

Recent Trends in Recovery and Use of Coal Mine Methane

by

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Acknowledgements

Sponsors and organizers of this conference
for their efforts

United States Environmental Protection
Agency for their support

My colleagues at Raven Ridge Resources for
their encouragement and boundless energy

Global Trends in CMM Emissions

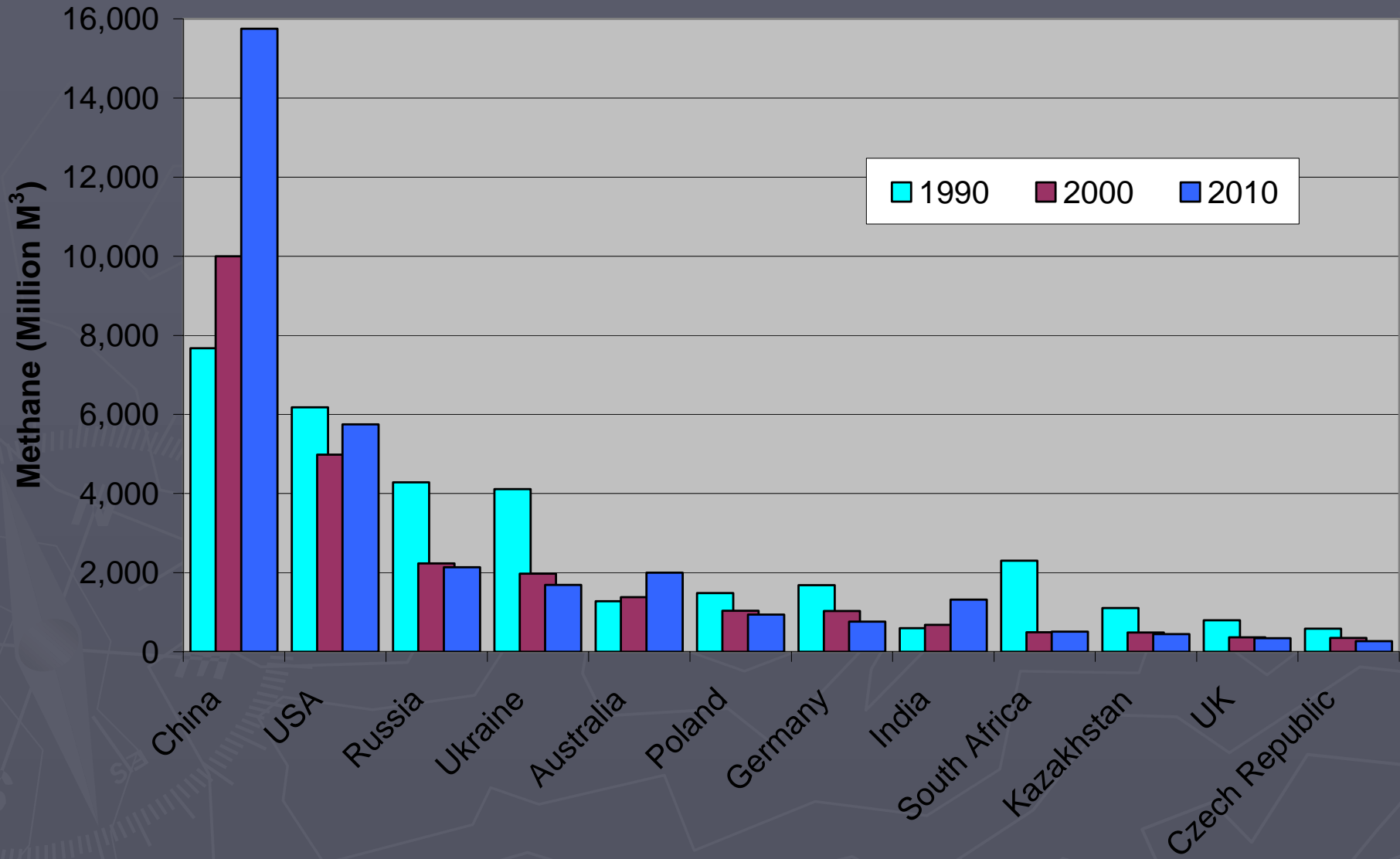
CMM emissions grew by 20% from 1990 to 2000

