

METHANE IN ABANDONED COAL MINES IN CHINA – AN UNEXPLOITED RESOURCE

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PRESENTATION OUTLINE

- Goals and Objectives of the Study
- Shanxi Mine Closure Objectives
- Selection of the Study Area
- Estimating Reserves
- Results
- Project website: www.chinamethane.org
- Summary and Conclusions

GOALS AND OBJECTIVES OF STUDY

- Determine data availability for abandoned mines
- Develop an approach to estimate the methane emissions through time for a sample set of abandoned mines based on the data available
- Estimate the methane resource available for development by mine
- Utilize Geographical Information System (GIS) technology to facilitate project identification

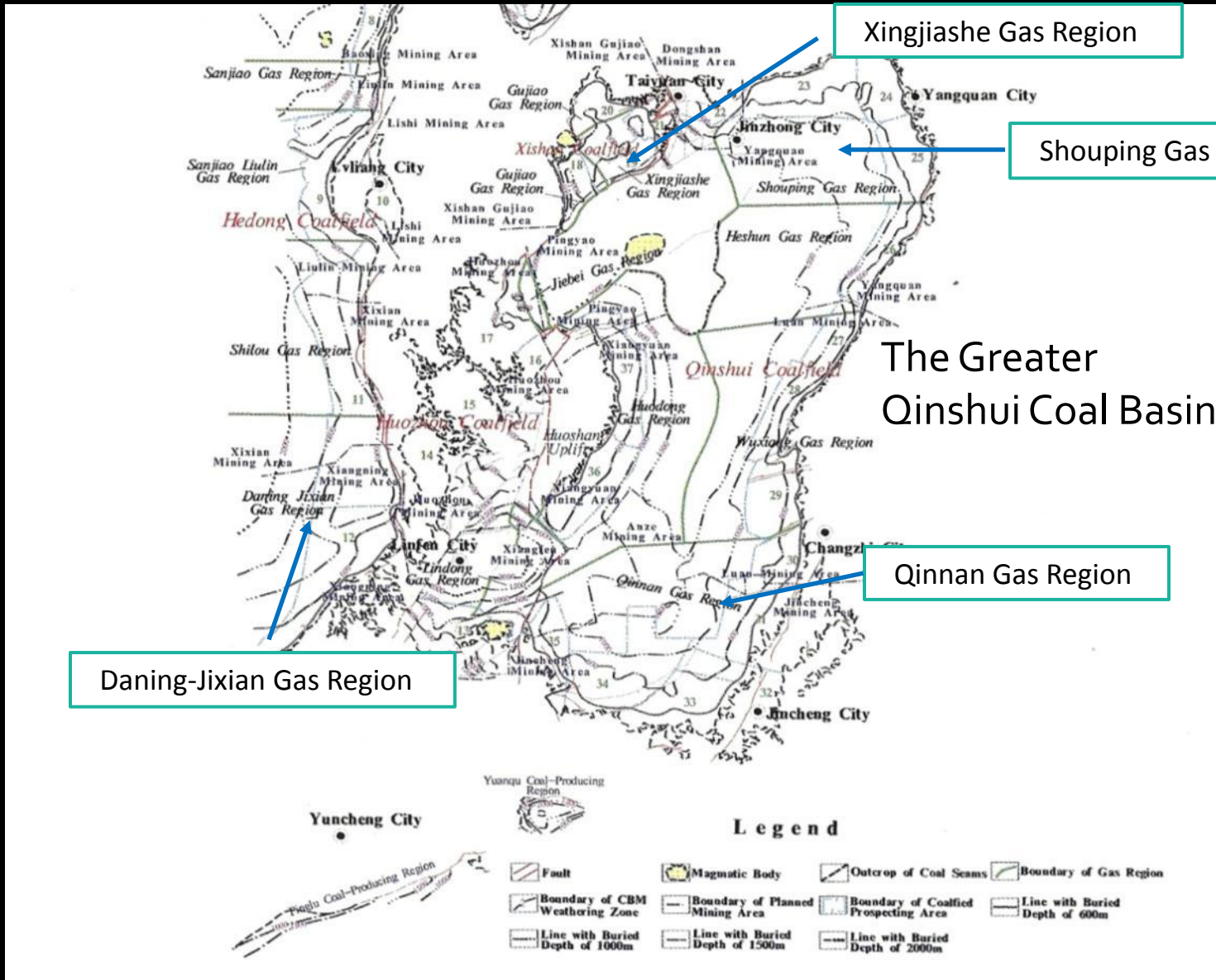
SHANXI MINE CLOSURE

OBJECTIVES: 11TH 5 YEAR PLAN

- Closed **6,799** mines by 2005
- Closed **1,156** mines from July 2005 through June 2006
- Planned on closure of **600** mines between July 2006 and June 2007
- Planned on closure of **500** mines between July 2007 and June 2008

