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Will China's Shale Gas Industry Achieve Its Production Goals with Subsidy Removal?

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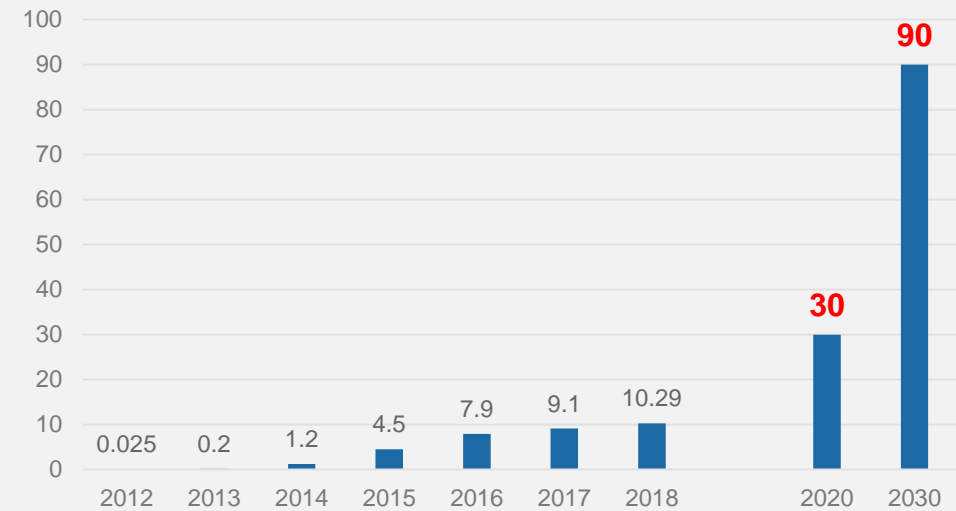
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Background

- The expectation of growing **gas demand**,
- A desire to improve **environmental impact**,
- The high **resource potential of shale gas** in China,
- The success of the **shale gas revolution** in the U.S.

China's shale gas production, bcm





Development Challenges

Limited **water** availability, Tight **funding**, Application of **technology**



Contribution

Build a better understanding of **how fiscal subsidy and tax relief will affect the production**

Caution against optimistic assumptions of a steady and robust acceleration of shale gas production



Guidelines

Introduce **social capital** and **expand the investment** in shale gas

Focus on **marine shale gas** in the middle and upper Yangtze region

Make shale gas an important part of China's natural gas supply

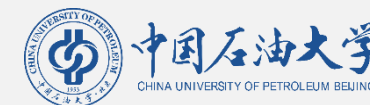


Basic Principles

Strengthen **resource exploration**, Innovate **mechanisms**, Intensify **market competition**

Strengthen **policy support**, focus on **ecological protection**

Policy Environment



No.	File Published	Publishing Department	Time	Core Contents	Matching Problems
1	Notice of NEA on the establishment of 22 national energy research and development centres (National energy technology [2010] no.215)	NEA	2010	Establish national energy shale gas research and development centres, focus on the research of key technologies in shale gas development.	T
2	Notice of new mineral discoveries (no. 30, 2011)	MLR	2011	Set shale gas as China's 172nd independent mineral	M
3	MLR held the first public tender for the sale of shale gas exploration rights	MLR	2011	Innovate the oil and gas resource management system, invite bids for 4 shale gas exploration rights	M
4	Catalogue of industrial guidance for foreign investment (revised in 2011) (NDRC no. 12)	NDRC, MC	2011	Encourage foreign investment into the exploration and development of unconventional natural gas resources such as shale gas (limited to joint ventures and cooperation)	M
5	Opinions on further encouraging and guiding private capital investment in land and resources (land resources development [2012] no. 100)	MLR, ACFIC	2012	Support the participation of private capital in shale gas exploration and exploitation, and protecting the legitimate rights and interests of private capital in accordance with the law	M
6	Notice on promoting advanced and applicable technologies to improve the level of saving and comprehensive utilization of mineral resources (no.154 [2012] of MLR)	MLR	2012	Focus on advanced, applicable and efficient development technologies in key areas such as shale gas	T
7	Notice on the issuance of the 12th five-year plan for natural gas development (FGD [2012] no. 3383)	NDRC	2012	1. Conduct national shale gas resource potential survey and evaluation; 2. Improve basic measures for shale gas transportation; 3. Carry out special exploration and development of shale gas; 4. Research and formulate the special plan for major equipment independence of shale gas; 5. Implement policies to encourage shale gas industry and strengthening international cooperation; 6. Pay attention to environmental protection measures, strengthening management and environmental monitoring.	T, C, M, E
8	Notice on the introduction of shale gas development and utilization subsidy policy (MF [2012] no. 847)	MF, NEA	2012	From 2012 to 2015, the subsidy standard from the central government is 0.4 yuan per cubic meter.	C
9	Notice on the issuance of shale gas development plan (2011-2015) (FGD [2012] no. 612)	NDRC, MF, MLR, NEA	2012	1. Strengthen the investigation and evaluation of shale gas resource potential; 2. Strengthen scientific and technological research; 3. Implement incentive policies for shale gas industry; 4. Strengthen supervision and pay attention to environmental protection.	T, C, M, E
10	Notice on strengthening the work related to the exploration, exploitation, supervision and administration of shale gas resources (MLR (2012) no. 159)	MLR	2012	1. Establish norms and standard systems for shale gas investigation and evaluation, exploration, exploitation and reserve estimation; 2. Strengthen technological breakthroughs in shale gas exploration and exploitation; 3. Encourage all types of social investors to enter the market according to law; 4. Encourage the exploration and exploitation of shale gas in oil and natural gas blocks; 5. Strengthen supervision and implementing shale gas exploration commitment system; 6. Strengthen environmental protection and production safety according to law; 7. Shale gas mining royalties and mineral resource compensation fees shall be reduced or exempted according to law.	T, C, M, E
11	Notice on agreeing to build 46 key laboratories including natural gas hydrate (no.83 [2012] of MLR)	MLR	2012	1. Set up the key laboratory for shale gas exploration; 2. Establish the key laboratory for strategic evaluation of shale gas resources.	T
12	Measures for the management of special funds for the conservation and comprehensive utilization of mineral resources (MF [2013] no. 81)	MF, MLR	2013	Special funds for the conservation and comprehensive utilization of mineral resources are mainly used to support the comprehensive development and utilization of shale gas and other resources, and are mainly used to tackle key scientific research, formulate and promote technical standards.	T, C, M
13	Notice of bidding for shale gas exploration rights of MLR	MLR	2013	Bidding for 20 blocks of shale gas exploration rights; 2. 16 bid-winning candidates from 19 blocks were selected.	M
14	Announcement of NEA on shale gas industry policy (no. 5, 2013)	NEA	2013	1. Strengthen the supervision of shale gas development and production process, pay attention to conservation and environmental protection; 2. Encourage local enterprises to cooperate with foreign enterprises through joint ventures and cooperation; 3. Incorporate new strategic industries and increase financial support; 4. Develop the shale gas technology innovation mechanism with enterprises as the main body and the combination of production, study, research and application; 5. Attach importance to the industrial technology policy of shale gas, and accelerating the pace of independent exploration technology and localization of equipment; 6. Implement market pricing for ex-factory prices, encouraging various investors to enter the shale gas sales market, and encouraging shale gas to be used nearby and connected to the pipe network; 7. Bring shale gas into the national strategic emerging industry and increasing financial support; 8. Reduce or exempt relevant taxes and fees of mining enterprises.	T, C, M, E

