Economic Growth  
Energy and the Environment Series  
Natural Gas Rate Situation of the  
United Fuel Gas Company in West  
Virginia, Kentucky, and Ohio  
Hearing Before the Subcommittee  
on Regulation, Business  
Opportunities, and Technology of  
the Committee on Small Business,  
House of Representatives, One  
Hundred Third Congress, First  
Session, Portland, OR, June 3,  
1993

A comprehensive review of the  
current status and challenges for  
natural gas and shale gas production,  
treatment and monetization  
technologies Natural Gas Processing  
from Midstream to Downstream  
presents an international perspective  
on the production and monetization

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of shale gas and natural gas. The authors review techno-economic assessments of the midstream and downstream natural gas processing technologies. Comprehensive in scope, the text offers insight into the current status and the challenges facing the advancement of the midstream natural gas treatments. Treatments covered include gas sweetening processes, sulfur recovery units, gas dehydration and natural gas pipeline transportation. The authors highlight the downstream processes including physical treatment and chemical conversion of both direct and indirect conversion. The book also contains an important overview of natural gas monetization processes and the potential for shale gas to play a role in the future of the energy market, specifically for the



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production of ultra-clean fuels and value-added chemicals. This vital resource: Provides fundamental chemical engineering aspects of natural gas technologies Covers topics related to upstream, midstream and downstream natural gas treatment and processing Contains well-integrated coverage of several technologies and processes for treatment and production of natural gas Highlights the economic factors and risks facing the monetization technologies Discusses supply chain, environmental and safety issues associated with the emerging shale gas industry Identifies future trends in educational and research opportunities, directions and emerging opportunities in natural gas monetization Includes contributions from leading

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researchers in academia and industry  
Written for Industrial scientists,  
academic researchers and  
government agencies working on  
developing and sustaining state-of-  
the-art technologies in gas and fuels  
production and processing, *Natural  
Gas Processing from Midstream to  
Downstream* provides a broad  
overview of the current status and  
challenges for natural gas production,  
treatment and monetization  
technologies.

Touted by industry as a "clean  
energy" panacea, unconventional gas  
is widely heralded as deliverance  
from air pollution to global warming  
to foreign energy dependence. It is  
clean, the drillers say, and there is  
plenty of it. Descriptions like 'trillions  
of cubic feet' and 'more than a  
century's worth' are becoming

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commonplace, used to prop up the vision of a clean, affordable and homegrown unconventional gas future ... This report takes on three myths undergirding our gas ambitions: the myth that hydraulic fracturing and horizontal drilling have guaranteed our access to a century's worth of fuel; the myth that the price of natural gas, which has been historically volatile, will remain low; and the myth that, from a global warming and public health perspective, natural gas is a clean and safe alternative to other fossil fuels.

Medium- and heavy-duty trucks, motor coaches, and transit buses - collectively, "medium- and heavy-duty vehicles", or MHDVs - are used in every sector of the economy. The fuel consumption and greenhouse

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gas emissions of MHDVs have become a focus of legislative and regulatory action in the past few years. This study is a follow-on to the National Research Council's 2010 report, *Technologies and Approaches to Reducing the Fuel Consumption of Medium-and Heavy-Duty Vehicles*. That report provided a series of findings and recommendations on the development of regulations for reducing fuel consumption of MHDVs. On September 15, 2011, NHTSA and EPA finalized joint Phase I rules to establish a comprehensive Heavy-Duty National Program to reduce greenhouse gas emissions and fuel consumption for on-road medium-and heavy-duty vehicles. As NHTSA and EPA began working on a second round of standards, the National Academies issued another report,

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Reducing the Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two: First Report, providing recommendations for the Phase II standards. This third and final report focuses on a possible third phase of regulations to be promulgated by these agencies in the next decade.