SELECTION OF THE AREA OF STUDY

- The greater Qinshui coal basin of Shanxi province was chosen because:
 - Most of the coal mined is high gas content anthracite and coking coal;
 - There has been a long history of coal mining and hence a large number of abandoned mines; and
 - Numerous active mine methane capture and utilization projects are underway which could provide operational expertise for AMM projects



ESTIMATING RESERVES*

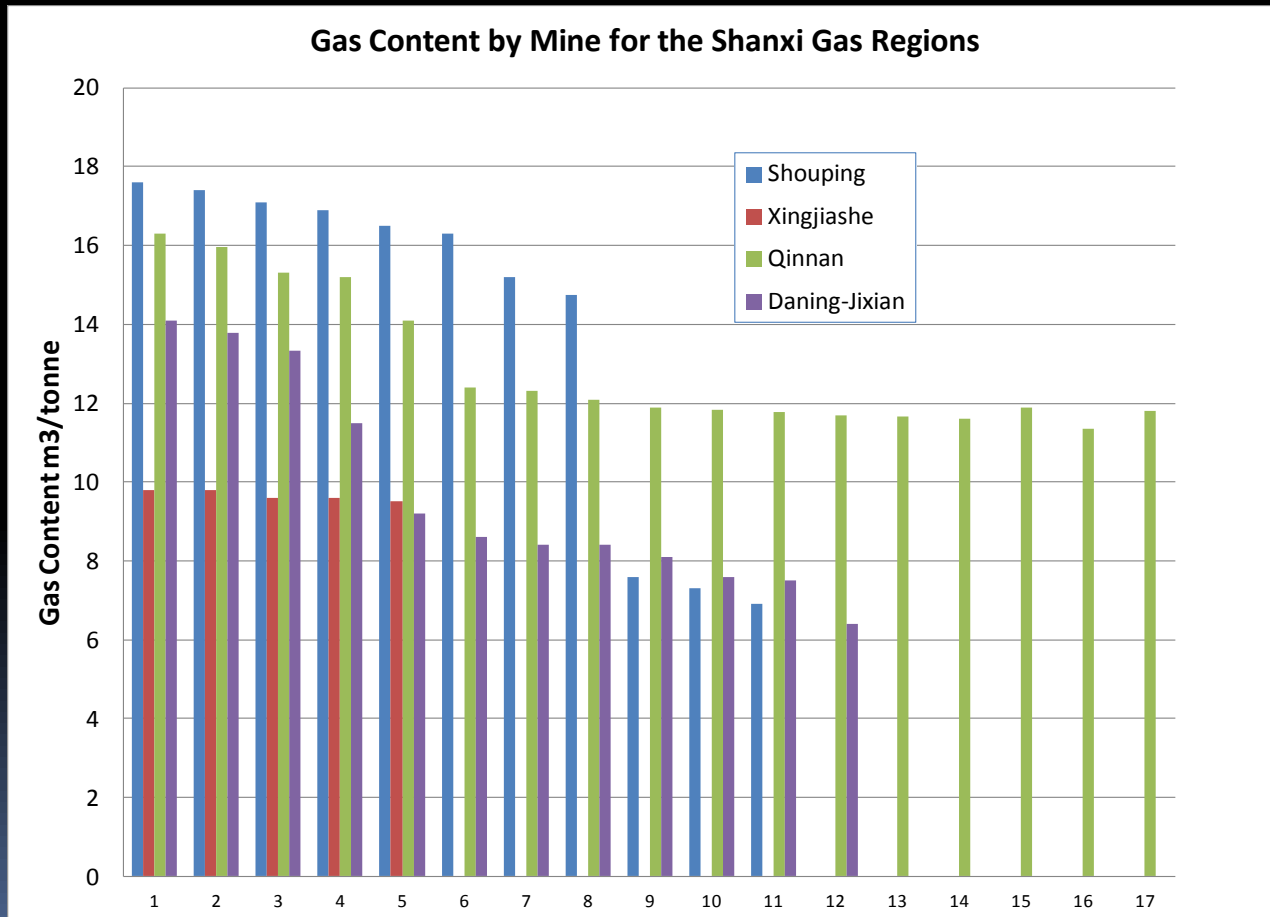
- An initial estimate of the recoverable resource is necessary for project planning
 - Estimate the original volume of methane in place in the mine area
 - Estimate the amount of methane liberated during mining activities
 - Estimate the amount of methane emitted to the atmosphere from time of closure to the present