Policy Environment



No.	File Published	Publishing Department	Time	Core Contents	Matching Problems
15	Government work report 2014	SC	2014	Promote the reform of energy production and consumption mode, and strengthening the exploration, exploitation and application of natural gas, coal bed methane and shale gas.	M
16	Measures for the construction and operation management of natural gas infrastructure (NDRC no. 8)	NDRC	2014	Strengthen the construction, operation and management of natural gas infrastructure, establishing and improving the national natural gas pipeline network	T, M
17	Notice of the general office of the state council on the issuance of strategic action plan for energy development (2014-2020) (SC [2014] no. 31)	SC	2014	1. Strengthen shale gas geological survey and research; 2. List shale gas as a key innovation direction and carrying out relevant major shale gas demonstration projects; 3. Implement major science and technology projects to strengthening core technologies of shale gas; Improve policies on energy taxes and fees, energy investment and industrial policies, and energy consumption.	C, T, M
18	Notice on the issuance of recommended industry standards for shale gas resources/reserves calculation and evaluation technical specification (no. 6, 2014)	MLR	2014	Technical requirements for shale gas resources/reserves classification and classification, definition, reserves calculation method and reserves evaluation are specified.	T
19	Notice on the disposal result of the expiration of the exploration period of the tendered shale gas exploration right (no. 25, 2014)	MLR	2014	1. The area of "Nanchuan block" of Sinopec will be reduced to 593.44 square kilometres; 2. The area of "Xiushan block" of Henan CBM development and utilization co., LTD is 994.15 square kilometres.	M
20	Measures for fair and open supervision of oil and gas pipeline network facilities (trial) (NEA [2014] no. 84)	NEA	2014	1. Encourage and guide private capital to enter the shale gas field, and realizing the gradual diversification of upstream and downstream market players; 2. Clarify regulatory content, promoting fair and open oil and gas pipeline network, and improving the utilization efficiency of pipeline network facilities.	M
21	Government work report 2015	SC	2015	The revolution in energy production and consumption is crucial with development and people's livelihood.	M
22	Notice on the issuance of standardized management measures and implementation rules for the energy sector (no. 52 [2009] of NEA)	NEA	2015	Approving 10 shale gas-related industry standards (NB)	T
23	Notice on fiscal subsidy policy for shale gas development and utilization (MF [2015] no. 112)	MF	2015	The central government will provide subsidies to shale gas extraction companies, 0.3 yuan per cubic meter for 2016-2018 and 0.2 yuan per cubic meter for 2019-2020.	C
24	Notice on the issuance of the 13th five-year plan for national science and technology innovation (issued by SC in 2016 (43))	SC	2016	Launch a major national science and technology project to develop key technologies and core equipment for shale gas and coal-bed methane in an economical and effective manner.	T

MLR: Ministry of Land and Resources; **NEA:** National Energy Administration; **MC:** Ministry of Commerce; **NDRC:** National Development and Reform Commission; **ACFIC:** All-China Federation of Industry and Commerce; **MF:** Ministry of Finance; **SC:** the State Council.