Natural Gas Processing from  
Midstream to Downstream

Reducing Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two

Manufactured and Natural Gas in America, 1800-2000

Final Report

21st Century Complete Guide to Natural Gas Vehicles - Covering Alternative Fuel Vehicles (AFV), Compressed Natural Gas (CNG),

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Liquefied Natural Gas (LNG),  
Technology, Safety and Refueling  
Issues

Fossil Fuel Hydrogen

**Natural gas has commonly been described as a 'bridge fuel' that could transition U.S. from fossil fuels to a low-carbon energy system by 2050 in order to reach the internationally agreed target of limiting the global mean surface temperature to about 2 degrees Celsius (°C) above pre-industrial levels. This natural gas resource has grown tremendously over the last decade, as its production has been fueled by the use of more advanced hydraulic fracturing and horizontal drilling technologies. Being a cleaner form of fossil fuel, burning natural gas emits about half as much carbon dioxide as coal and is thought to aid in decarbonizing the nation by displacing coal as a fuel for**

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**power generation. However, the increased supply of cheap natural gas could also have an effect of delaying the advancement of renewable resources such as solar and wind. Nonetheless, optimal conditions could be explored on how natural gas can become an effective 'bridge fuel' towards a low carbon energy system. This thesis developed a system dynamics model to analyze these required conditions and found that high natural prices that rise to \$26.45/mmBTU in 2050 are necessary to hit the 2°C target. An efficient policy that could drive these high natural gas prices is the carbon tax. Furthermore, another important role that natural gas serves is as a backup power source for intermittent renewable energy resources.**

**1-Developing an Energy Purchasing Strategy  
2-Gas Purchasing: Business,**

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**Legal & Contracting Issues3-The Role  
of the Gas Marketer4-Selecting a Gas  
Marketer to Deliver Transportation  
Gas5-Avoiding Common Pitfalls in Gas  
Contracts6-Gas Futures, Swaps and  
Options7-Retail Energy Contracts:  
Choices for Customers8-Natural Gas  
Purchasing as a Strategic  
Input9-Natural Gas Purchasing  
Options10-Fuel Management in the  
Real World11-Fuel Savings via Gas  
Supply Aggregation12-Benefits of  
Effective Fuel Management13-Fuels  
Utilization for Cost-Effective Energy  
Management14-Managing Your  
Facility's Energy Needs in Competitive  
Energy Markets15-Background: FERC  
Orders 636, 636-A, and 636-B16-The  
Hidden Costs of Doing Business Under  
Order 63617-Order 636: The Next  
Stage of Implementation18-Spot Market  
Natural Gas**



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**Reliability**  
**19-Understanding & Using  
New LDC Supply Options**  
**20-How a  
Local Natural Gas Distributor Helped  
an Institutional  
Cogenerator**  
**21-Brooklyn Union Gas  
Company's Competitive Power Systems  
Program**  
**22-The Gas Industry  
Standards Board: Organizing the  
Marketplace for Natural Gas**  
**23-Gas  
Reduction Strategies to Benefit the  
Environment**  
**24-Gas Cooling Engine  
Emissions: Meeting the Clean Air  
Act**  
**25-Meeting CFC Phase-Out  
Requirements with Gas Cooling**  
**26-The  
Environmental Benefits of Natural Gas  
Powered Fuel Cells**  
**Index**  
**"Energy plays a critical role in fueling  
the transition from a traditional to a  
modern society and thus aiding  
economic costs of extracting and  
transporting the major energy  
resources used. Research suggests that**

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**current oil and gas reserves are sufficient for only a few more decades. It is well-known that transport is almost totally dependent on fossil fuels, particularly petroleum-based fuels such as gasoline, diesel fuel, liquefied petroleum gas, and compressed natural gas. For the foreseeable future automotive fuels will still be largely based on liquid biorenewables and gaseous biohydrogen. Natural gas is a vital component of the world's supply of energy and an important source of many bulk chemicals and speciality chemicals. It has many qualities that make it an efficient, relatively clean burning, and economical energy source. However, there are environmental and safety issues associated with the production and use of natural gas. Exploring, producing and bringing gas to the user or converting gas into**

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**desired chemicals is a systematical engineering project, and every step requires thorough understanding of gas and the surrounding environment.**