*http://www.globalmethane.org/Data/Final_Report_AMM_Emissions_China.pdf

ORIGINAL METHANE IN-PLACE

- Total coal thickness
- Mining area
- Original gas content of the coal
- Percent methane in the adsorbed gas

MEASURED GAS CONTENTS FOR MINES IN GAS REGIONS



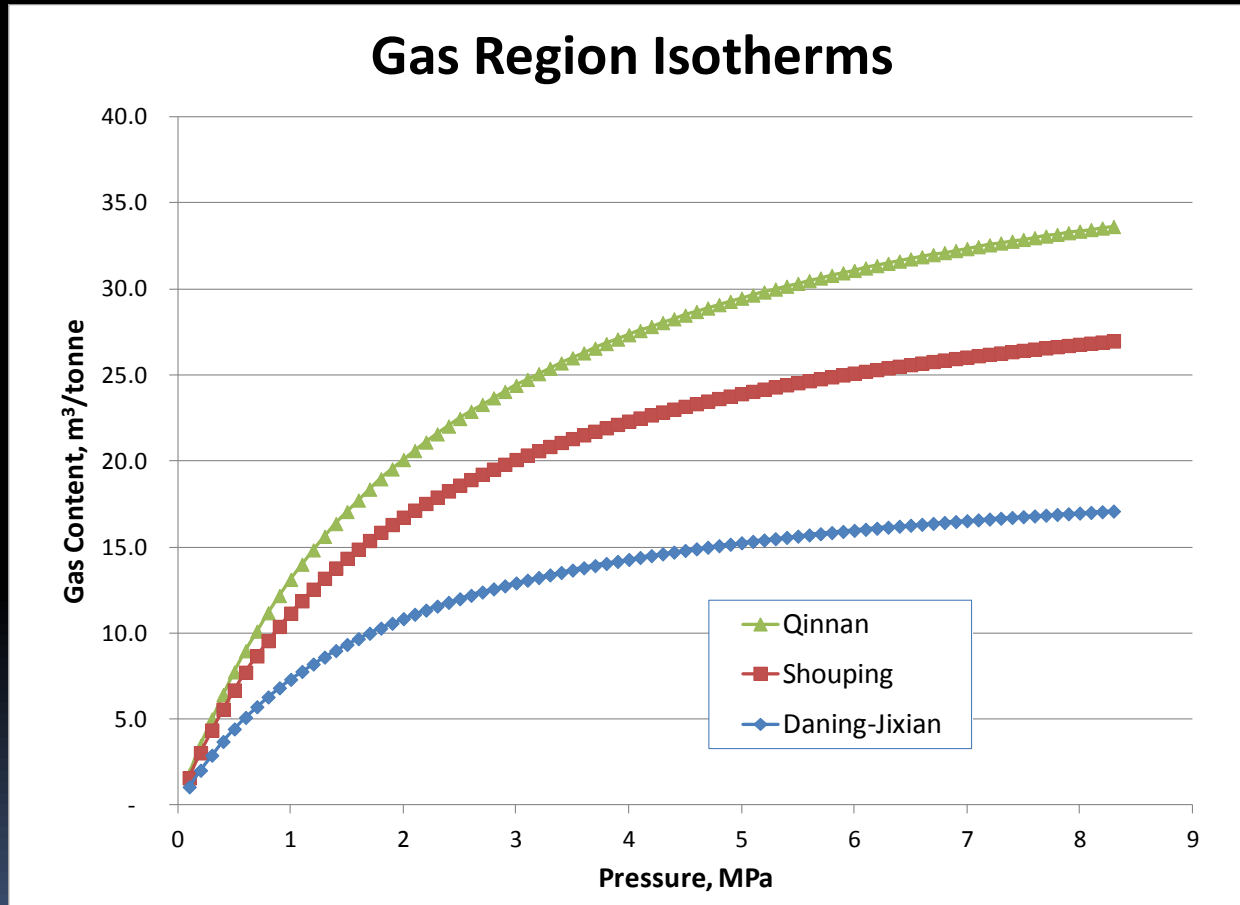
METHANE LIBERATED DURING MINING

- Mass of coal mined prior to closure
- Specific methane emissions
 - volume of methane per mass of coal mined (m^3/t mined)
 - May be a function of initial gas content (m^3/t) and ratio of total coal thickness to mined coal thickness

