INSIGHTS ON INDUSTRIAL NATURAL GAS DEMAND

National Petroleum Council Study

Presentation to
National Energy Modeling System Conference
Energy Information Administration

March 23, 2004

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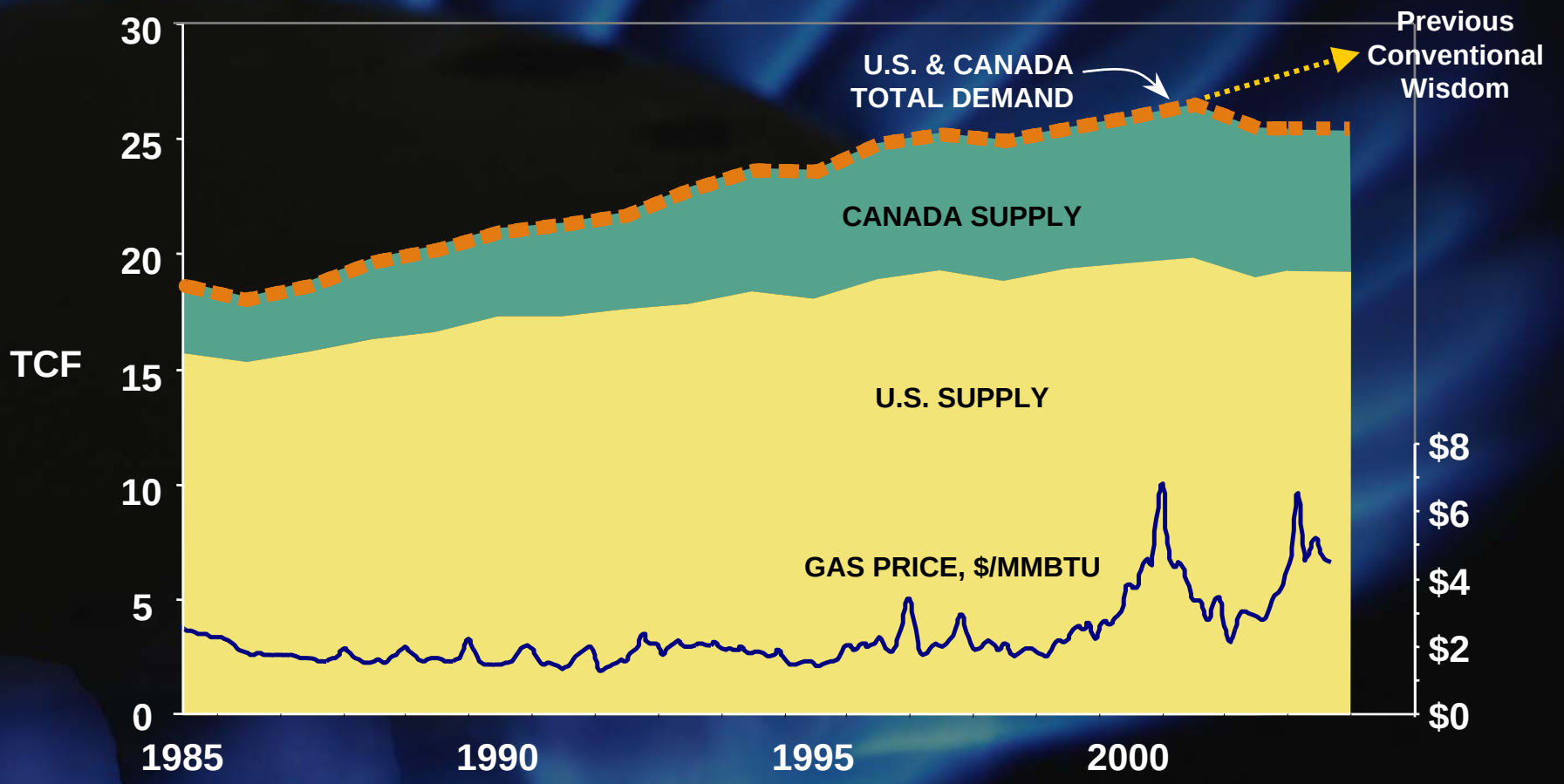
North America: Higher Prices Reflect a Fundamental Shift in Supply & Demand



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The NPC Considered Two Paths Beyond the Status Quo

Reactive Path

Public policies remain in conflict, encouraging consumption while inhibiting supply … resulting in higher prices and volatility

Balanced Future

Public policies aligned: alternate fuels and new natural gas supply sources compete to ensure lowest consumer cost

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NATURAL GAS SUPPLY

Findings on Natural Gas Supply

Traditional North American producing areas will provide 75% of long-term U.S. gas needs, but will be unable to meet projected demand

Increased access to U.S. resources (excluding designated wilderness areas and national parks) could save consumers $300 billion in natural gas costs over the next 20 years

New, large-scale resources such as LNG and Arctic gas are available and could meet 20-25% of demand, but are higher-cost, have longer lead times, and face major barriers to development

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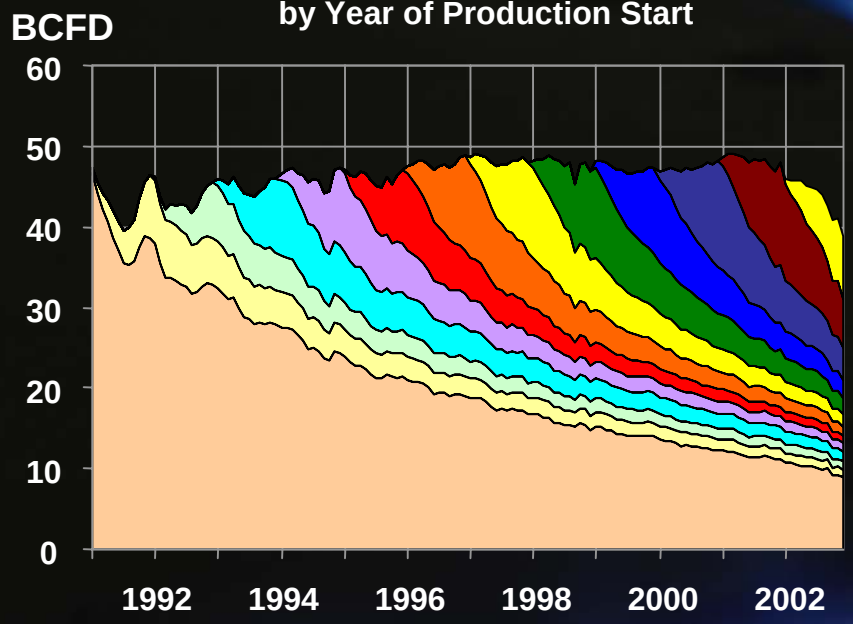
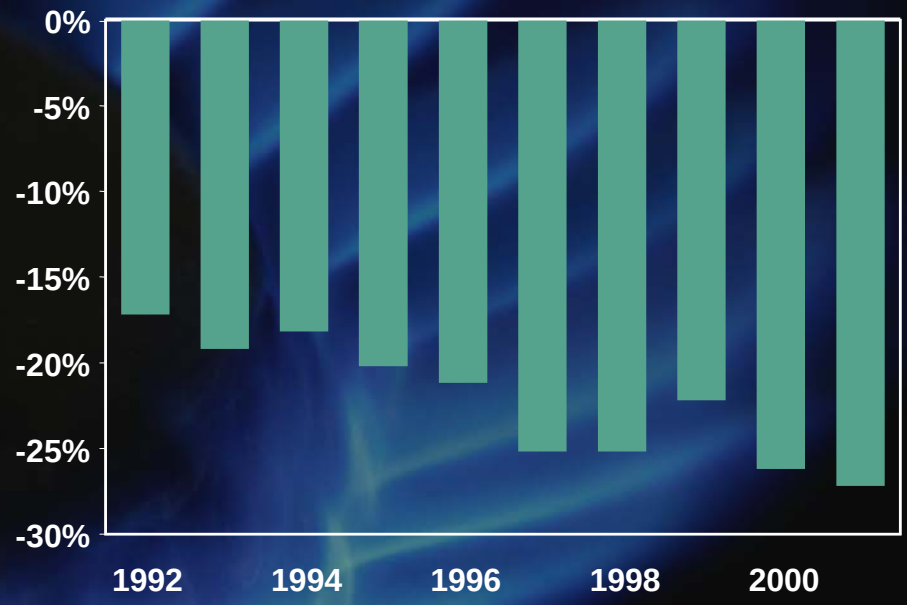
The Natural Gas Supply Picture: Increasing Declines, More "Just-in-Time" Drilling