**Although the natural gas that people use as a fuel is processed so that it is mainly methane, unprocessed natural gas from a well may contain many other compounds, including hydrogen sulfide, a very toxic gas. Natural gas with high concentrations of hydrogen sulfide is usually flared. Natural gas flaring produces CO<sub>2</sub>, carbon monoxide, sulfur dioxide, nitrogen oxides, and many other compounds depending on the chemical composition of the natural gas and depending on how well the natural gas burns in the flare. Natural gas wells and pipelines often have engines to run equipment and compressors that produce additional air pollutants and noise. As the amount of available**

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**petroleum decreases, the need increases for alternate technologies to produce liquid biorenewables and gaseous biohydrogen fuels that could potentially help prolong the liquid fuels culture and mitigate the forthcoming effects of the shortage of transportation fuels. This volume Natural Gas and Hydrogen tries to chronicle the state-of-the-art in various aspects of natural gas: exploration, drilling, gas processing, storage, distribution, end use and finally the impact on environment. The chapters of this book are contributed by leading authors around the world. Modeling approaches, as well as, recent advances in specific natural gas technologies are covered in detail. The book emphasize the science on which such technology is based, the limitations of each technology, the environmental effects of its use, questions of**

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**availability and cost, and the way that government policies and energy markets as well as the technical and economic barriers that could detail a transition toward hydrogen energy systems. This book is a great read for researchers, practitioners, or just about anyone with an enquiring mind on this subject."**

**What Role Should Fuel Choice and Natural Gas Play in Meeting the Energy Needs of the Pacific Northwest?**

**The Efficient Use of Natural Gas in Transportation**

**Alaska natural gas transportation system**

**Fuel Switching and Human Health**

**The Role of Natural Gas as a Vehicle Transportation Fuel**

**hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce,**

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House of Representatives, Ninety-seventh Congress, second session  
***Natural Gas: A Basic Handbook, Second Edition*** provides the reader with a quick and accessible introduction to a fuel source/industry that is transforming the energy sector. Written at an introductory level, but still appropriate for engineers and other technical readers, this book provides an overview of natural gas as a fuel source, including its origins, properties and composition. Discussions include the production of natural gas from traditional and unconventional sources,

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*the downstream aspects of the natural gas industry, including processing, storage, and transportation, and environmental issues and emission controls strategies. This book presents an ideal resource on the topic for engineers new to natural gas, for advisors and consultants in the natural gas industry, and for technical readers interested in learning more about this clean burning fuel source and how it is shaping the energy industry. Updated to include newer sources like shale gas Includes new discussions on natural gas hydrates and flow assurance Covers*

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*environmental issues Contain expanded coverage of liquefied natural gas (LNG) Natural gas is a vital component of the world's supply of energy. It is one of the cleanest, safest and most useful of all energy sources. Despite its importance, however, there are many misconceptions about natural gas. For instance, the word 'gas' itself has a variety of different uses, and meanings. When we fuel our car, we put 'gas' in it. However, the gasoline that goes into your vehicle, while a fossil fuel itself, is very different from natural gas. The 'gas' in*



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*the common barbecue is actually propane, which, while closely associated and commonly found in natural gas, is not really natural gas itself.*

*This book describes the feasibility and status of the use of alternative fuels in marine engineering, as well as the application of liquefied natural gas, biodiesel and their blends as marine fuels, and the combustion of synthetic coal-based fuels. Each chapter in the book ends with a summary, which gives the reader a quick and clear understanding of the main contents of the chapter. The book gives a lot of advice*

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*on the selection of equipment and parameters, fuel reserves and preparation for scholars related to alternative fuels in ships, and points them in the way. It contains lots of illustrations and tables and explains it in the form of chart comparison. The authors have developed mathematical models and methods for calculating the parameters of fuel systems for biodiesel fuels and liquefied natural gas. Recommendations for choosing the rational parameters of these systems are given, as are schematic solutions of the fuel systems, recommendations for*