T: Technology; **C:** Cost; **M:** Market Activities; **E:** Environment.



Core Contents

T echnology, C ost, M arket activities and E nvironment



Deficiencies

Rigorous

Poor executive possibility

Pay limited attention to environmental issues



Purpose

We use SD model to simulate **how current incentive policies affect China's shale gas's demonstrated capacity, production, investment and enterprise profit.**



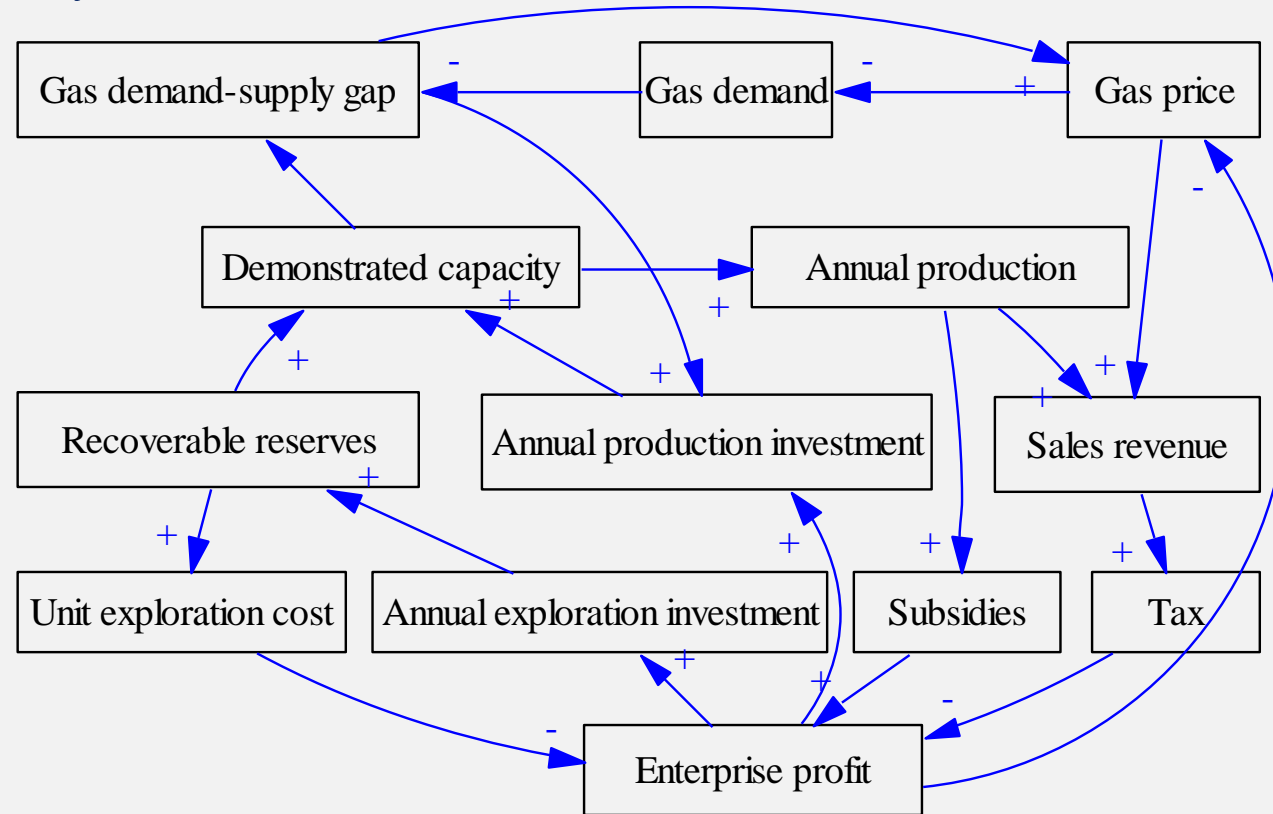
Model Assumption

The **period** of simulation realized in Vensim is from **2017 to 2030**

Current published incentive policies are as follows: a **quantitative subsidy** which is 0.3 CNY/ m³ from 2017 to 2018, 0.2 CNY/ m³ from 2019 to 2020, and **resource tax reduction**, from 6% to 4.2% between April 2018 and March 2021. We assume **both the subsidy and resource tax reduction will end in 2021.**

System Boundary

*‘gas supply and demand’,
‘shale gas exploration and development’,
‘fiscal subsidy and tax relief’, and ‘enterprise profit’*