Lower - 48 Wet Gas Production from Gas Wells, by Year of Production Start



Lower - 48 Decline Rate From Existing Wells



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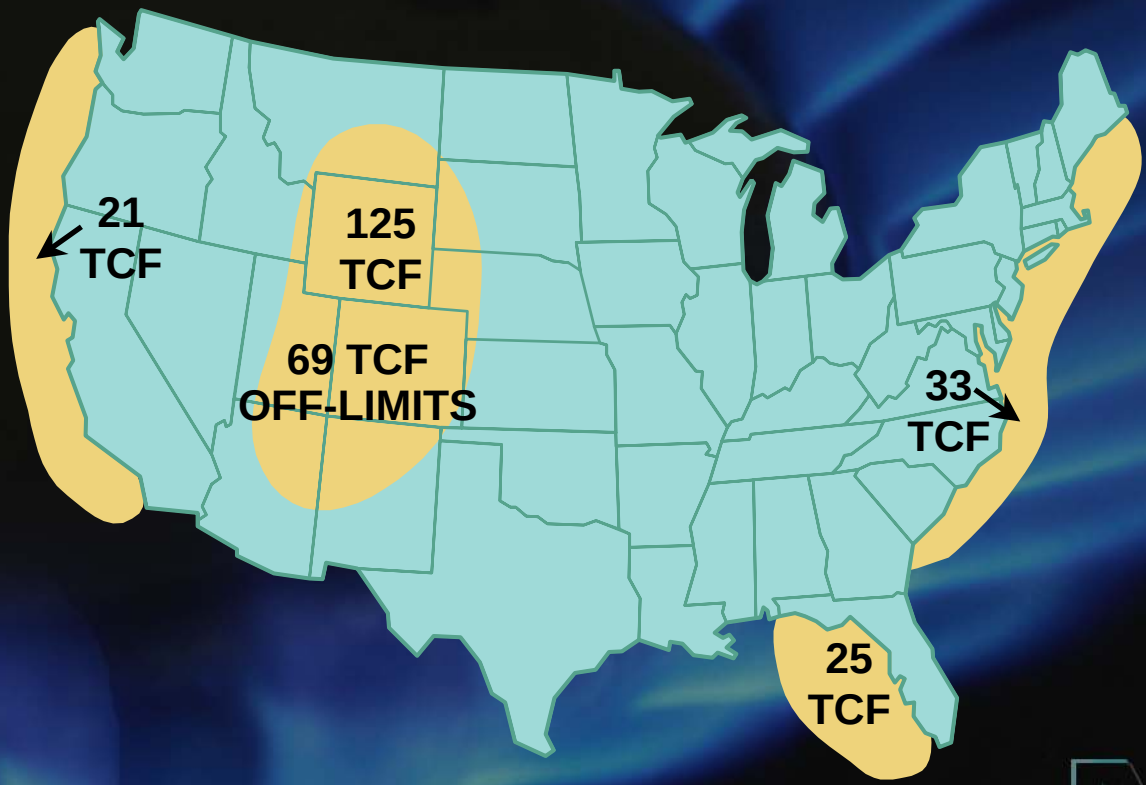
U.S. Resources Are Not Fully Utilized

Technical Resource Impacted by Access Restrictions



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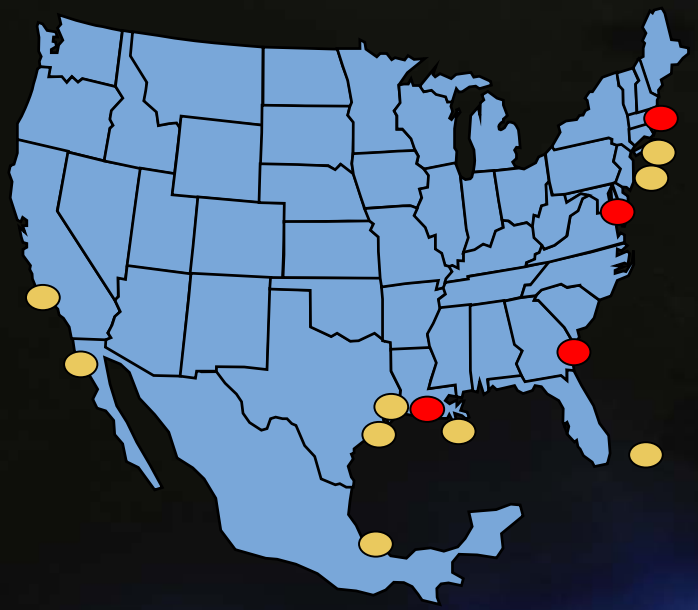
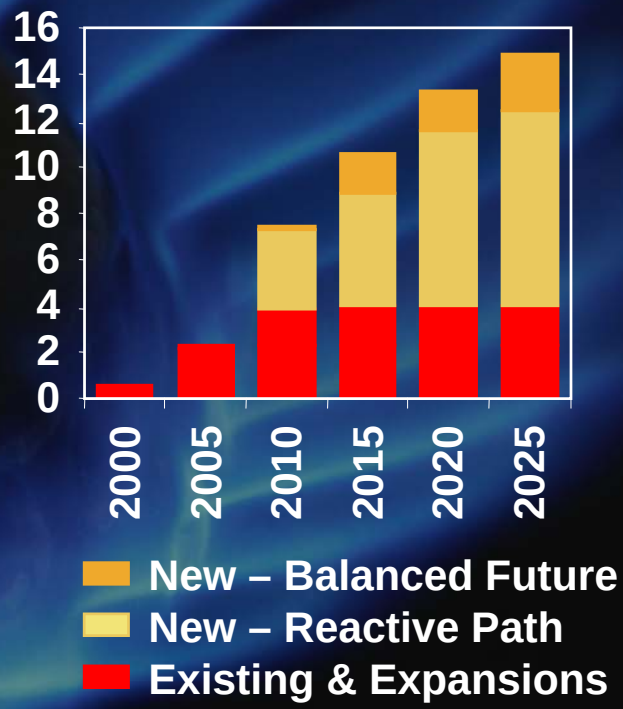
LNG Outlook in NPC Study

Import Terminals



Existing
Potential

Projected Imports BCFD



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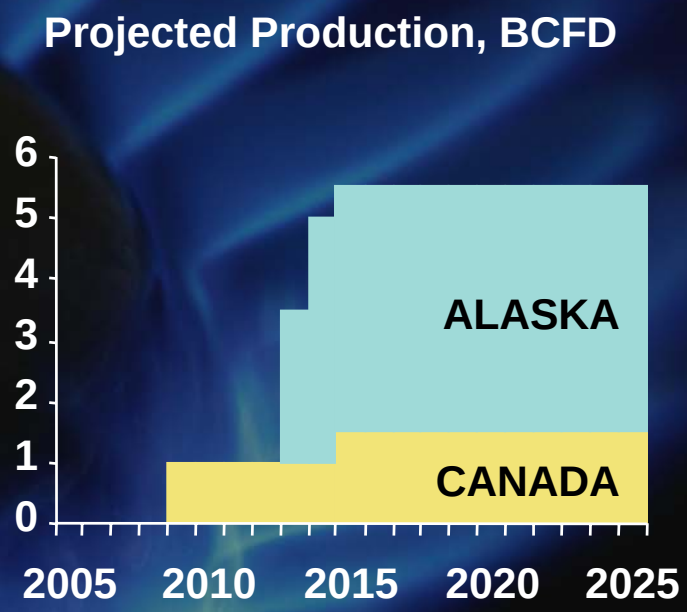
Arctic Pipeline Project Outlook