But not all countries had increased emissions:

- CMM emissions from Russia and Ukraine dropped nearly 50% during the 1990's
- Significant reductions occurred in the United States, Germany, South Africa, Kazakhstan, and the United Kingdom

Notable increases were seen in China, Australia, and India

Trends in Global CMM Emissions



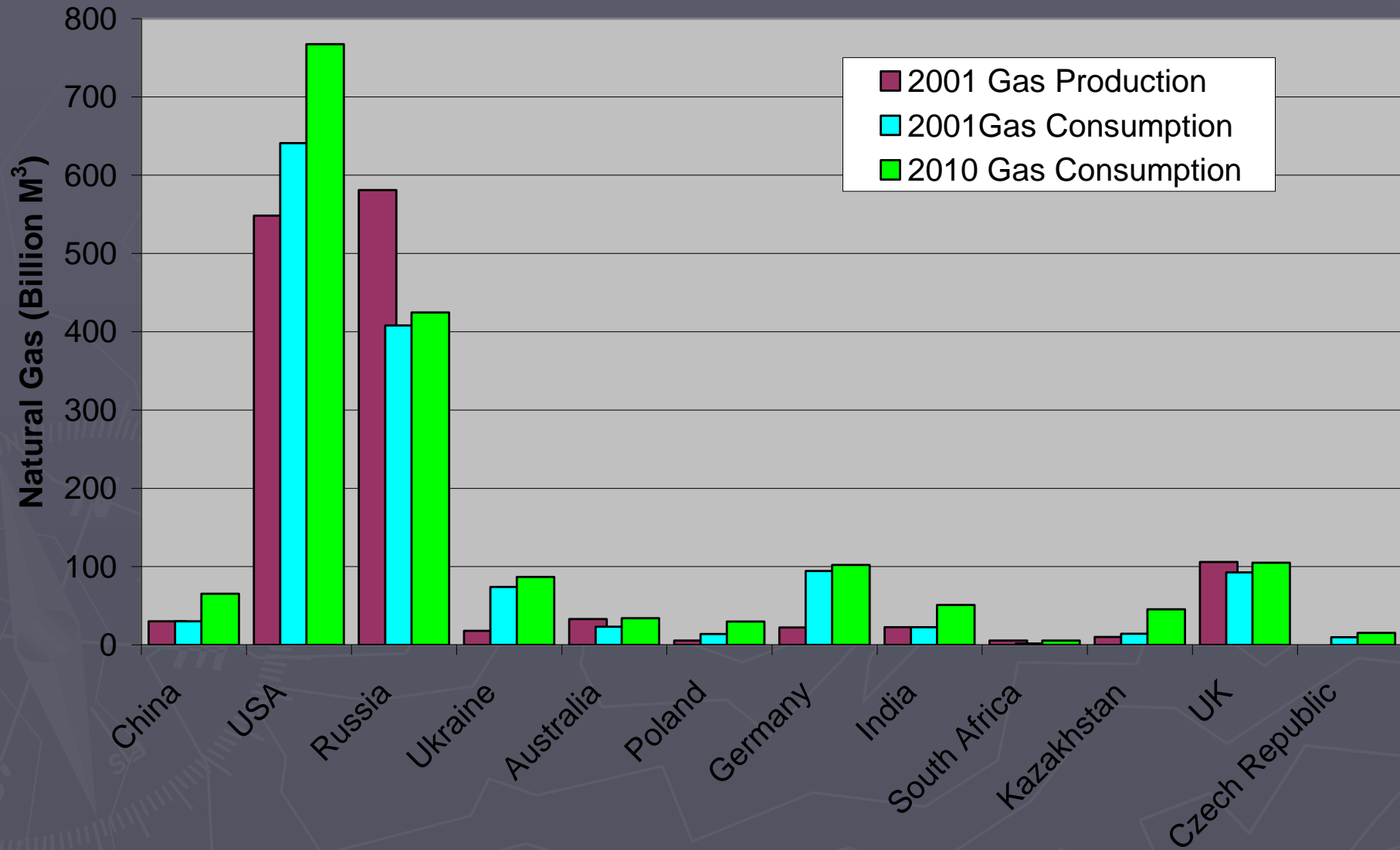
Markets for CMM

Six of the twelve largest emitters of CMM needed to import gas in 2001 to meet demand