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*selecting equipment,  
storing, and preparing the  
fuels. Application of the  
materials described in the  
book provides the SPP  
designers with a reliable  
tool for choosing rational  
characteristics of the fuel  
systems operating on  
alternative fuels and  
improving the efficiency of  
their application on ships.  
A Propane-natural Gas Fuel  
System for Gas Turbines  
Moving from Oil to Natural  
Gas at New York City  
Electricity Generating  
Facilities  
Marginal Oil and Gas  
Fuel for the 21st Century  
Natural Gas and Alternative  
Fuels for Engines*

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### **Hydrogen**

Modern societies require energy systems to provide energy for cooking, heating, transport, and materials processing, as well as for electricity generation. Energy systems include the primary fuel, its conversion, and transport to the point of use. In many cases this primary fuel is still a fossil fuel, a one-use resource derived from a finite supply within our planet, causing considerable damage to the environment. After 300 years of increasing reliance on fossil fuels, particularly coal, it is becoming ever clearer that the present energy systems need to change. In this Very Short Introduction Nick

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Jenkins explores our historic investment in the exploitation of fossil energy resources and their current importance, and discusses the implications of our increasing rate of energy use. He considers the widespread acceptance by scientists and policy makers that our energy systems must reduce emissions of CO<sub>2</sub> and other greenhouse gases, and looks forward to the radical changes in fuel technology that will be necessary to continue to provide energy supplies in a sustainable manner, and extend access across the developing world. Considering the impact of changing to an environmentally benign and low-carbon energy system, Jenkins also

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looks at future low-carbon energy systems which would use electricity from a variety of renewable energy sources, as well as the role of nuclear power in our energy use.

ABOUT THE SERIES: The Very Short Introductions series from Oxford University Press contains hundreds of titles in almost every subject area. These pocket-sized books are the perfect way to get ahead in a new subject quickly.

Our expert authors combine facts, analysis, perspective, new ideas, and enthusiasm to make interesting and challenging topics highly readable.

Commercial development of energy from renewables and nuclear is

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critical to long-term industry and environmental goals. However, it will take time for them to economically compete with existing fossil fuel energy resources and their infrastructures. Gas fuels play an important role during and beyond this transition away from fossil fuel dominance to a balanced approach to fossil, nuclear, and renewable energies. Chemical Energy from Natural and Synthetic Gas illustrates this point by examining the many roles of natural and synthetic gas in the energy and fuel industry, addressing it as both a "transition" and "end game" fuel. The book describes various types of gaseous

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fuels and how are they are recovered, purified, and converted to liquid fuels and electricity generation and used for other static and mobile applications. It emphasizes methane, syngas, and hydrogen as fuels, although other volatile hydrocarbons are considered. It also covers storage and transportation infrastructure for natural gas and hydrogen and methods and processes for cleaning and reforming synthetic gas. The book also deals applications, such as the use of natural gas in power production in power plants, engines, turbines, and vehicle needs. Presents a unified and collective look at gas in the energy



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and fuel industry, addressing it as both a "transition" and "end game" fuel. Emphasizes methane, syngas, and hydrogen as fuels. Covers gas storage and transport infrastructure. Discusses thermal gasification, gas reforming, processing, purification and upgrading. Describes biogas and bio-hydrogen production. Deals with the use of natural gas in power production in power plants, engines, turbines, and vehicle needs.

Natural gas is the world's cleanest fossil fuel; it generates less air pollution and releases less CO<sub>2</sub> per unit of useful energy than liquid fuels or coals. With its vast supplies

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of conventional resources and nonconventional stores, the extension of long-distance gas pipelines and the recent expansion of liquefied natural gas trade, a truly global market has been created for this clean fuel. *Natural Gas: Fuel for the 21st Century* discusses the place and prospects of natural gas in modern high-energy societies. Vaclav Smil presents a systematic survey of the qualities, origins, extraction, processing and transportation of natural gas, followed by a detailed appraisal of its many preferred, traditional and potential uses, and the recent emergence of the fuel as a globally traded commodity. The unfolding

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diversification of sources, particularly hydraulic fracturing, and the role of natural gas in national and global energy transitions are described. The book concludes with a discussion on the advantages, risks, benefits and costs of natural gas as a leading, if not dominant, fuel of the 21st century. This interdisciplinary text will be of interest to a wide readership concerned with global energy affairs including professionals and academics in energy and environmental science, policy makers, consultants and advisors with an interest in the rapidly-changing global energy industry.