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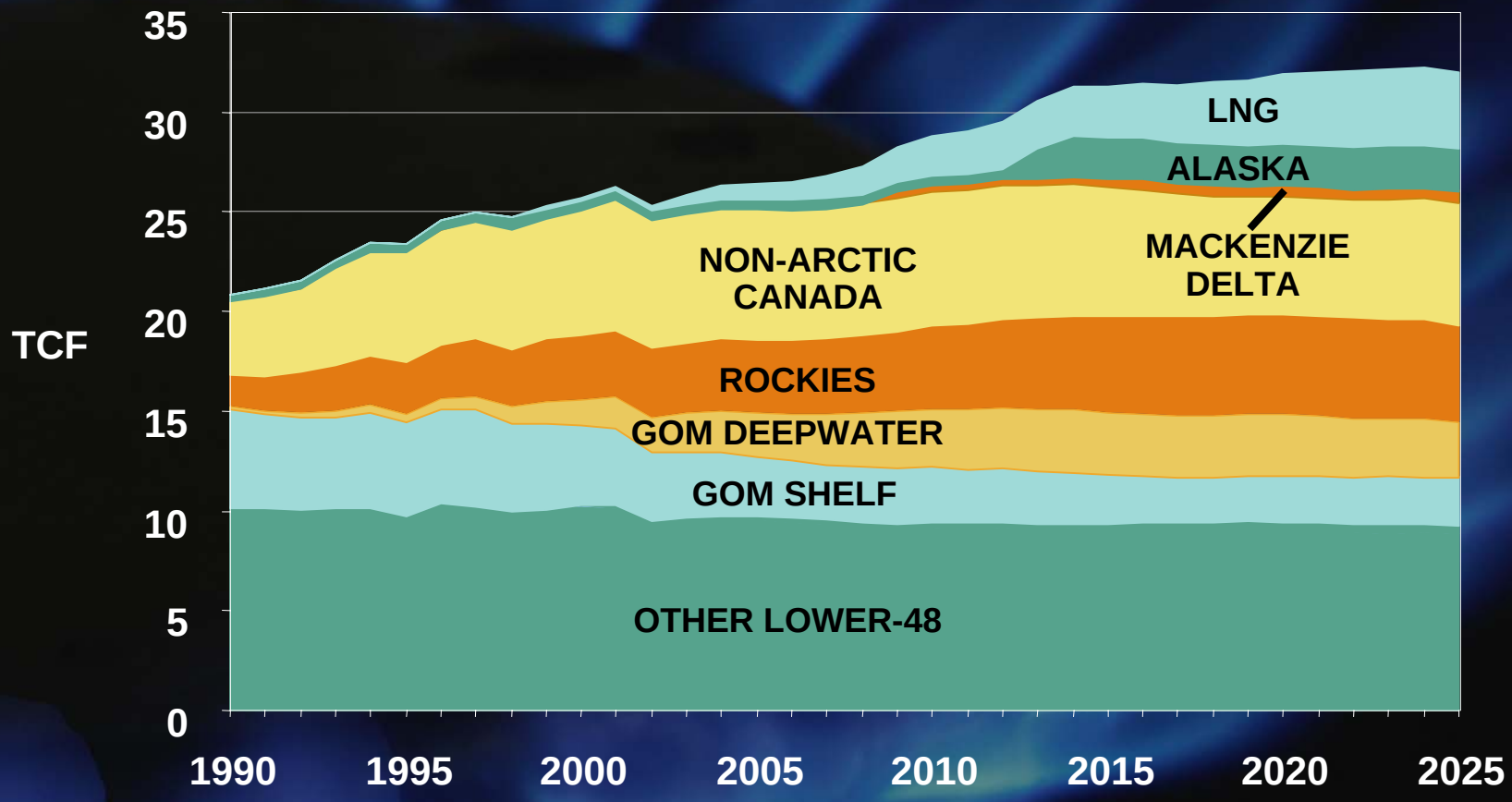
Demand is Met from Diverse Sources of Supply



NATURAL GAS DEMAND

Findings on Natural Gas Demand

Greater energy efficiency and conservation are vital near-term and long-term mechanisms for moderating price levels and reducing volatility

Power generators and industrial consumers are more dependent on gas-fired equipment and less able to respond to higher gas prices by utilizing alternate sources of energy

Gas consumption will grow, but such growth will be moderated as the most price-sensitive industries become less competitive, causing some industries and associated jobs to relocate outside North America

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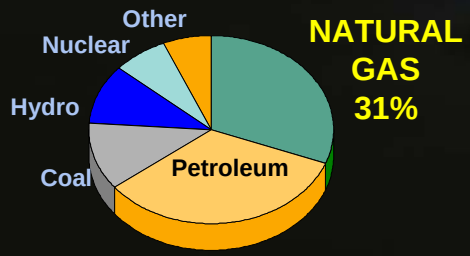
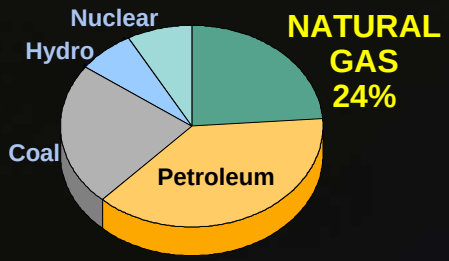
Natural Gas in North America's Economy