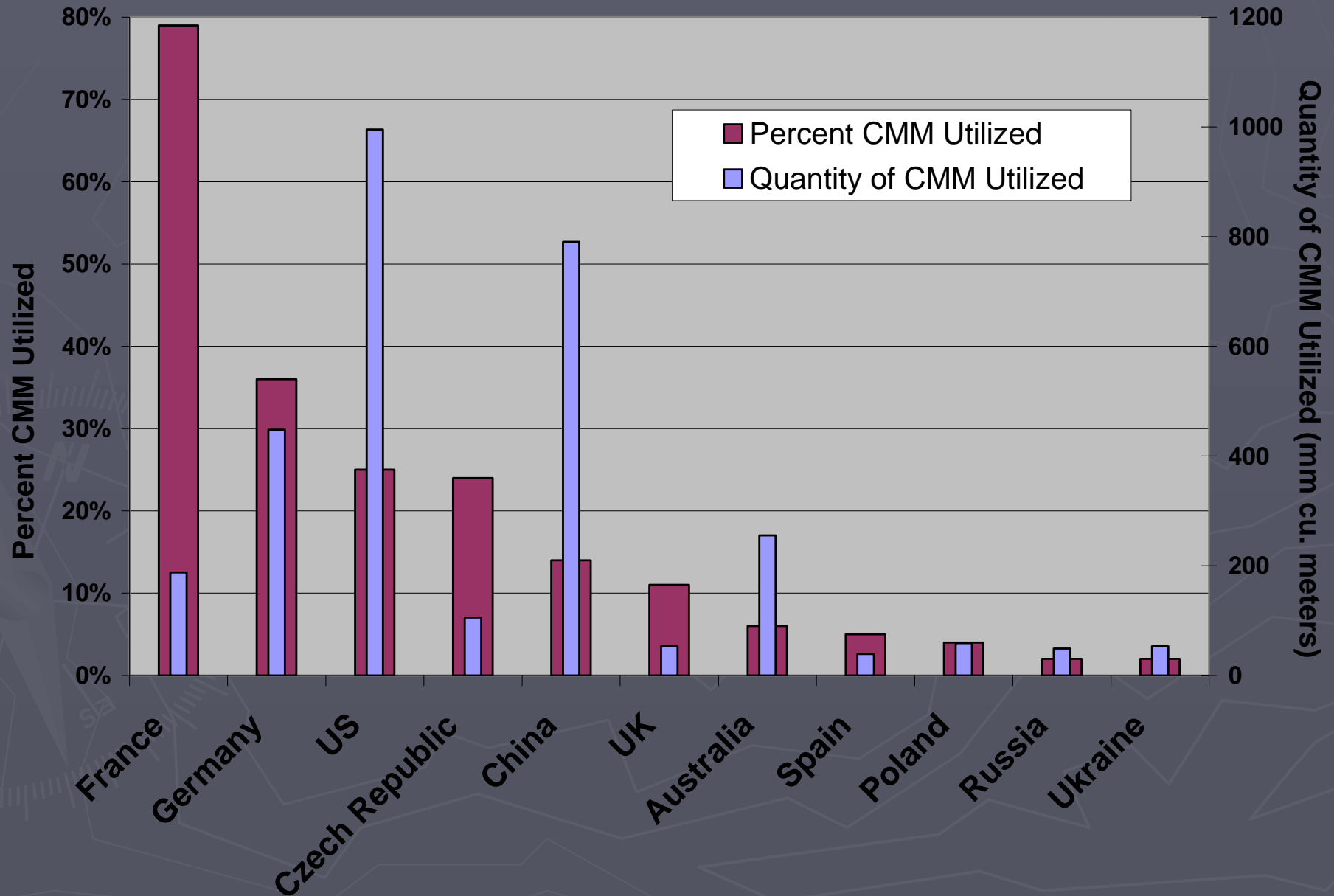
Countries with largest expected increase in annual gas consumption in 2010 will be USA (125Bcm), China (35Bcm), Kazakhstan (31Bcm) and India (29Bcm).