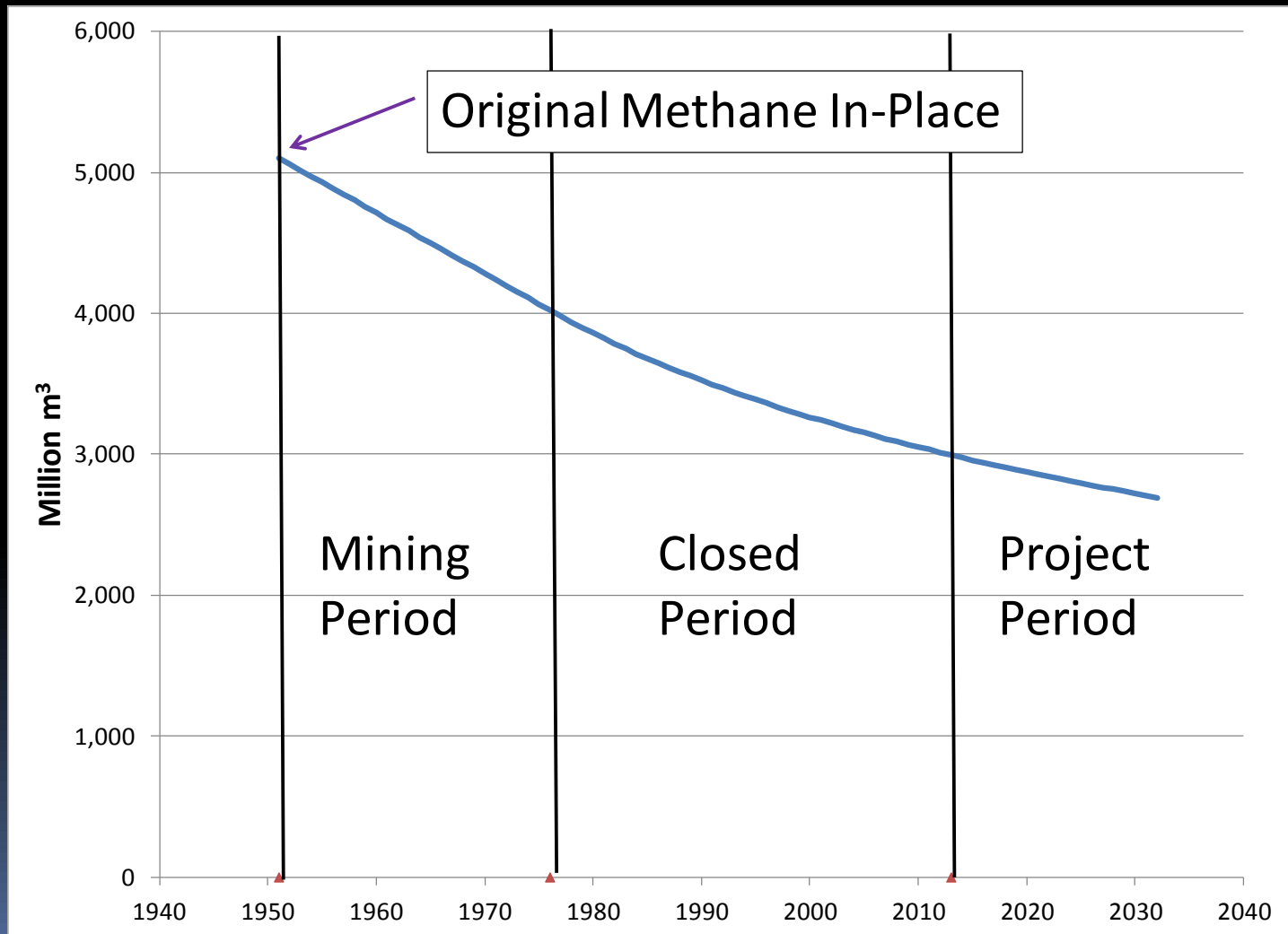
POST MINING DECLINE FUNCTION

- The decline function is an expression of the pressure loss in the system through time as more methane is emitted to the atmosphere
- As the adsorption pressure decreases in relationship to the atmospheric pressure the rate of methane loss decreases
- The decline function can be thought of as the baseline methane emission rate