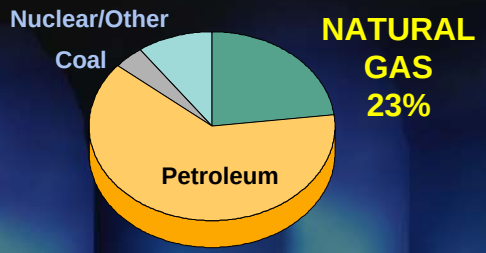
Canada



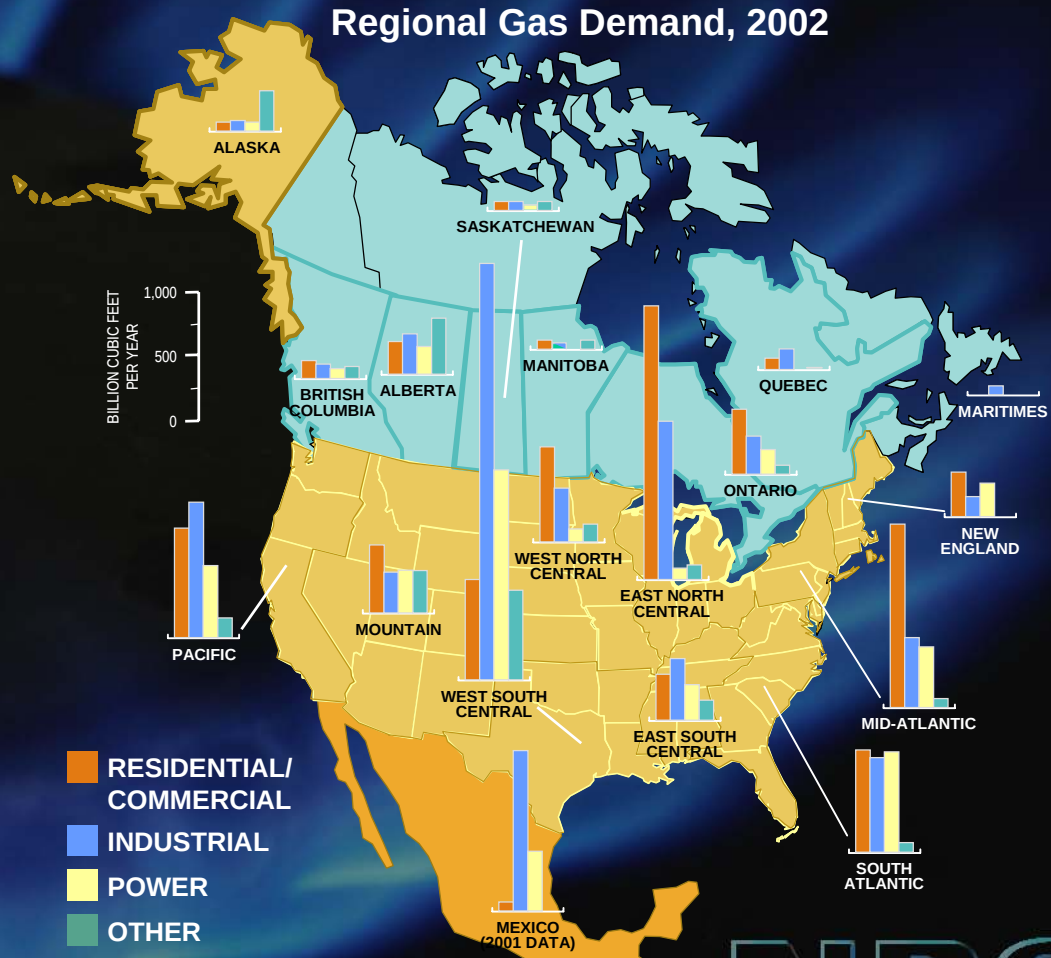
United States



Mexico



Regional Gas Demand, 2002



Source: NPC, EIA

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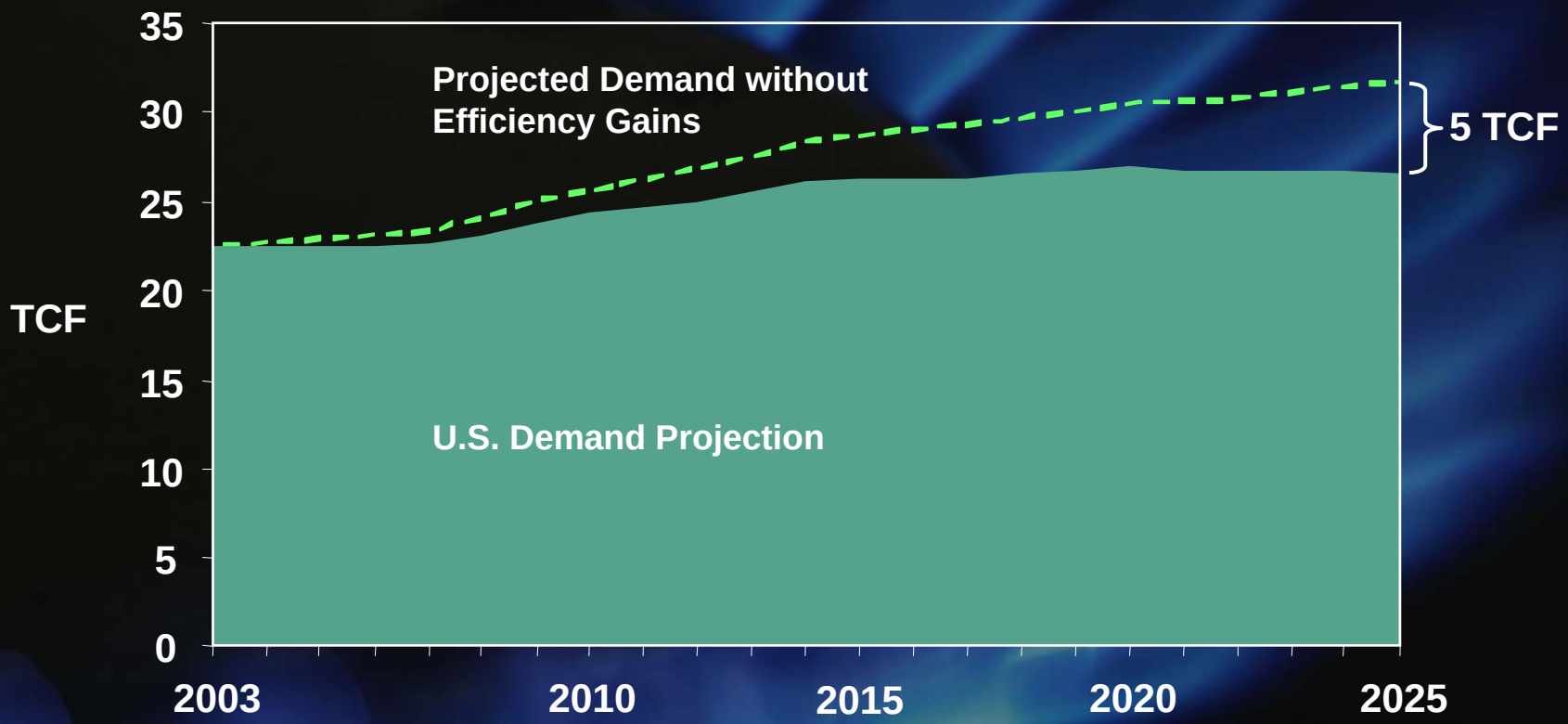
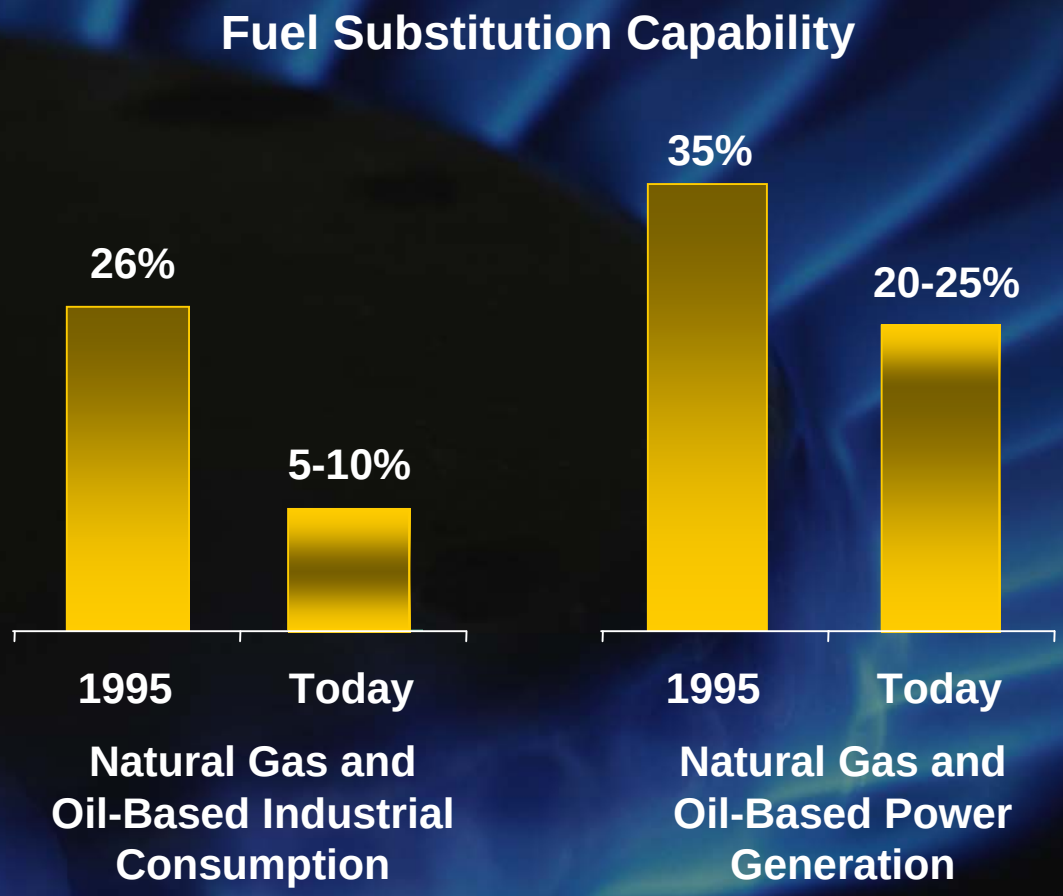
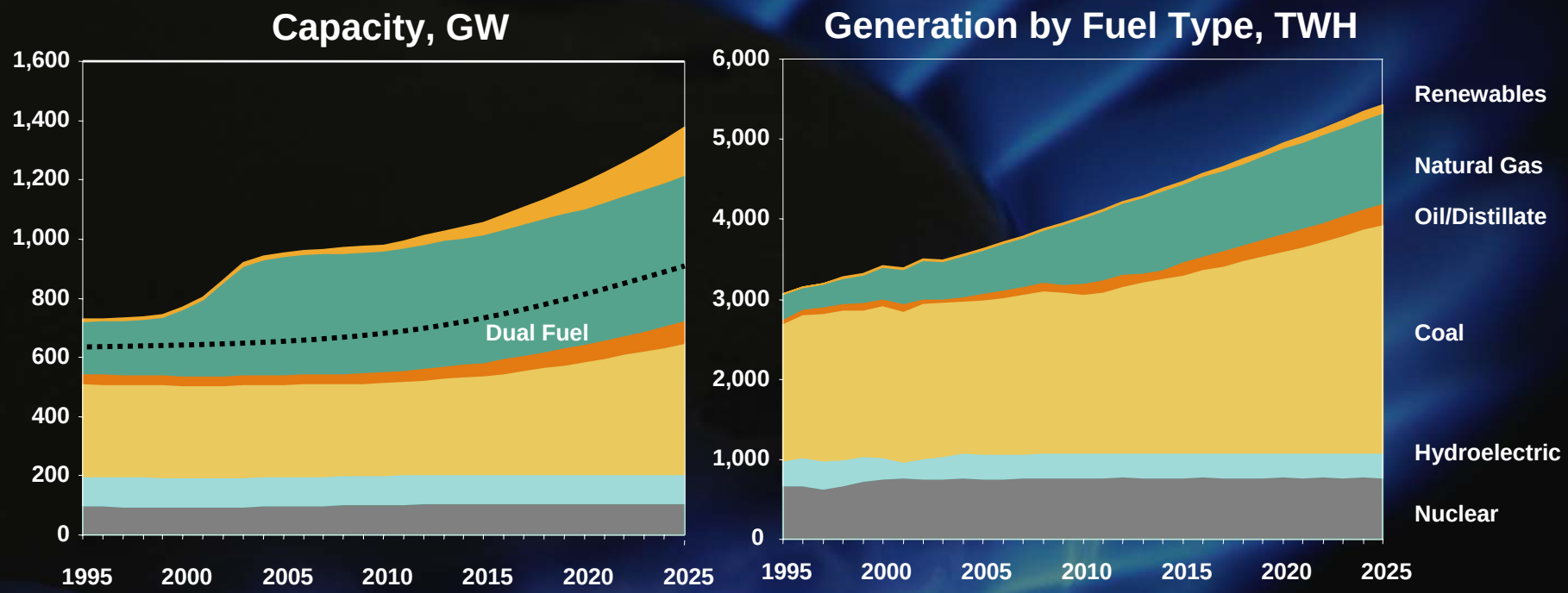
Continued Energy Efficiency is an Important Element of the Supply/Demand Picture