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Natural Gas/fuel Forecast  
Alternative Fuels in Ship Power  
Plants

Invisible Fuel

Natural Gas Vehicles

Industrial

Natural Gas

Covers all aspects related  
to natural gas vehicles,  
including cost parameters,  
environmental benefits,  
fuel availability, and the  
role of federal, state,  
and local governments

Discusses the early  
technical and  
entrepreneurial activities  
that transformed gas from  
a waste product into a  
viable energy source.

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Natural gas resources exist and can be produced on a worldwide basis; they are far more equally distributed than other fossil fuel deposits. The use of this source of energy as substitute and/or complement to the traditional fuels, such as gasoline or diesel, has become an important issue over the past 30 years, especially for nations with limited resources. The ownership or lack of resources is just one of the possible motivations to embrace this option. For societies these

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opportunities include improvement of the environment, national economic health, safety, and energy independence. For individuals the prime motivation is usually a more economical fuel. In the Venezuelan case, political issues related to the fuel cost structure and gasoline-retailing price to Venezuelans are the driving forces of the project. Understanding the Venezuelan case, and all its implications, along with the knowledge of other successful experiences, could give to

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the promoter of a similar solution the keys to achieve desired goals. an alternative fuel? : the Venezuelan experience  
Energy Systems  
joint hearings before the Subcommittee on Fossil and Synthetic Fuels of the Committee on Energy and Commerce and the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs, House of Representatives, Ninety-seventh Congress, first session, on H.J. Res. 341 providing for a waiver of law pursuant to the Alaska

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Natural Gas Transportation  
Act

Natural gas for vehicles  
Compressed Natural Gas Fuel  
Containers

Liquefied Natural Gas 101  
Success Secrets - 101 Most  
Asked Questions on

Liquefied Natural Gas -  
What You Need to Know

This thesis analyzes pathways to directly use natural gas, as compressed natural gas (CNG) or liquefied natural gas (LNG), in the transportation sector. The thesis focuses on identifying opportunities to reduce market barriers in order to make the US natural gas vehicle market more efficient. We also identify vehicle market segments where NGV technology is mature and does not



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require sustained public subsidy to economically compete with comparable gasoline or diesel vehicles. This thesis finds that natural gas can play a useful but modest role as a vehicle fuel in the US, predominantly as CNG in high-mileage, light-duty fleet vehicles and in heavy-duty, short-haul fleet vehicles. For light-duty applications, there is a need to address an existing market barrier in the US by reducing the incremental cost and improving the vehicle performance of CNG vehicles to levels found in Europe. This incremental cost reduction is critical to foster market penetration in high-mileage fleet vehicles and to create a potential opportunity for market penetration beyond high-mileage fleet vehicles to average-mileage individual drivers. Increased use of CNG in light

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duty vehicles would displace petroleum, reduce greenhouse gas emissions in the transportation sector, and hedge consumers from volatile world oil prices (if CNG is used in a bi-fuel - gasoline and CNG- vehicle). In the heavy-duty, short-haul sector, CNG provides an additional benefit of reduced nitrogen oxide emissions compared to diesel trucks. With respect to long-haul LNG trucks, this thesis finds that while there is a large potential market for natural gas in the long-haul truck market, the present prospects for the use of LNGpowered long haul trucks appears quite limited. This is due to high incremental costs, unresolved operational issues, fueling infrastructure requirements, and reluctance of the trucking industry. This comprehensive and up-to-date book provides a unique guide to