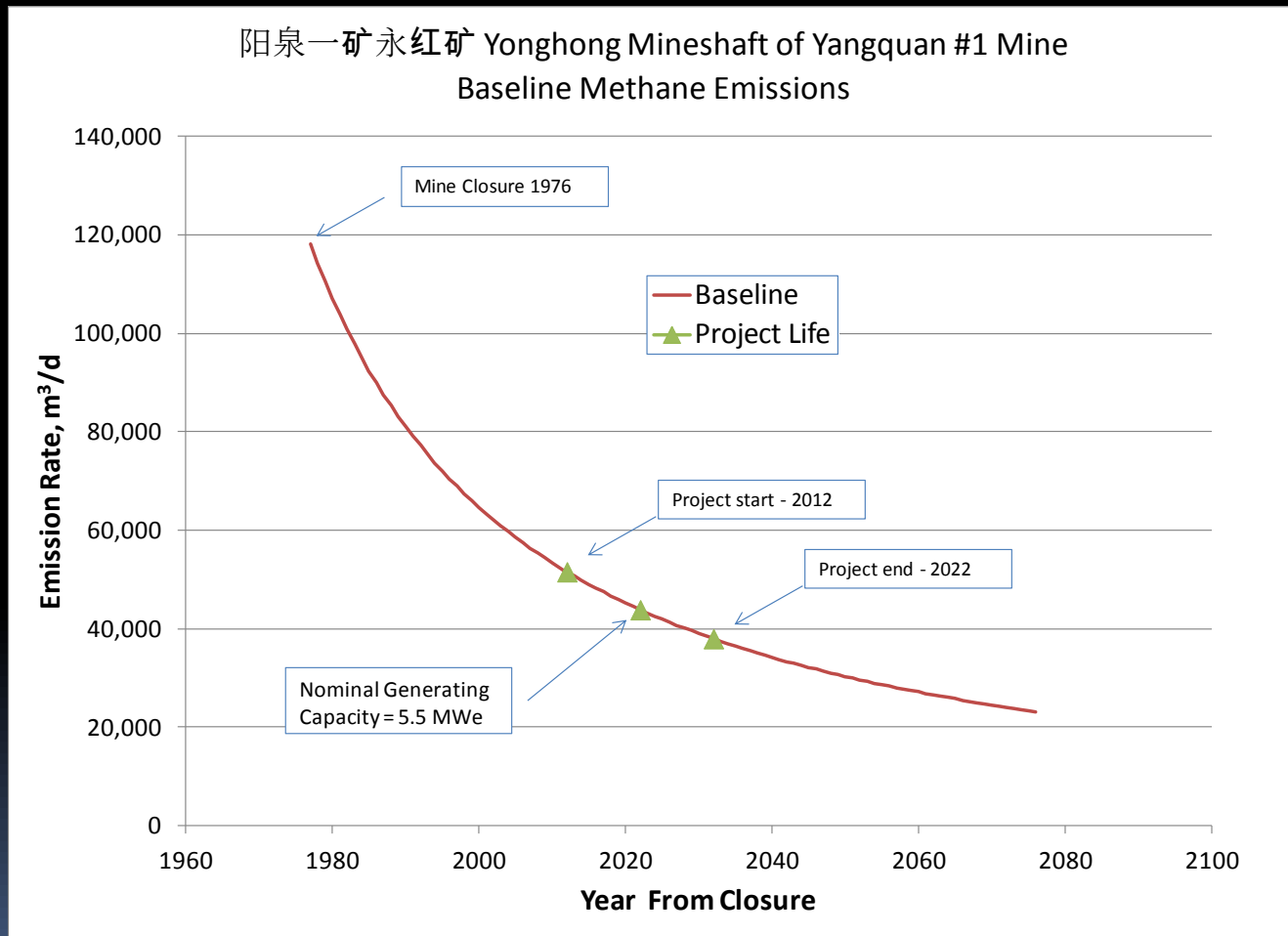
GAS REGION ISOTHERMS



METHANE IN MINED AREA THROUGH TIME



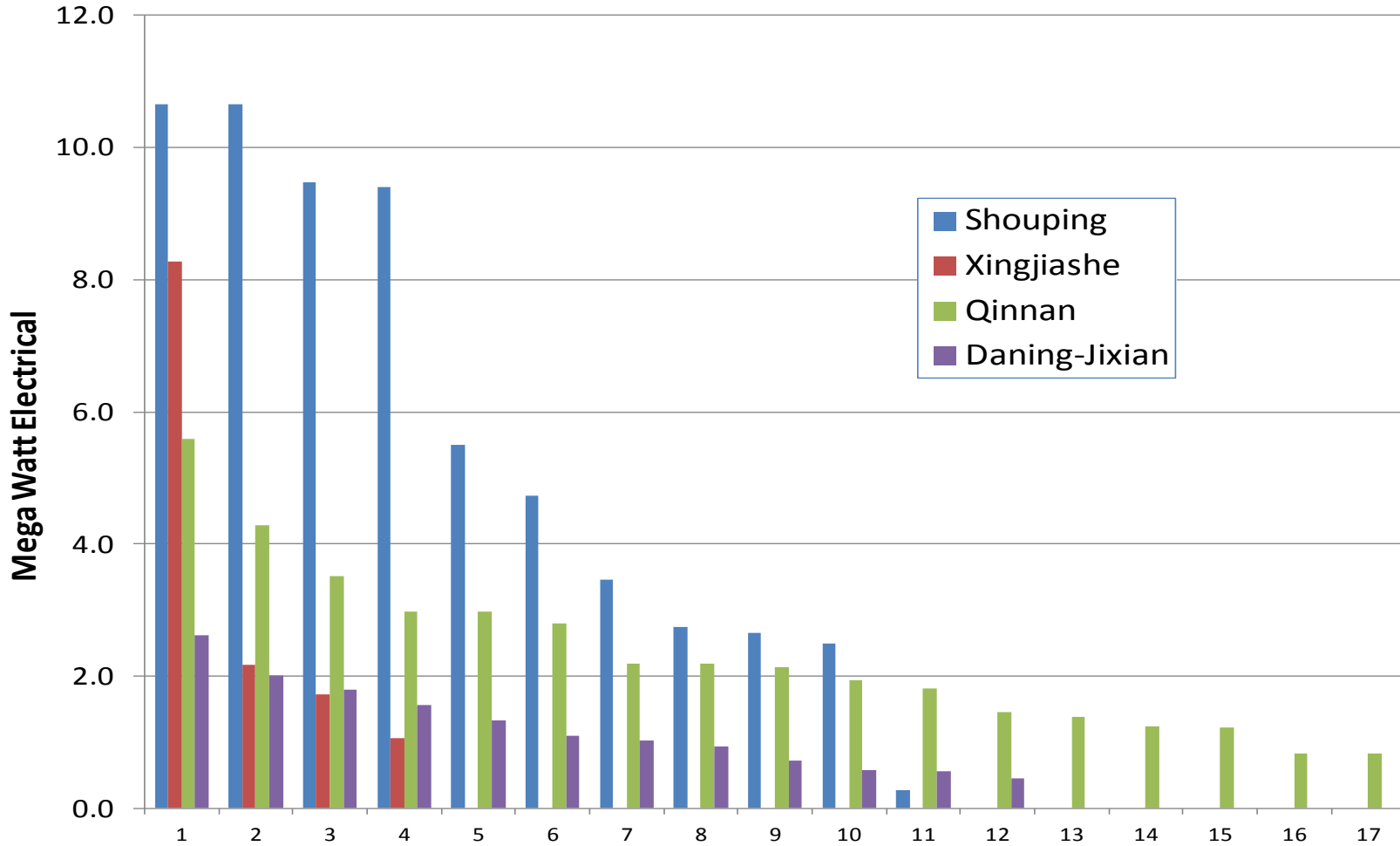
THE DECAY (DECLINE) STUDIES



RESULTS

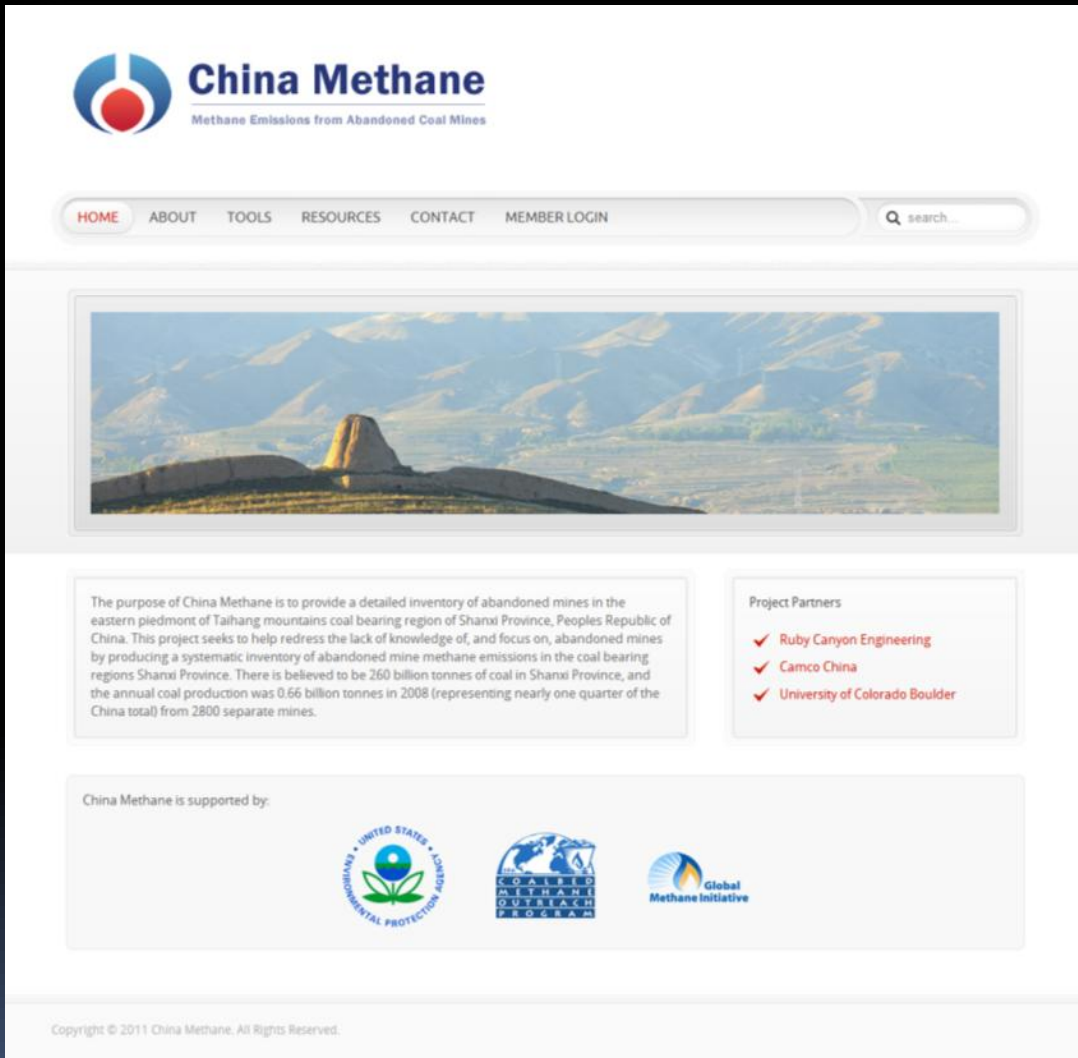
- Of the 44 abandoned mines studied 36 are expected to be able to produce over 60 million m³ over a twenty year project life. The largest of these mines may produce as much as 630 million m³
- While estimated recoverable volumes are uncertain, the process developed provides a valuable screening tool upon which to base further evaluation