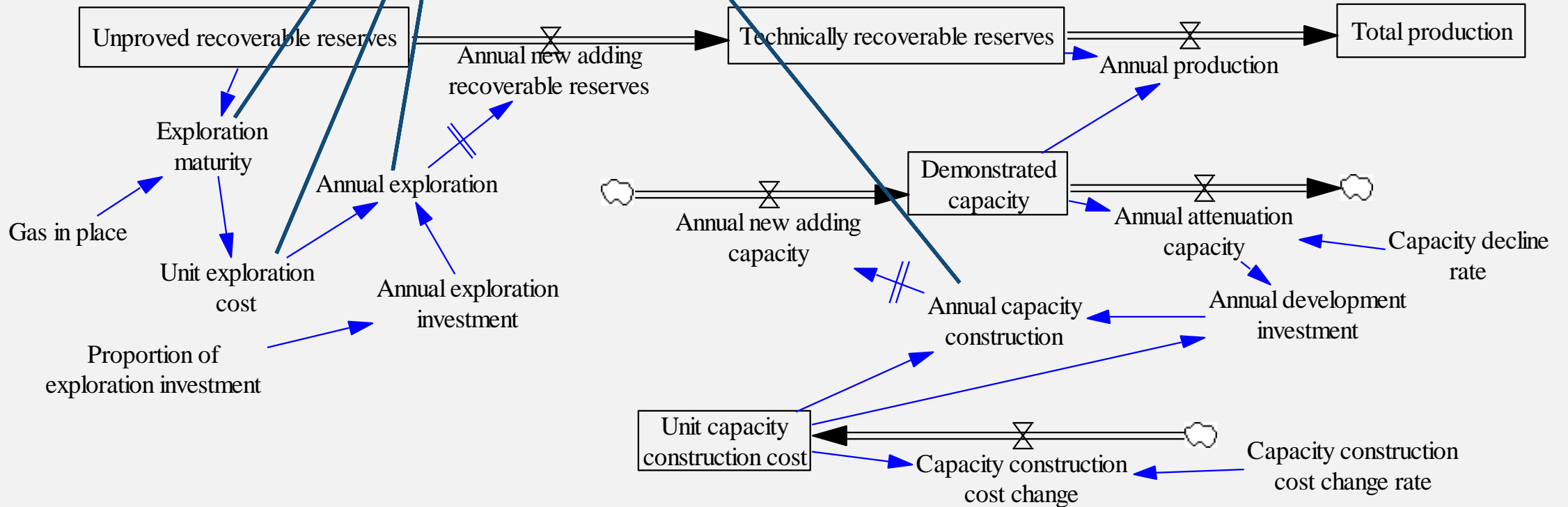


SD model



Model Structure

*Annual exploration units (Gas in place exploration development investment/Unit) (Gas in place construction cost)
Annual new adding capacity (Annual DELAY (Annual construction))*