Opportunities to sell CMM in natural gas markets in China, USA, Australia, Germany, Poland, India, Kazakhstan are substantial.

Production & Consumption of Natural Gas by CMM Producing Countries



Utilization of CMM



India

CMM is not being recovered and used

New pipelines are be constructed by Gas Authority of India, Ltd.

Central government is considering gas pricing reforms

India is currently host to CMM recovery and use demonstration project funded by GEF, UNIDO and GOI.

China

Several notable CMM projects are operating

Market potential is being realized -- prices are becoming rationalized in some regions

Policies at central, provincial and local levels are supportive of CMM development, ownership issues

Technology is available and is being employed successfully by Chinese and foreign companies

Investment in CMM projects arising from Chinese private sector is rare

USA

Total volume liberated in the US was 4.9 Bcm in 2003

1.1 Bcm was recovered and used from underground mine drainage systems

- 94 percent of total was recovered from 7 mines
- 68 percent of total was recovered from 2 mines

April 2004 - First new active coal mine projects to go on line since 1997

Many new abandoned mine projects have become operative in the past few years

Recent conflicts over gas resource ownership and primacy reflect need for policy development

Australia

Commercially advanced-- has largest CMM power project in the world

VAM technology was demonstrated

Australian government awarded funds to three CMM emission reduction projects, two are VAM related

Limited markets may be the most significant barrier

Germany

Laws and policy have been developed to promote CMM as a renewable/green energy source and a way of meeting the country's commitment to GHG reduction

Energy conversion of CMM is supplying both the electricity and heat market---CHP

Gas to electricity projects at active and abandoned coal mines now greater than 120+MW.

Realizing full development potential of CMM depends on cumulative gains arising from five interrelated aspects of development:

Market Development

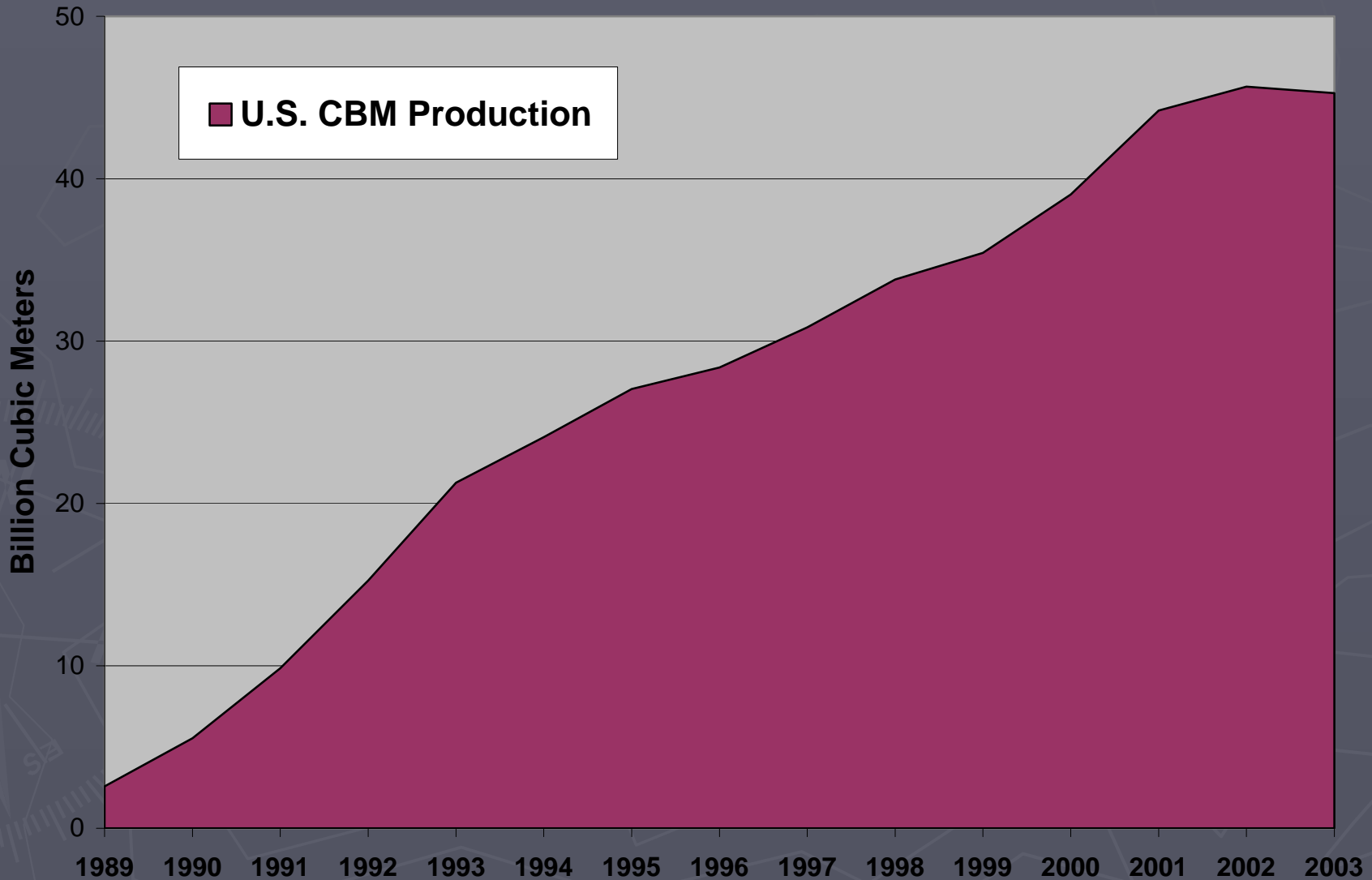
Economic Development

Socioeconomic Development

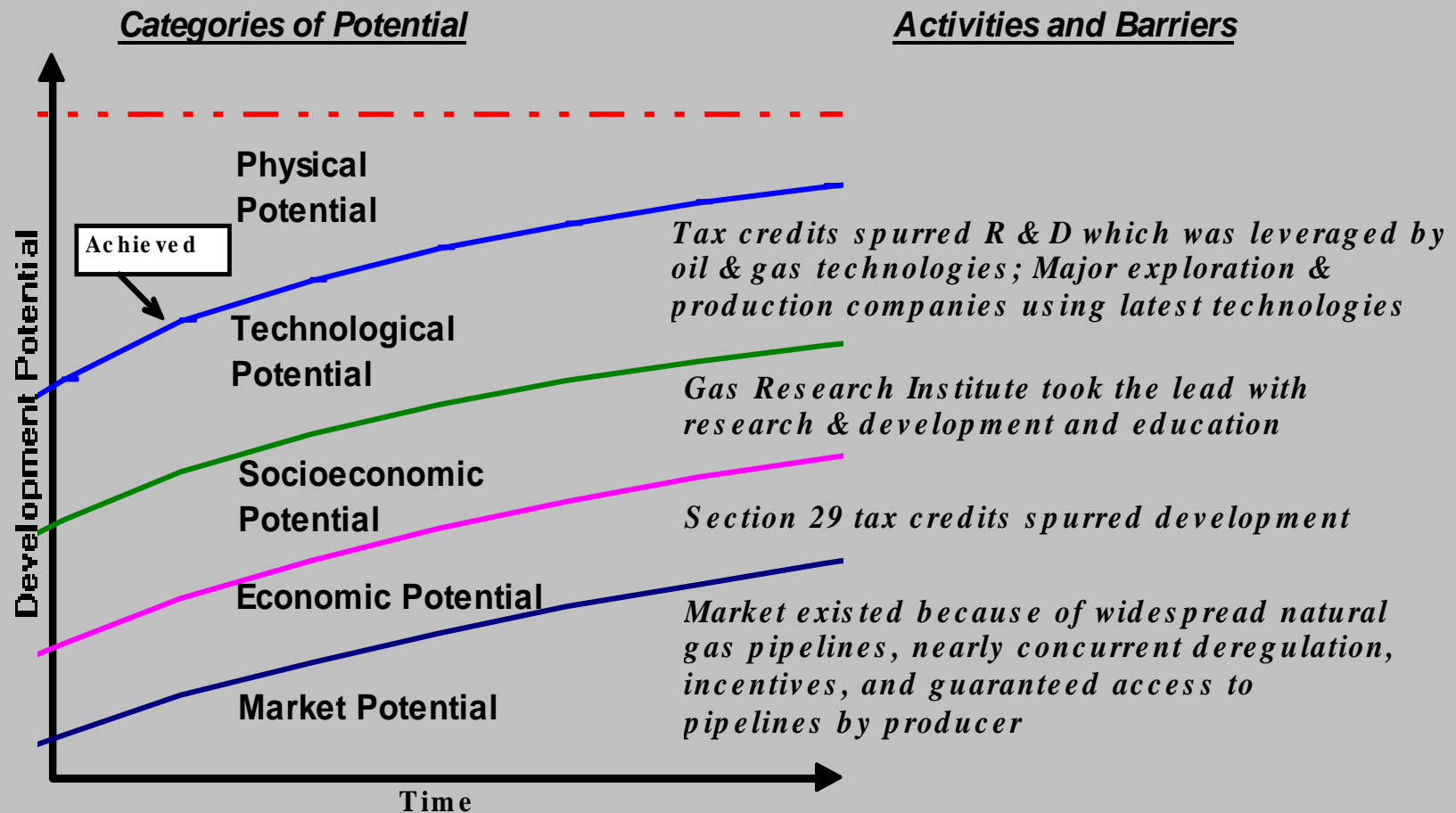
Technological Development

Physical Development

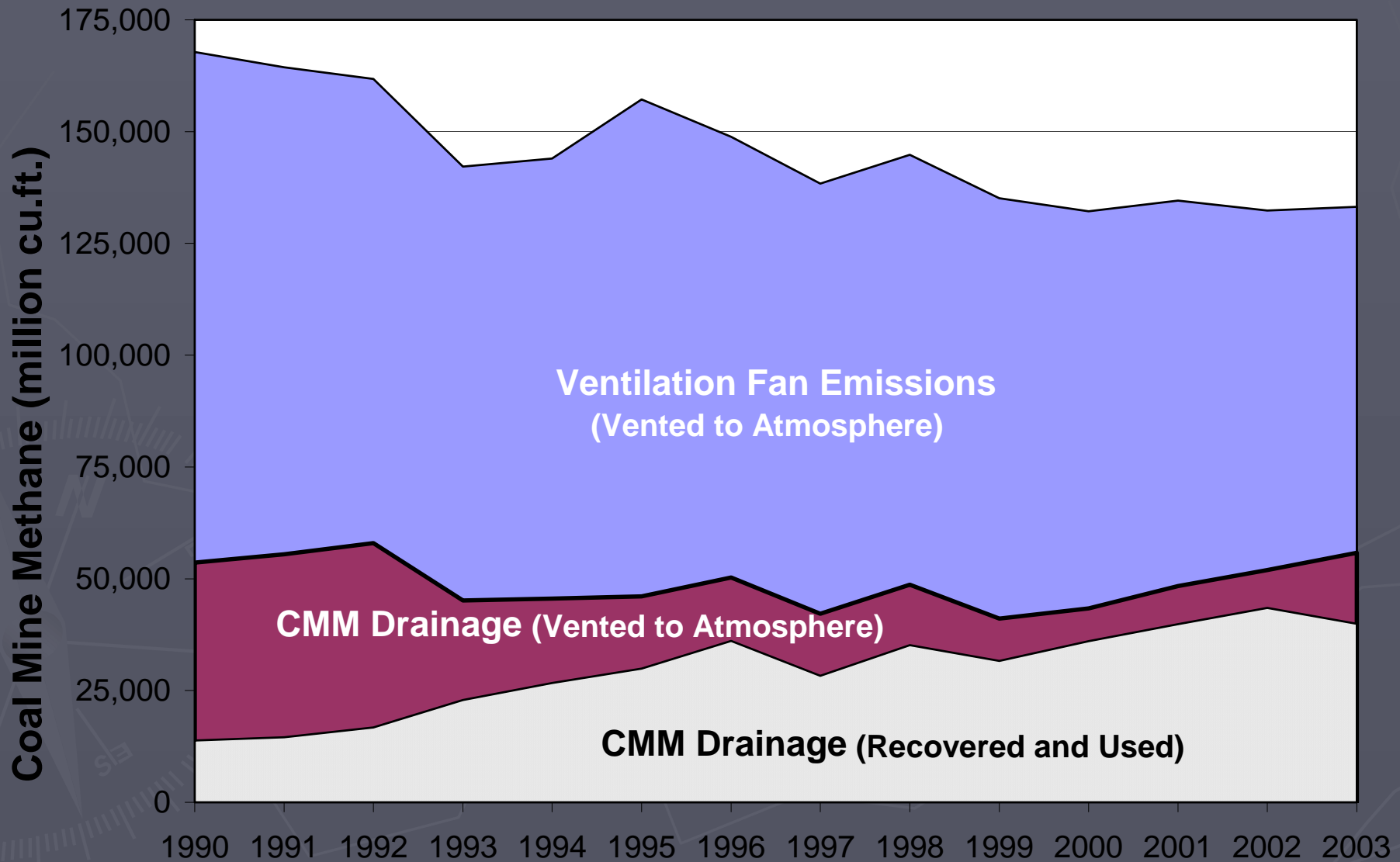
U.S. CBM Production 1989-2003



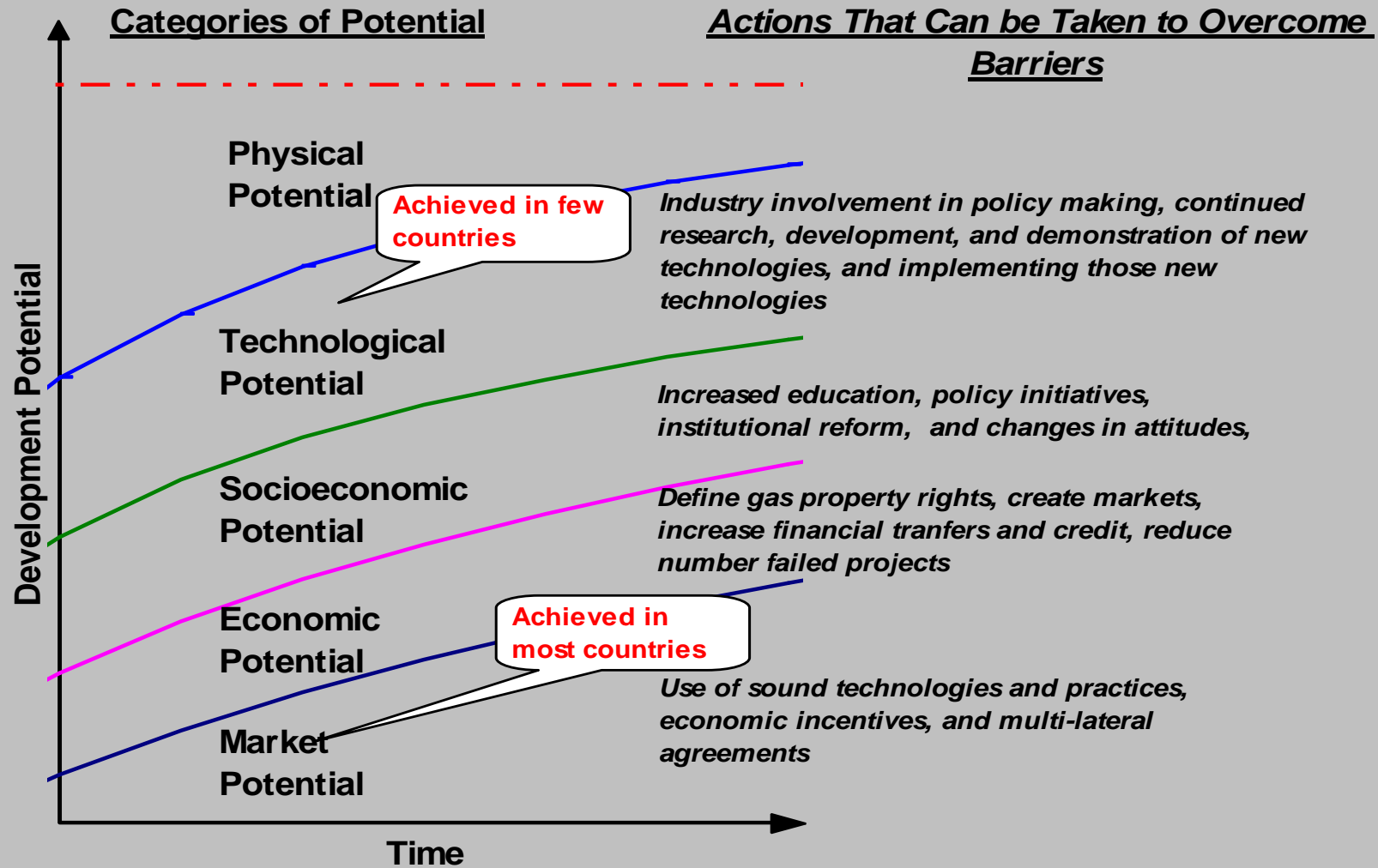
CBM Development in USA



U.S. CMM Emissions & Recovery 1990-2003



CMM Development Potential



Market Development

Achieved and stabilized for sustainable growth through:

Use of sound technologies and practices,

Economic incentives (tax incentives and rationalization of prices),

Multi-lateral agreements (contracts and the rule-of-law allowing enforcement of agreements)

Economic Development

Actions that facilitate the fully achieving the potential gains of economic development are:

Defining gas property rights,

Creating markets,

Increasing financial transfers and credit,

Reducing number failed projects

Socioeconomic Development

Achieving, full realization of socioeconomic benefits is dependent on:

Increased advanced education and technical skills training

Policy initiatives supporting sustainable development ,

Institutional reform,

Changes in attitudes toward resource development and environmental issues.

Technological Development

Advancement of technological potential is achieved through:

Industry input and support of rational policy initiatives

Ongoing research and development in supporting sciences and engineering applications,

Invention and demonstration of new technologies,

Commercialization and deployment of new technologies

Physical Development

Physical development of CMM resources is dependent on synergism of the development components described previously.

The upper bound is impacted by changes in the economy, advances in technology, changes in policy and political agendas.

Relative Achievements of Profiled Countries

	Market Potential			Economic Potential			Socio-Economic Potential			Technical Potential			Physical Potential			
	Use of and technologies and practices	Utilize existing economic incentives	Bi-lateral or multi-lateral agreements	Define gas property rights; Create and expand markets	Reduce risk and failure rates of projects	Unsubsidized, free gas market	Educational and institutional reform	Changes in attitudes	Industry involvement in policymaking	Government initiatives, CMM/CBMs energy plan	Development and demonstration of new technologies	Implementing new technologies	Continued research	Increased use of new technologies	Widespread use of new technologies	New technologies commonplace
China	X	X		X			X	X						X		
USA	X	X	X	X	X	X	X			X				X		
Russia	X	X	X	X			X	X								
Ukraine	X	X														
Australia	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Poland	X	X	X				X	X	X					X		
Germany	X	X	X	X	X		X	X	X	X	X			X		
India	X	X	X													
South Africa	X	X														
Kazakhstan	X	X														
UK	X	X	X	X	X	X	X							X		
Czech Republic	X	X					X	X	X					X		

Conclusions and Predictions Through 2010

Largest number of new CMM projects developed will be located in:

- China
- USA

Most comprehensive use of CMM will be in:

- Australia
- Germany

Technology transfer and outside investment will be needed to result in significant CMM development in:

- India
- Kazakhstan