Estimated Nominal Power Generation Capacity from Abandoned Mines in Each Shanxi Gas Region



RESULTS

- The Shouping gas region shows the highest potential for AMM development based on mine size, coal thickness and gas content followed by the Qinnan gas region
- Pro forma economic analysis showed that projects should produce an IRR of between 10% and 30% for projects between 3MWe and 10MWe based on current incentivized power prices



- DATA ENABLING ANALYSIS
- 3 PROJECT PARTNERS
- JOOMLA DRIVEN SITE
- SQL DATABASE
- SQL, PHP, GOOGLE API MASHUP
- BACKEND INTERFACE TO SQL
- BACKEND INTERFACE TO MASHUP
- DYNAMICALLY INTERLINKED
- FRONT END INTERFACES
- ADDITIONAL FILTERS
- MORE DATA LAYERS, AND . . .



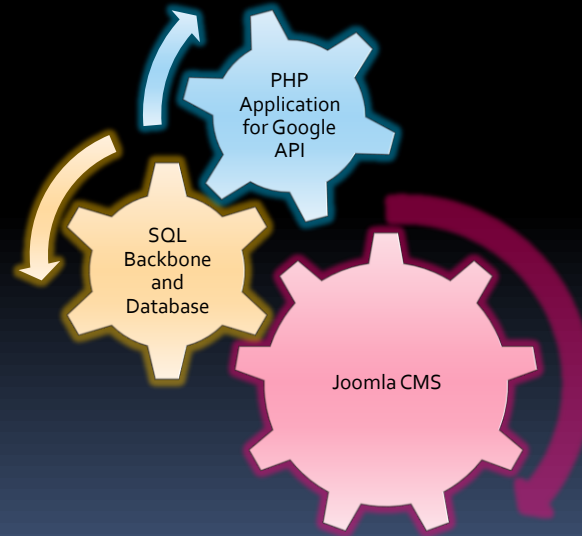
WWW.CHINAMETHANE.ORG

WEBSITE

DATABASE

MAP INTERFACE

RESOURCES





China Methane

Methane Emissions from Abandoned Coal Mines

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search...

ABANDONED MINE METHANE DATABASE

The AMM Database provides a detailed inventory of abandoned coal mines in Shanxi Provinces, People's Republic of China. To search for abandoned coal mine data, first select a city. Relevant basins will then appear in the basin field. To refine the search, select a basin or simply click search to view records for all relevant basins. If a basin is selected, the Mine Name field will auto-populate with relevant Mine Names. Search results can be downloaded as a CSV file.

Abandoned coal mine data can also be searched using the [Map Interface](#).