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natural gas vehicles, compiling ten official documents with details of every aspect of the issue: CNG and LNG designs, success stories, references, information on safety and refueling issues, and much more. Contents include: Part 1: UPS CNG Truck Fleet Final Results, Alternative Fuel Truck Evaluation Project \* Part 2: Clean Cities 2010 Vehicle Buyer's Guide - Natural Gas, Propane, Hybrid Electric, Ethanol, Biodiesel \* Part 3: Natural Gas Vehicles: Status, Barriers, and Opportunities \* Part 4: White Paper on Natural Gas Vehicles: Status, Barriers, and Opportunities \* Part 5: Natural Gas Passenger Vehicles: Availability, Cost, and Performance \* Part 6: Clean Alternative Fuels: Compressed Natural Gas \* Part 7: Clean Alternative Fuels: Liquefied Natural Gas \* Part 8: EPA Case Study: Tests Demonstrate

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Safety of Natural-Gas Vehicles for King County Police \* Part 9: Resource Guide for Heavy-Duty LNG Vehicles, Infrastructure, and Support Operations \* Part 10: Senate Hearing - Usage of Natural Gas - To Assess the Opportunities For, Current Level of Investment In, and Barriers to the Expanded Usage of Natural Gas as a Fuel for Transportation (2012) While natural gas is often used as the energy source for residential, commercial, and industrial processes, engines designed to run on gasoline or diesel can also be modified to operate on natural gas - a clean burning fuel. Natural gas vehicles (NGVs) can be dedicated to natural gas as a fuel source, or they can be bi-fuel, running on either natural gas or gasoline, or natural gas or diesel, although most natural gas engines are spark ignited. Natural gas

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engine technologies can differ in the following ways: the method used to ignite the fuel in the cylinders, the air-fuel ratio, the compression ratio, and the resulting performance and emissions capabilities. Natural gas has a high octane rating, which in spark ignition engines (usual for CNG) allows an increase in power. However, natural gas occupies a larger volume in the cylinder than liquid fuels, reducing the number of oxygen molecules (share of air in the cylinder), which reduces power. The net effect on natural gas power vs. gasoline is relatively neutral. However, since it is a gaseous fuel at atmospheric pressure and occupies a considerably larger storage volume per unit of energy than refined petroleum liquids, it is stored on-board the vehicle in either a compressed gaseous or

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liquefied state. The storage requirements are still much greater than for refined petroleum products. This increases vehicle weight, which tends to reduce fuel economy. To become compressed natural gas (CNG), it is pressurized in a tank at up to 3,600 pounds per square inch. Typically, in sedans, the tank is mounted in the trunk or replaces the existing fuel tank; on trucks, the tank is mounted on the frame; and on buses, it is mounted on top of the roof. Although tanks can be made completely from metal, they are typically composed of metal liners reinforced by a wrap of composite fiber material with pressure-relief devices designed to withstand impact. Tanks do increase the vehicle weight, and with the lower energy density of natural gas, vehicle ranges are

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generally reduced. To become liquefied natural gas (LNG), natural gas is cooled to  $-260^{\circ}\text{F}$  and filtered to remove impurities. LNG is stored in double-wall, vacuum-insulated pressure tanks and is primarily used on heavy-duty trucks, providing increased range over CNG. NGVs and their respective fueling systems must meet stringent industry and government standards for compression, storage, and fueling. They are designed to perform safely during both normal operations and crash situations. Nozzles and vehicle receptacles are designed to keep fuel from escaping.

Liquefied natural gas' ('LNG') is normal gas (predominantly methane,  $\text{CH}_4$ ) that has been changed to fluid shape for effortlessness of storage either conveyance. There has never been a

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Liquefied Natural Gas Guide like this. It contains 101 answers, much more than you can imagine; comprehensive answers and extensive details and references, with insights that have never before been offered in print. Get the information you need--fast! This all-embracing guide offers a thorough view of key knowledge and detailed insight. This Guide introduces what you want to know about Liquefied Natural Gas. A quick look inside of some of the subjects covered:

- Cryogenics - Fuels, Alternative fuel - Carbon-neutral and negative fuels,
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and much more...

A Basic Handbook

Energy and Climate

Natural gas annual

Compressed Natural Gas Fuel

Containers

Vision for the Future

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Program