As Demand Has Grown, Flexibility Has Eroded



The Gas-Fired Generation Buildup Has Reshaped Demand



U.S. Figures Only

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Industrial Demand Analysis

- **Industrial demand for natural gas particularly driven by a discrete group of industries**
  - Chemicals, refining, food, paper, primary metals, stone/clay/glass
  - Model focused on these industries
- **Analysis focused on primary industrial uses of natural gas**
  - Feedstock
  - Boiler Fuel
  - Process Heating
  - Other (space heating, cogeneration, on-site electricity generation)
- **Demand forecasted from**
  - requirements for each end-use
  - intensity (gas use per unit of output), reflective of technology mix & fuel switching
- **Capacity idled in modeling for at least two years is assumed to be shut down permanently**

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Insights on Most Gas-Intensive Industries

- **Chemicals**
  - Feedstock, steam and process heat
  - Demand growth driven by cogeneration, hydrogen needs
  - Ammonia, methanol, ethane-based ethylene experiencing shutdowns
- **Petroleum Refining**
  - Steam generation and process heat
  - Demand growth driven by hydrogen, cogeneration, heavier crude feedstocks
  - No new refineries expected, but industry expected to maintain full capacity
- **Paper**
  - Steam generation and lime calcining
  - Demand growth driven by cogeneration and process reconfigurations
  - Increased mill production driven by demand for paper and paperboard
- **Primary metals**
  - Process heating
  - Lower demand and increased competition from imports
  - Consolidation and plant closures

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Industrial Demand Workshop Observations

- **Outreach efforts indicate relatively gloomy picture of expected industrial growth**
  - reflective of current economic downturn
  - concerns for long-term viability of some industries
- **Gas price *not* the primary driver in many industries**
  - keys: labor, raw materials, proximity to market, exchange rates, financing arrangements/loan guarantees
  - for consumer products (e.g., toilet paper, wallboard), higher gas prices mean higher consumer prices
- **Regulatory limitations exist to energy-intensive retrofits**
- **Bulk paper industry seeks continuation of PURPA or similar enabler to CHP**

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Industrial Demand Workshop Observations

- **Energy-intensive commodity industries not growing**
  - international competition from areas with “stranded gas” and/or emerging markets and/or other factors
  - temporary/permanent displacements of capacity planned/possible due to *relative* price differentials
  - gas-intensive ammonia and methanol capacity will decrease step-wise with time
  - primary metals (steel, aluminum) will not grow except in ‘planned economy’ such as Quebec
  - no new refineries or petrochemicals facilities seen
  - no new chlor-alkali facilities seen

- **Outreach efforts consistently reflected**
  - concerns over recent natural gas prices
  - belief that continued higher prices are detrimental to industrial sector
  - less demand responsiveness than in past due to environmental (emissions) restrictions and gas-favored process investments
  - fundamentally different downstream market for products (less liquid, less transparent than electric power, for example)
  - effect of non-domestic factors on natural gas demand (world markets, emerging economies, proximity to stranded gas, etc)

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Industrial Demand Modeling Process

- Model Framework: EEA Gas Market Data & Forecasting System (GMDFS)
- Short-form industrial sector model for GMDFS assessing gas demand, fuel-switching, industrial sector changes, long-term efficiencies, and impacts of import competition
- EEA Industrial Sector Technology Utilization Model (ISTUM) used for (a) base gas intensities, and (b) long-term demand elasticities
- Industrial Production factors defined by NPC Industrial Demand Working Group based on outreach workshops, including iterative post-processing analyses
- Fuel-switching curves updated from switching curves developed for GRI, considering boiler shares and input from industrial outreach sessions