INITIAL SEARCH PAGE

City	Jincheng ▾
Basin	Qinshui ▲ ▼
Mine Name	Select a basin to refine the search; or for multiple or intra-basin searches, just click search ▾
<input type="button" value="Search"/>	

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City	Jincheng ▼
Basin	Qinshui ▲
Mine Name	Fuyanshan Coal Mine ▼ Fuyanshan Coal Mine Gaoliang Coal Mine Niushan Coal Mine Qiling Coal Mine Shangkong Coal Mine Shangkong Yicheng Coal Mine Shenjiazhuang Duanjiagou Coal Mine Tianhu Coal Mine Tuncheng Coal Mine Wanshan Coal Mine Wozhuang Coal Mine Xianghe Coal Mine #1 Mineshaft

NESTED SEARCH



China Methane

Methane Emissions from Abandoned Coal Mines

ABANDONED MINE METHANE DATABASE

RECORDS PAGE

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Abandoned coal mine data can also be searched using the [Map Interface](#).

[Search Again](#)

Sort results by

[Download Data](#)

Mine Name	City	Basin	Gas Region	Year of initial Production	Year of closure		
Fuyanshan Coal Mine	Jincheng	Qinshui	Qinnan	1962	1986		Details

Records 1-1 of 1

- City (A to Z)
- Basin (A to Z)
- Gas Region (A to Z)
- Mine Name (A to Z)
- Year of initial Production (Low to High)
- Year of closure (Low to High)
- CH4 Vented m3 (Low to High)
- CH4 in Coal after 20 yrs m3 (Low to High)
- Rate after 20 years m3d (Low to High)

ABANDONED MINE METHANE DATABASE

The AMM Database provides a detailed inventory of abandoned coal mines in Shanxi Provinces, People's Republic of China. To use the database, you must first select a city. Relevant basins will then appear in the basin field. To refine the search, select a basin or a basin is selected, the Mine Name field will auto-populate with relevant Mine Names. Search results can be viewed in a table or on a map.

Abandoned coal mine data can also be searched using the [Map Interface](#).

DETAILS PAGE

 [Search Again](#)

Mine Name	Fuyanshan Coal Mine
City	Jincheng
Basin	Qinshui
Gas Region	Qinnan
Main Shaft Latitude	35.64
Main Shaft Longitude	112.29
Total Coal Thickness in Region m	21.72
Year of initial Production	1962
Year of closure	1986
Mining Area km2	3.2
Mined Coal Thickness m	5.04
Coal Produced Mt	10.8
Gas Content m3mt	11.84
Average Daily Rate mtd	1232.88
Average Emission Rate m3d	43219.97

China Methane

Methane Emissions from Abandoned Coal Mines

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Q search...

The Map Interface shows the location of abandoned coal mines in Shanxi Provinces, People's Republic of China. Click on a marker to view an information window containing details on a specific abandoned coal mine. For more detailed information, click on the Database Record link in the information window, or use the dropdown search option located below the map.

Use the links to the right to filter abandoned coal mines by City, Basin, or Gas Region. Abandoned coal mine data can also be searched using the [Abandoned Mine Methane Database](#).

VIEW ALL MINES

CITIES

BASIN

GAS REGION

COAL THICKNESS

20-YR CH4 RECOVERABLE



MAP INTERFACE

Mine Name Baijiazhuang Songshu Coal Mine of Xishan Coal Electricity Group

located below the map.

Use the links to the right to filter abandoned coal mines by City, Basin, or Gas Region. Abandoned coal mine data can also be searched using the [Abandoned Mine Methane Database](#).



BASIN	<input type="checkbox"/>
GAS REGION	<input type="checkbox"/>
COAL THICKNESS	<input type="checkbox"/>
20-YR CH4 RECOVERABLE	<input type="checkbox"/>
< 50,000,000 m3	<input type="checkbox"/>
< 100,000,000 m3	<input type="checkbox"/>
< 200,000,000 m3	<input checked="" type="checkbox"/>
> 200,000,000 m3	<input type="checkbox"/>

FILTERABLE RESULTS

SUMMARY AND CONCLUSIONS

- The very large number of abandoned mines ensures numerous successful projects
- Sufficient data exists at the prefecture city level in Shanxi province to estimate AMM reserves at a high level of uncertainty
- Drilling boreholes into the abandoned workings to test gas pressure and production rate is necessary to reduce uncertainty to acceptable levels

SUMMARY AND CONCLUSIONS

- Geographical Information System (GIS) technology was used to build an interactive online database to aid project developers in identifying potential AMM project sites by
 - Probable methane reserves
 - Favorable access to necessary infrastructure such as the existing power grid, pipelines, roads and towns.
- The database is readily expandable

Thank You!

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