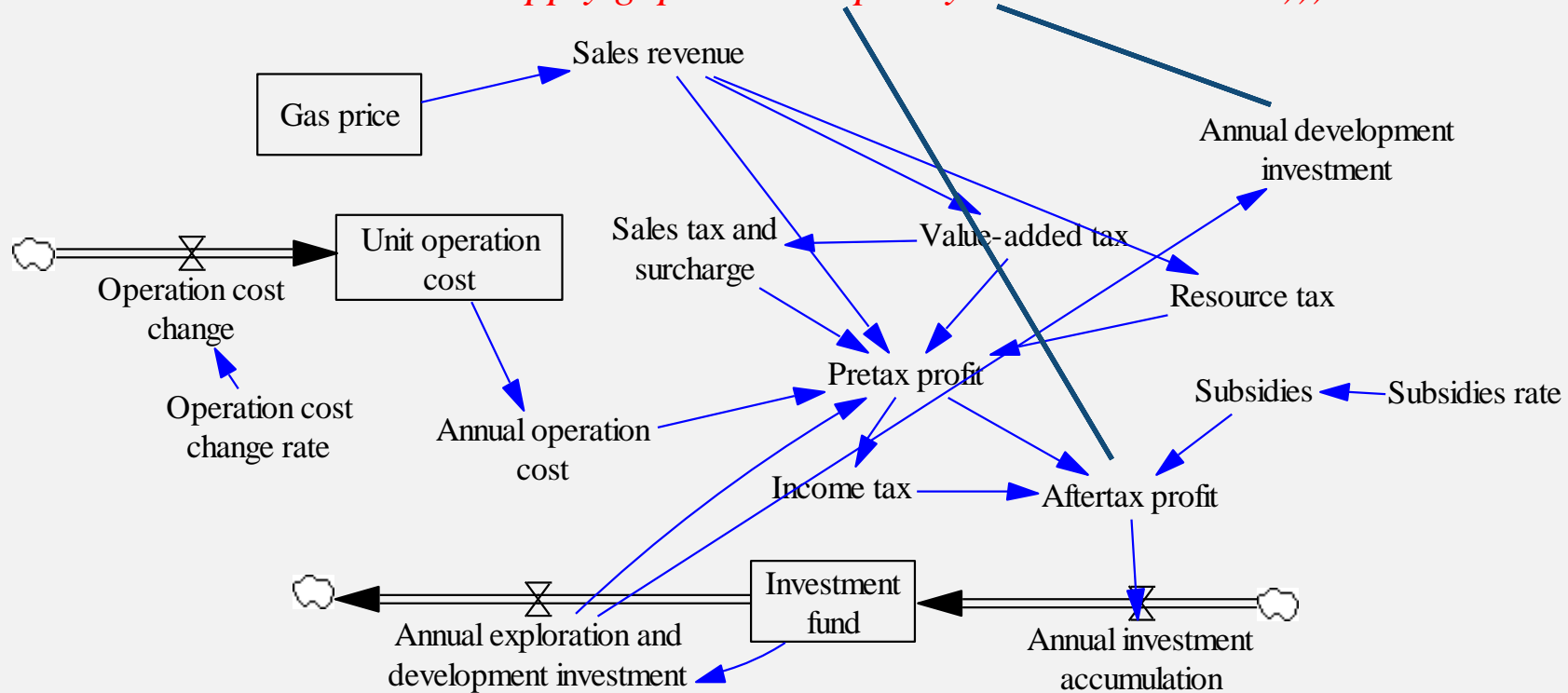


Shale gas exploration & development module



Model Structure

$Annual\ development\ investment = MIN (Annual\ exploration\ and\ development\ investment - Sales\ tax\ and\ surcharge - Resource\ tax - Value\ added\ tax - Demand\ supply\ gap > 0, MAX (Annual\ attenuation\ capacity * Unit\ capacity\ construction\ cost, After\ tax\ profit - Pre\ tax\ profit + Subsidies - Income\ tax - Demand\ supply\ gap * Unit\ capacity\ construction\ cost))$



Enterprise profit module

Model Structure

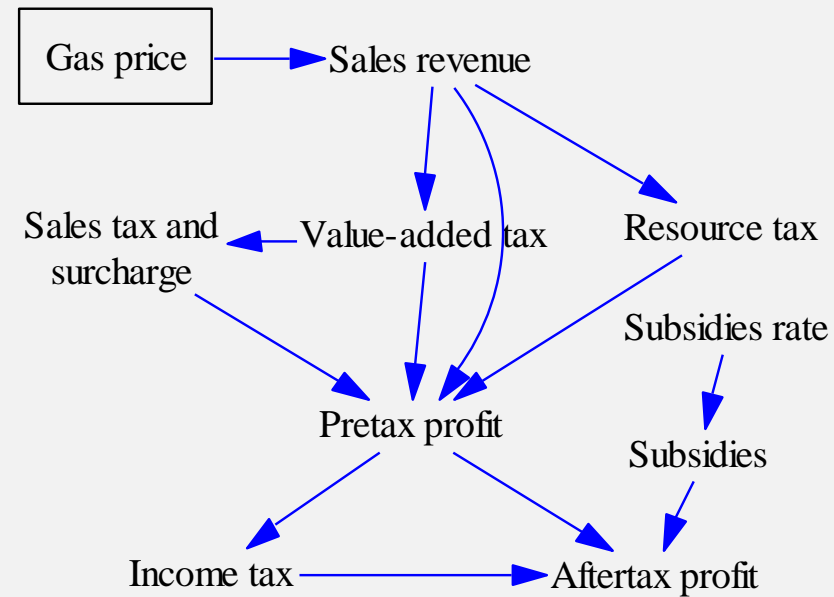
*Resource tax = Sales revenue * 0.06 * 0.7 (From 2018-2021)*

*Sales revenue * 0.06 (After 2021)*

*Value-added tax = Sales revenue * 0.16*

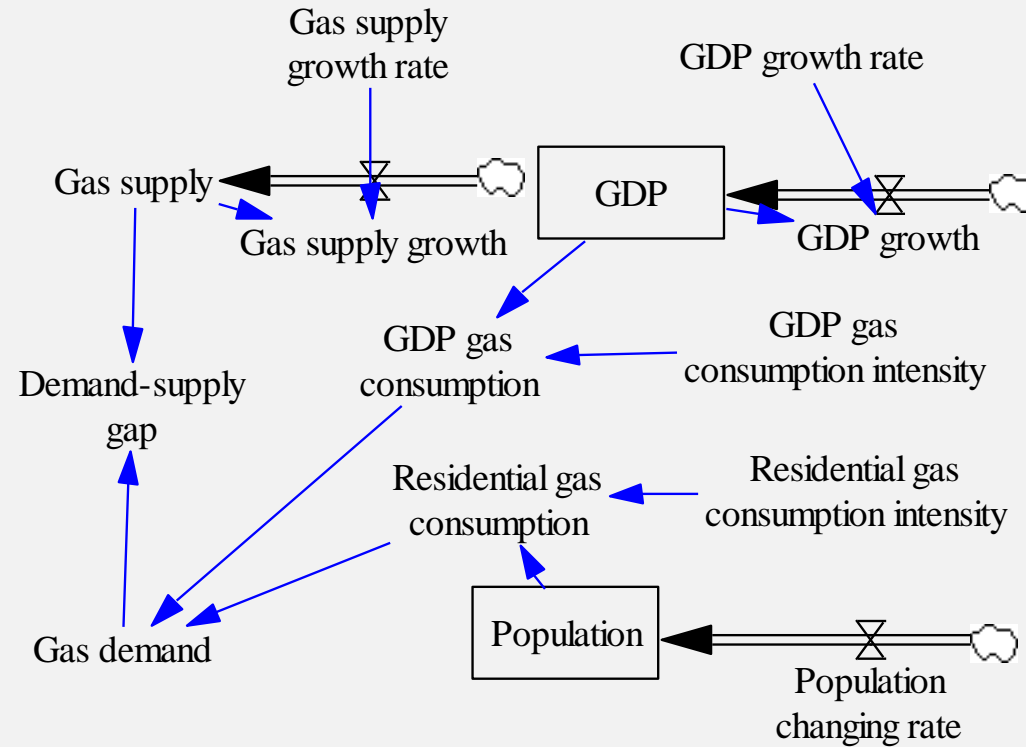
*Sales tax and surcharge = Value-added tax * (0.07 + 0.03)*