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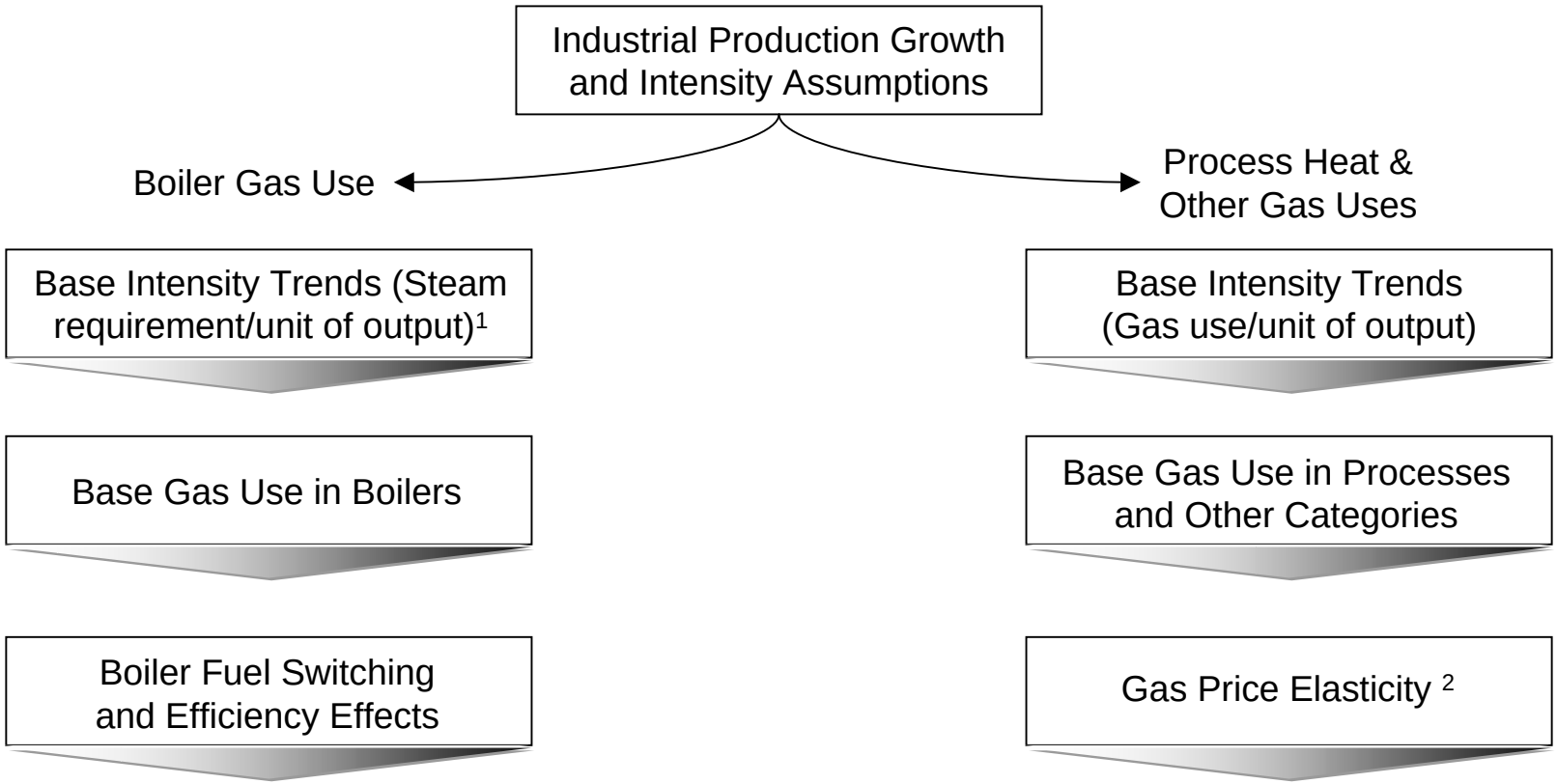
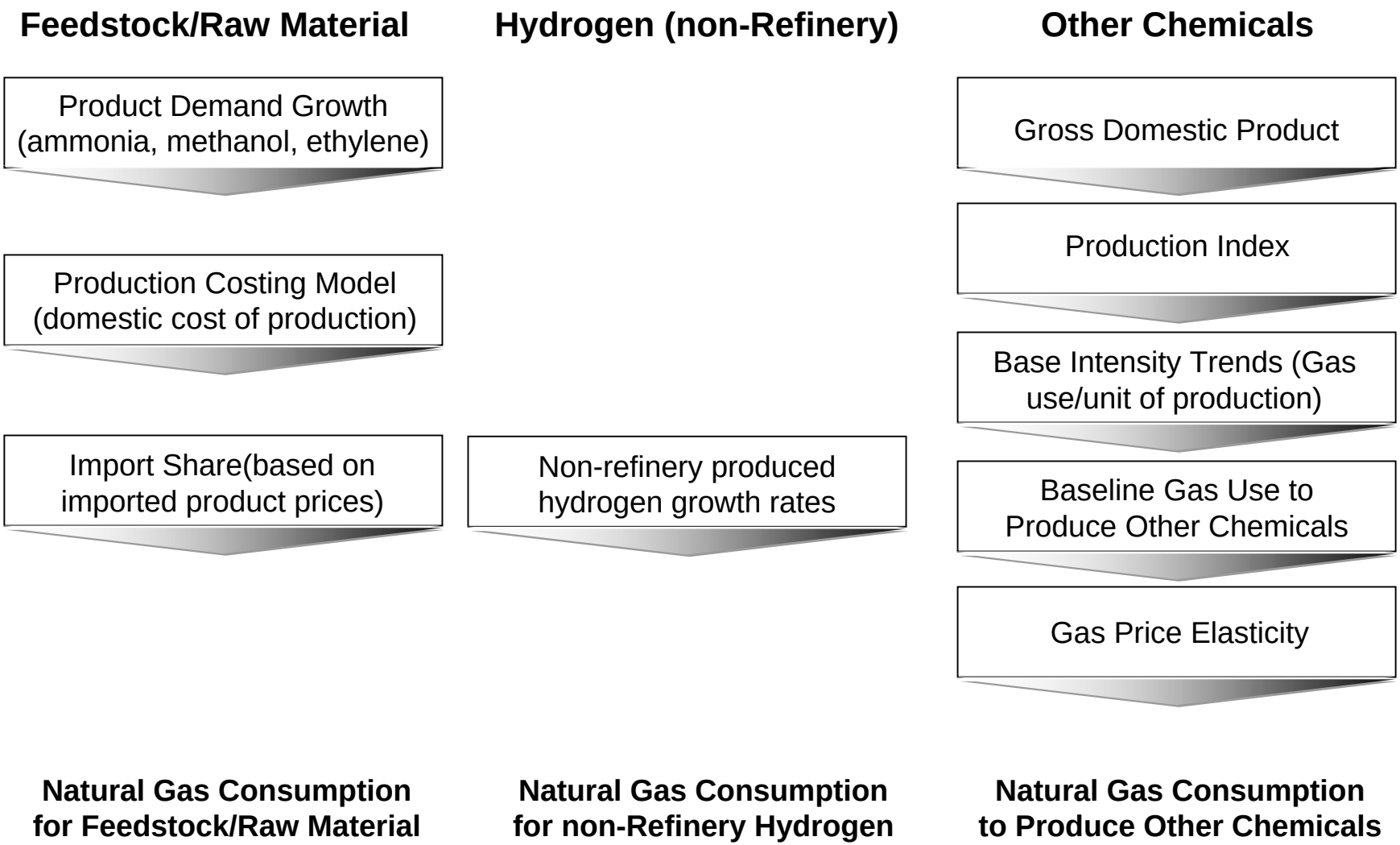
Modeling Framework for Non-Chemicals Gas Use



[1] steam unit efficiencies assumed to improve 0.3%/year

[2] gas price elasticity factors from Industrial Sector Technology Use Model, EEA, Inc.

Modeling Framework for Chemicals



Model Inputs and Outputs

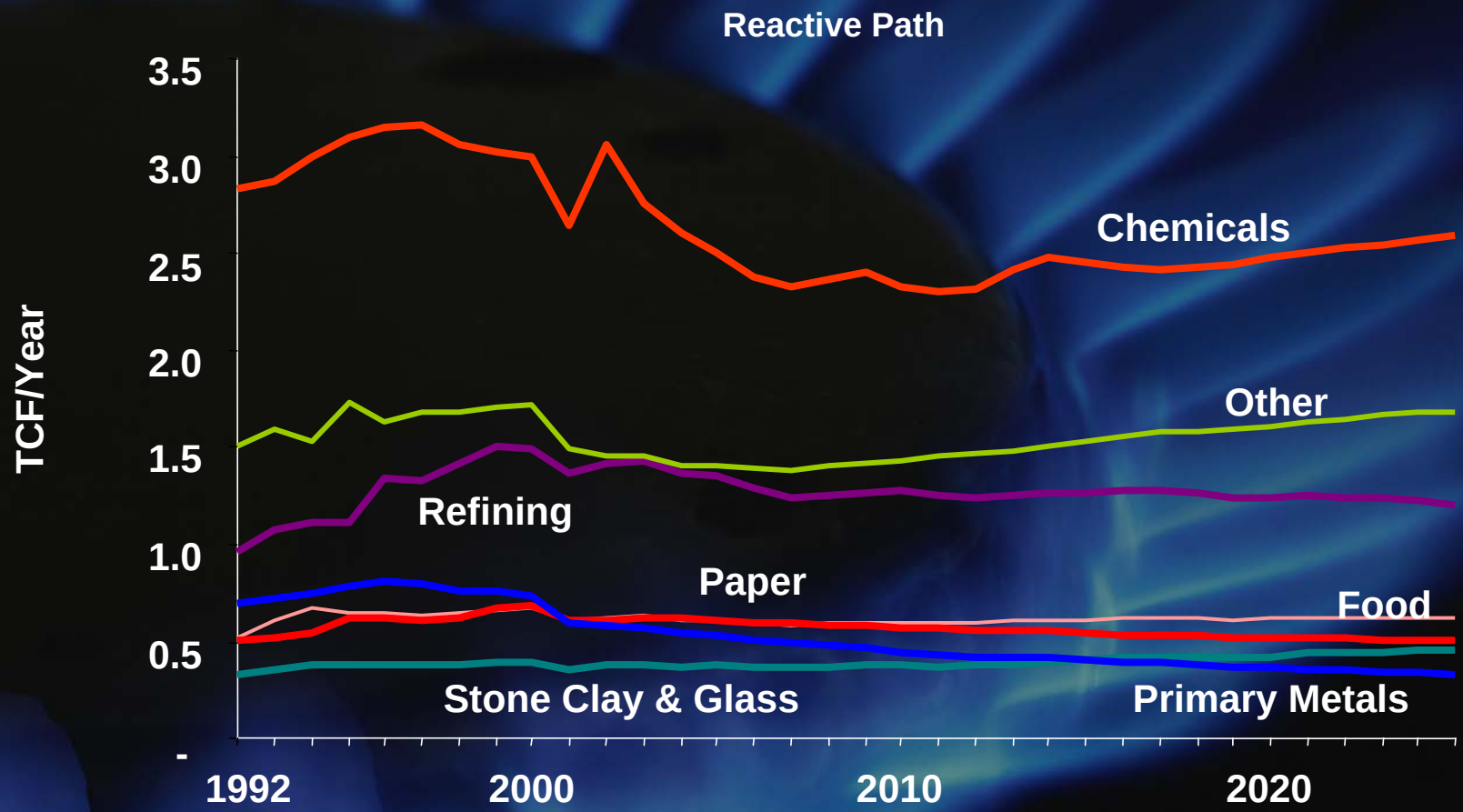
	1992-1998		2001-2025	
	Ind Prod	Gas Use	Ind Prod	Gas Use
Gas Intensive Industries	2.4%	2.9%	1.1%	-0.6%
Food	1.8%	3.8%	1.1%	-0.4%
Paper	0.4%	3.5%	0.0%	-1.3%
Refining	1.2%	6.7%	1.0%	-1.2%
Chemical[1]	0.6%	1.3%	0.8%	-0.1%
Stone, Clay and Glass	3.8%	2.8%	2.8%	0.8%
Primary Metals	3.5%	1.8%	-0.2%[3]	-2.7%
Other Industries	5.2%	1.9%	2.6%	0.1%
Total[2]	2.3%	2.7%	1.1%	-0.4%

[1]Industrial production growth rate for 1992 to 1998 is for the Organic Chemicals industry. Industrial production growth rate for 2001 to 2030 uses the model results' average of the growth rates of gas feedstocks and non-gas-intensive chemical industry production.

[2]Industrial production growth rate for both periods are unweighted averages of the seven industries.

[3]Primary aluminum -1.0%; iron & steel 0.0%; other primary metals 0.5%.

Industrial Natural Gas Demand Outlook For Gas-Intensive Industries



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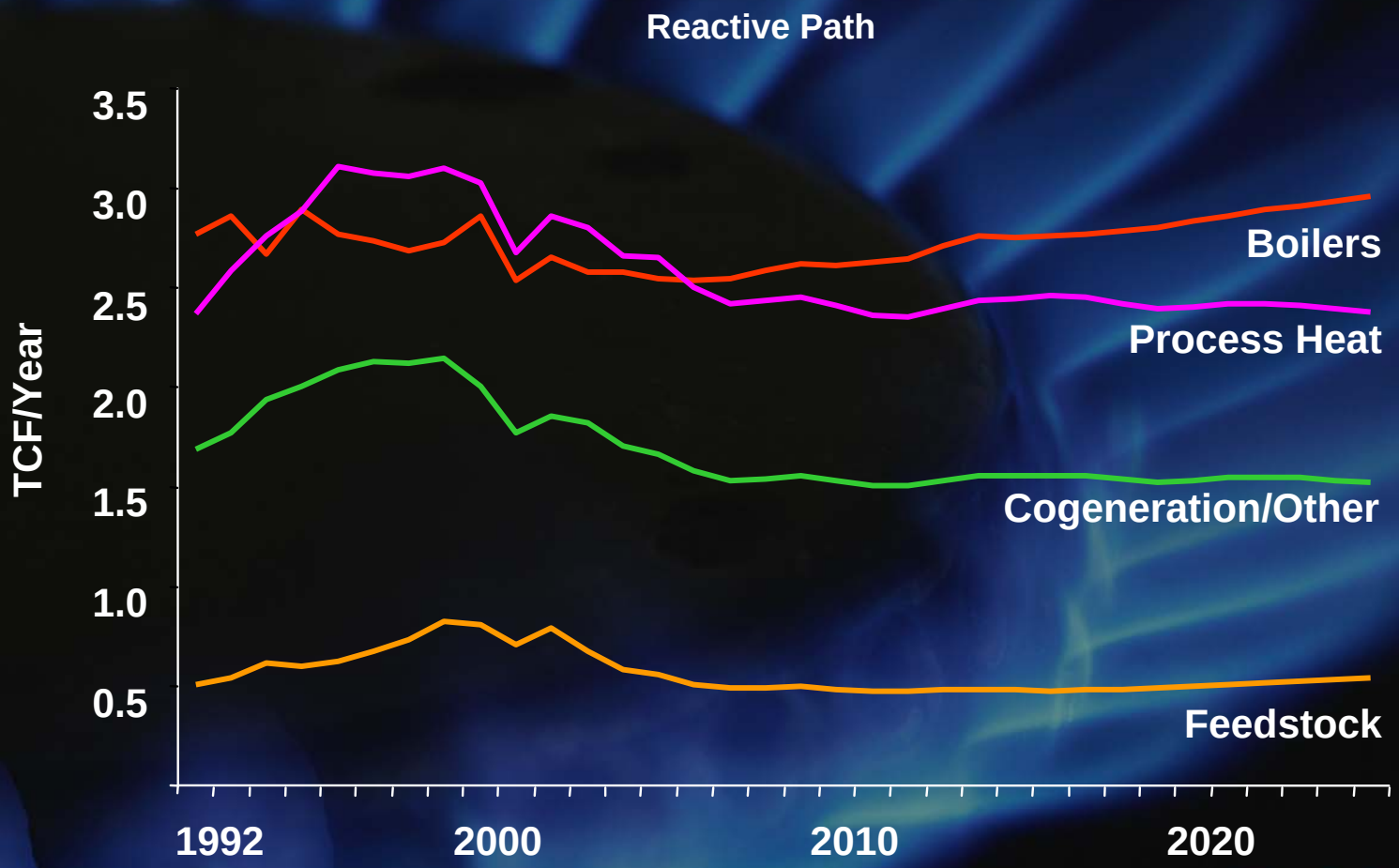
Industrial Natural Gas Demand Outlook For Major End-Uses