*After-tax profit = Pre-tax profit * (1 - 0.25) + subsidies*



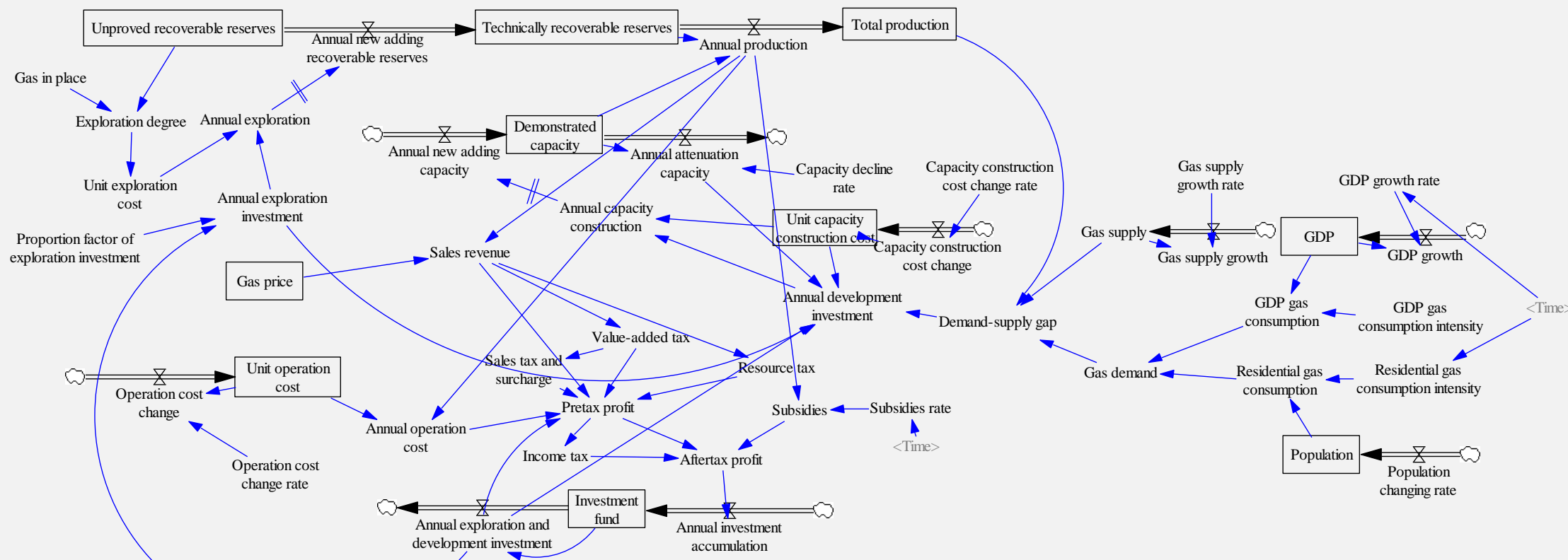
Fiscal subsidy and tax relief module

Model Structure



Gas supply and demand module

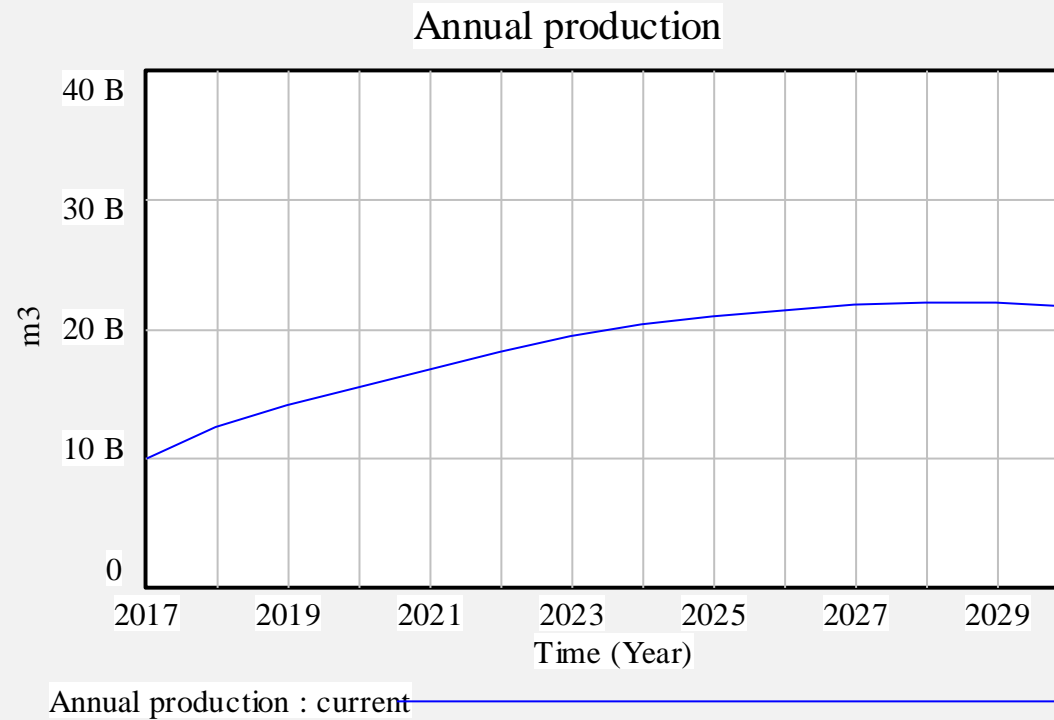
Model Structure



Flow graph of China's shale gas development system



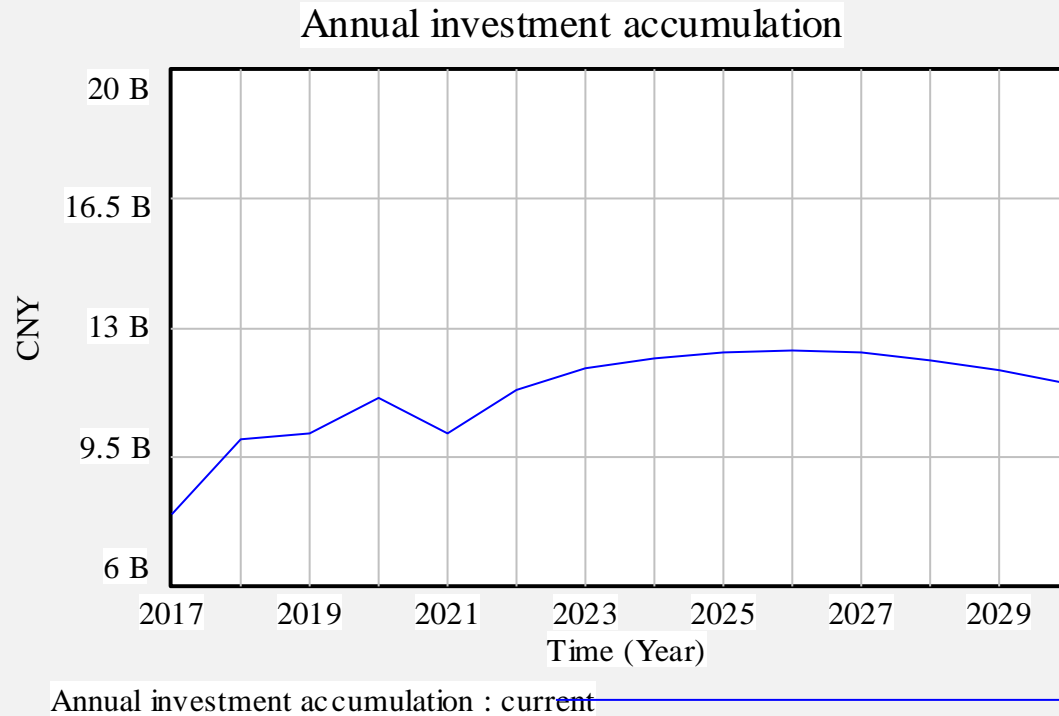
Shale Production



China's shale gas production



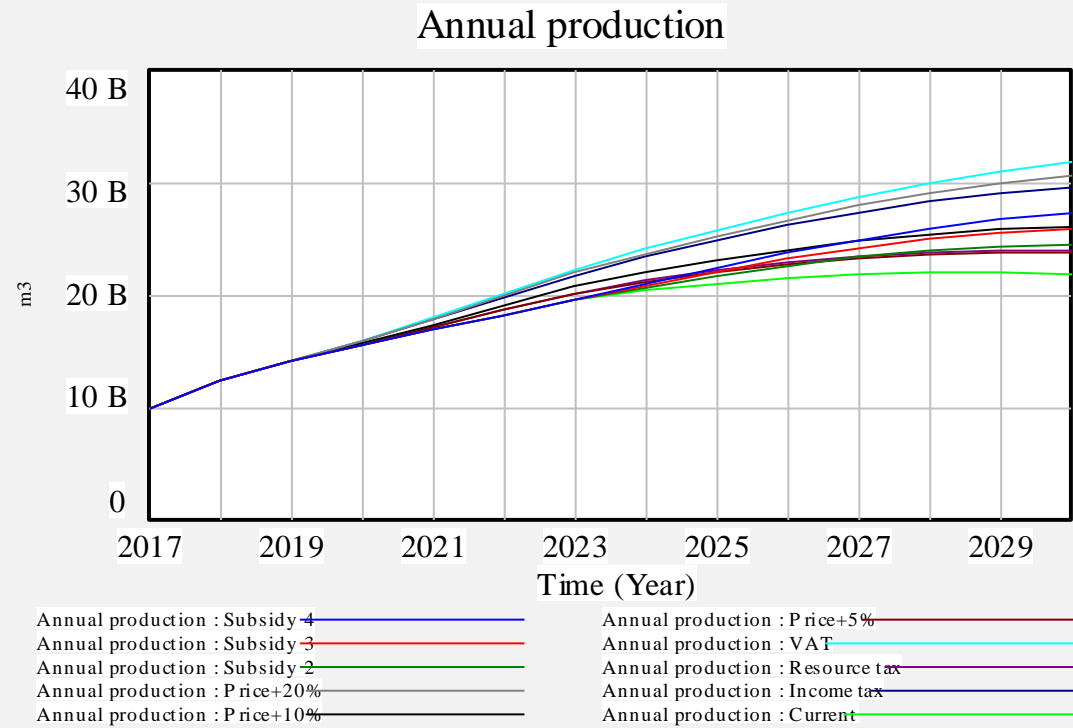