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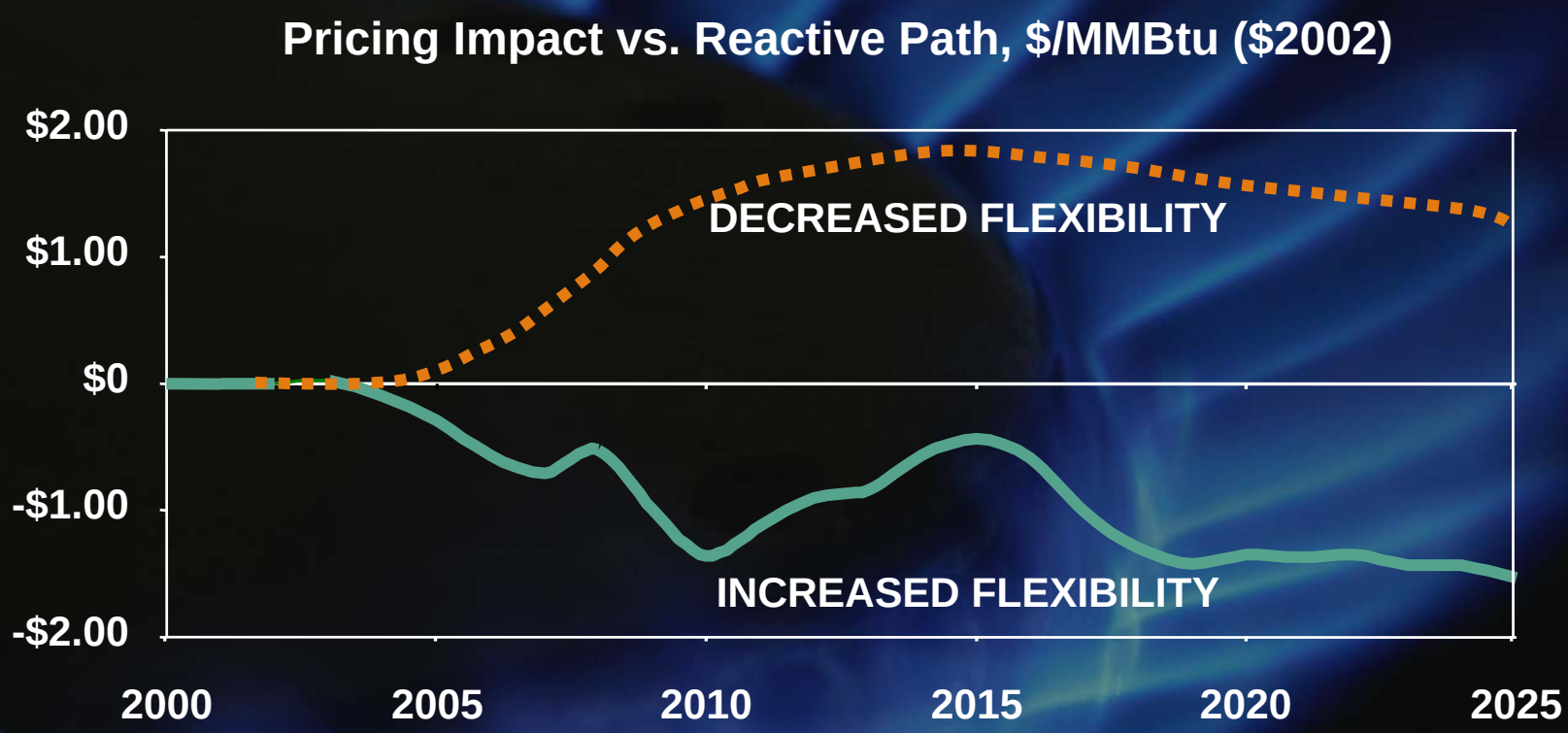
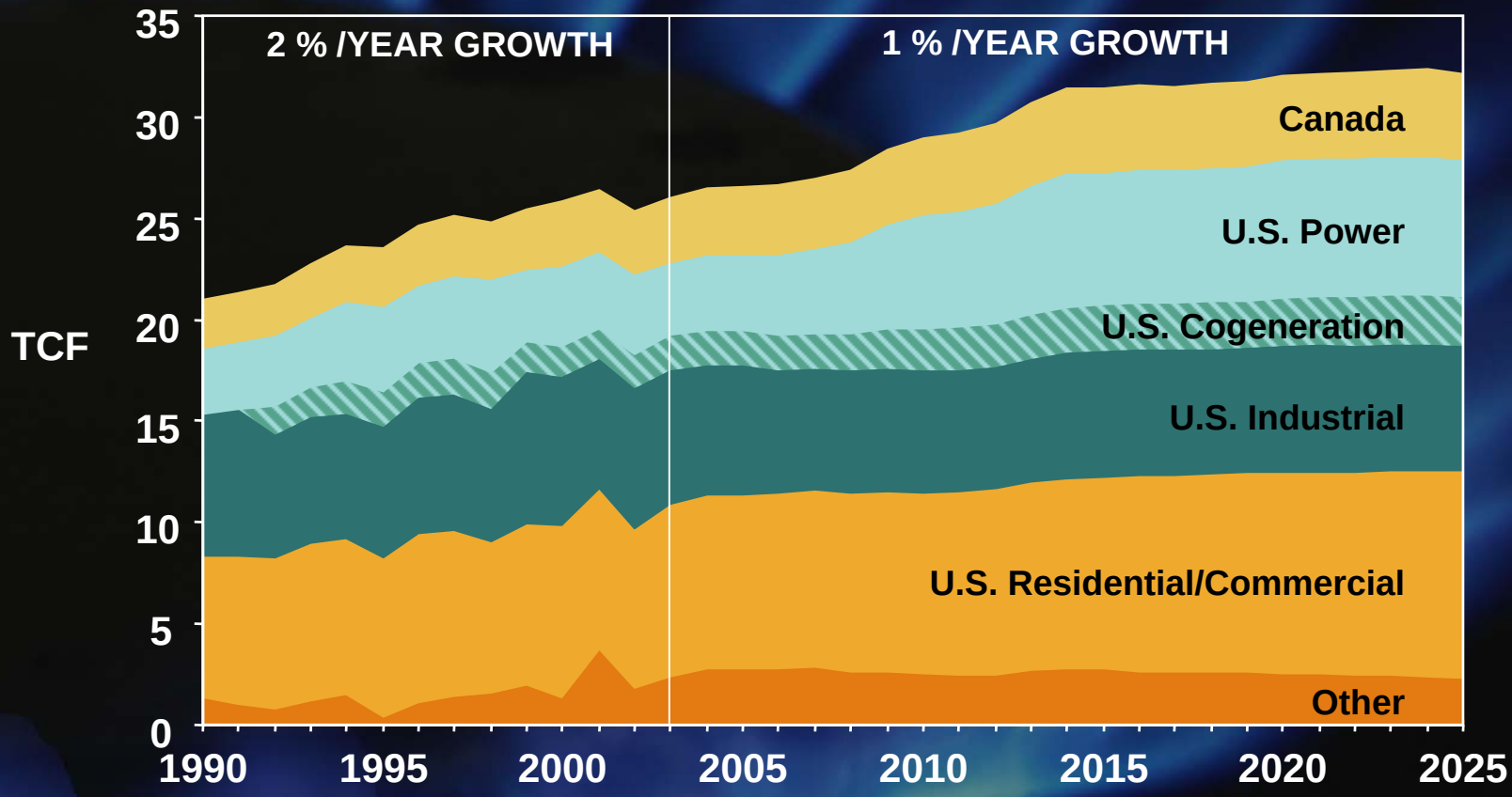
Sensitivity Analysis: Impact of Fuel Flexibility



Summary: Demand Growth Will Moderate, While the Power Sector Drives Growth



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