Annual Investment



Annual investment in shale gas



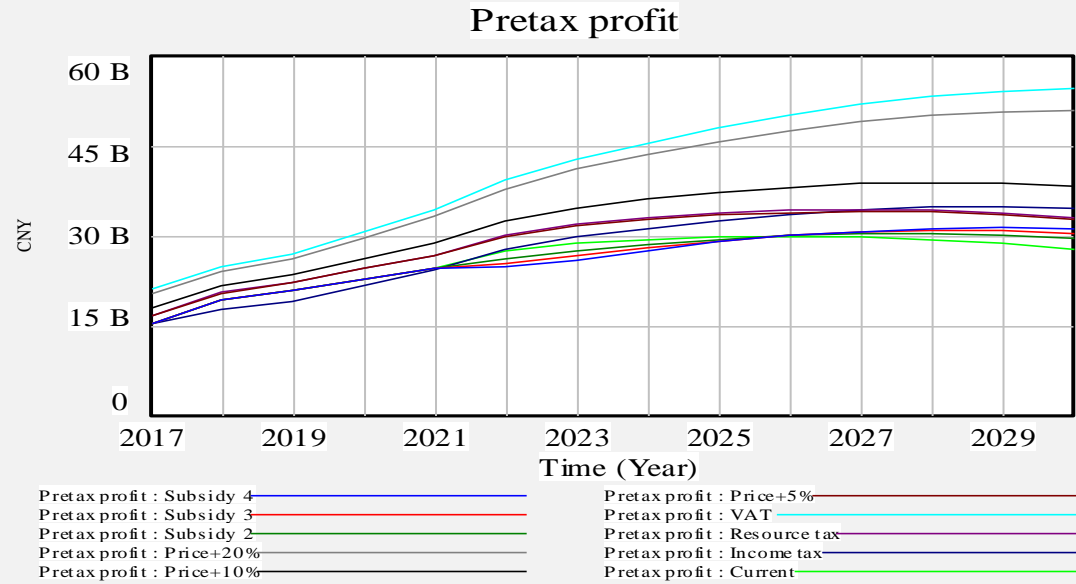
Sensitivity Analysis



Shale gas production



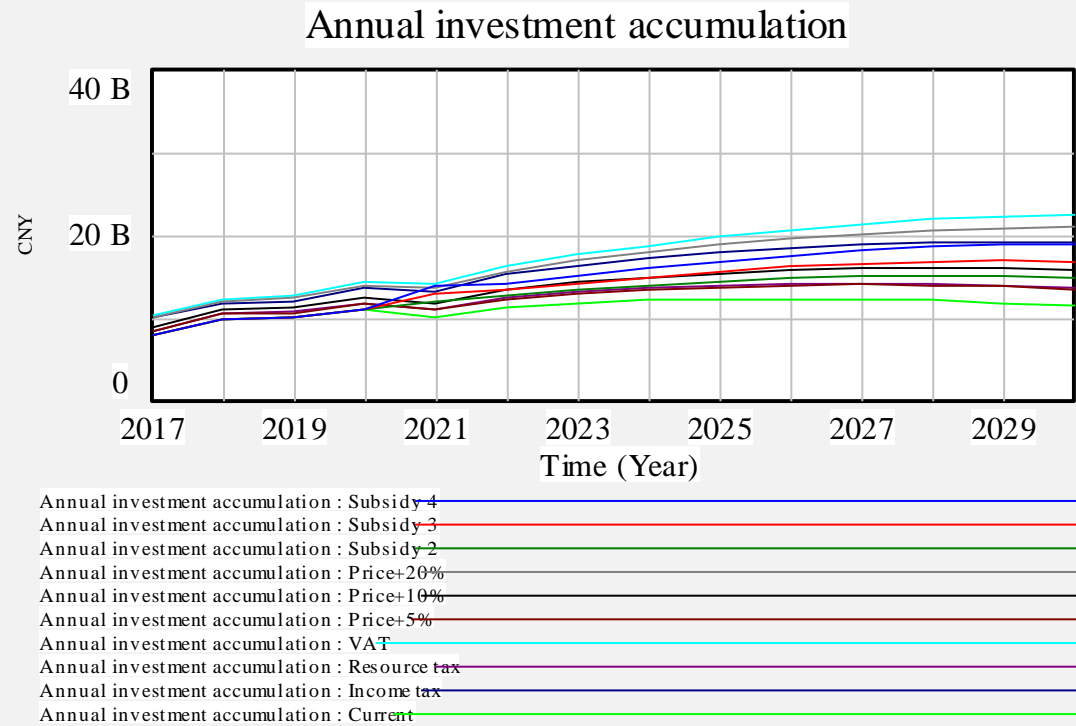
Sensitivity Analysis



Pre-tax profit



Sensitivity Analysis



Annual investment



Main Conclusions

We recommend the government **prolong policy incentives**

The “**price ceiling**” problem needs to be solved

A surge of **additional investment** for exploration and development is imperative



Further Research

Our SD model set generations of **other energies** as exogenous variables and omits

consideration of **their interactions with shale gas**



Final Note

Despite a potentially large resource base, **production and costs may vary** when further assessment is conducted in different stages of unconventional gas industry in China.

Thank You

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