



PATENTING TRENDS IN GREEN TECHNOLOGY OF GASIFICATION IN BRAZIL: A CURRENT ANALYSIS BY PATENT STATISTICS

Douglas Alves Santos

PhD Student

School of Chemistry

Federal university of Rio de Janeiro – UFRJ

E-mail: dougsaints@gmail.com

Advisors:

Maurício Bezerra de Souza Jr., DSc
Adjoint Professor
Department of Chemical Engineering
School of Chemical - UFRJ
mbsj@eq.ufrj.br

Eduardo Winter, DSc
Permanent Professor
Intellectual Property Academy
Brazilian Institute of Industrial Property -INPI
winter@inpi.gov.br

Goals

- To give an overview of the current patenting trends in the green technology of gasification in Brazil;
- To map the Brazilian gasification status, pointing out the main players and the essential sectors in the gasification technology from the chronological evolution;
- To compare the national scenario to some countries, such as China, India, Japan, The USA and South Korea, aiming to reveal the main stakeholders and technological areas involved in this sector;
- To provide subsidies for decision makers in order to promote investments in the gasification technology in Brazil;

Contextualizing over the Gasification Technology

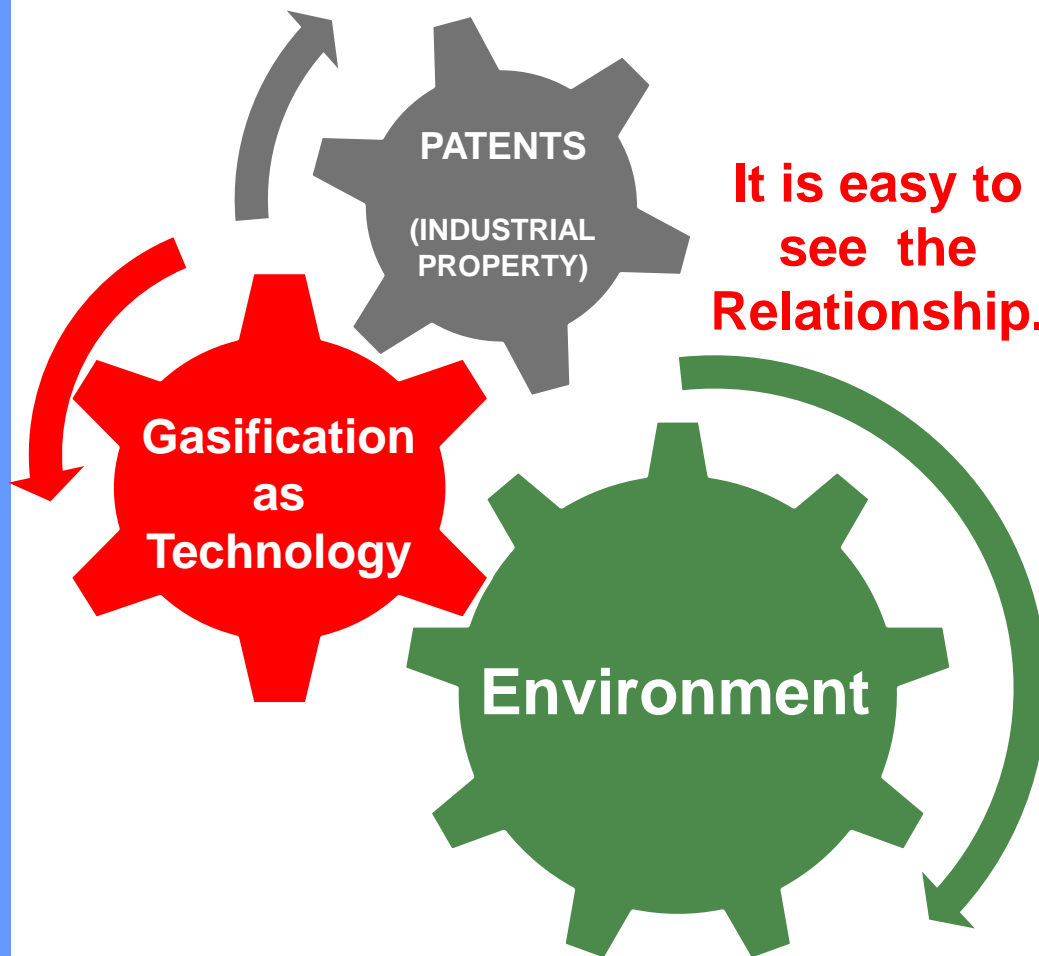
By definition, the gasification is the thermo-chemical conversion of organic mass with a limited oxygen supply into a lower calorific value gas (4–15 MJ/m³) whose main components include: CO₂, CH₄ and Syngas (CO+H₂), plus, more complex hydrocarbons and N₂.

The operating temperatures are rather high, commonly from 750 up to 1000°C. The gas that is produced is then combusted in a boiler or in combustion engines (and/or combustion turbines).

Gasification process therefore decreases the production of harmful emissions. Higher power production efficiency is achieved using gas in gas turbines and steam-gas cycles. Gasification also achieves lower heat loss and better energy production than combustion process.

If we look at the share of the energetic inputs (i.e. coal, biomass and natural gas), emerges that the gasification plant has a greater amount of energy entering as biomass, than the combustion plant, and this underline how the gasification is a more green technology.

Relations among Gasification, Environment and Patents



According to Professor Matthew Rimmer from the Australian Research Council Future Fellow: Patents as Technological IP are eligible rights in the context of Green Technology .

And considering that the Gasification fits perfectly with the principles observed in the Green Technologies concepts, since that gasification technology proves itself to be cleaner by employing fuels which are more sustainable, natural and anthropogenic. This technology still allows for the recycling of energy in a wide range of solid, liquid and gaseous compounds..



Relations among Gasification, GreenTech and Patents

- The Green Technology connects the attitude of improvement of the industrial production aiming to reduce the environmental impact. The term Green Technology refers to all "process and product technologies" that do not generate waste or has fewer reduced residues in order to avoid environmental contamination (Agenda 21, 1995);

In this scenario are included all forms of renewable energy, namely:

- (i) tidal and wave;
- (ii) hydraulic energy;
- (iii) wind power;
- (iv) solar energy;
- (v) geothermal energy;
- (vi) biofuels; and
- (vii) thermal energy generation from carbonaceous material (pyrolysis and gasification).

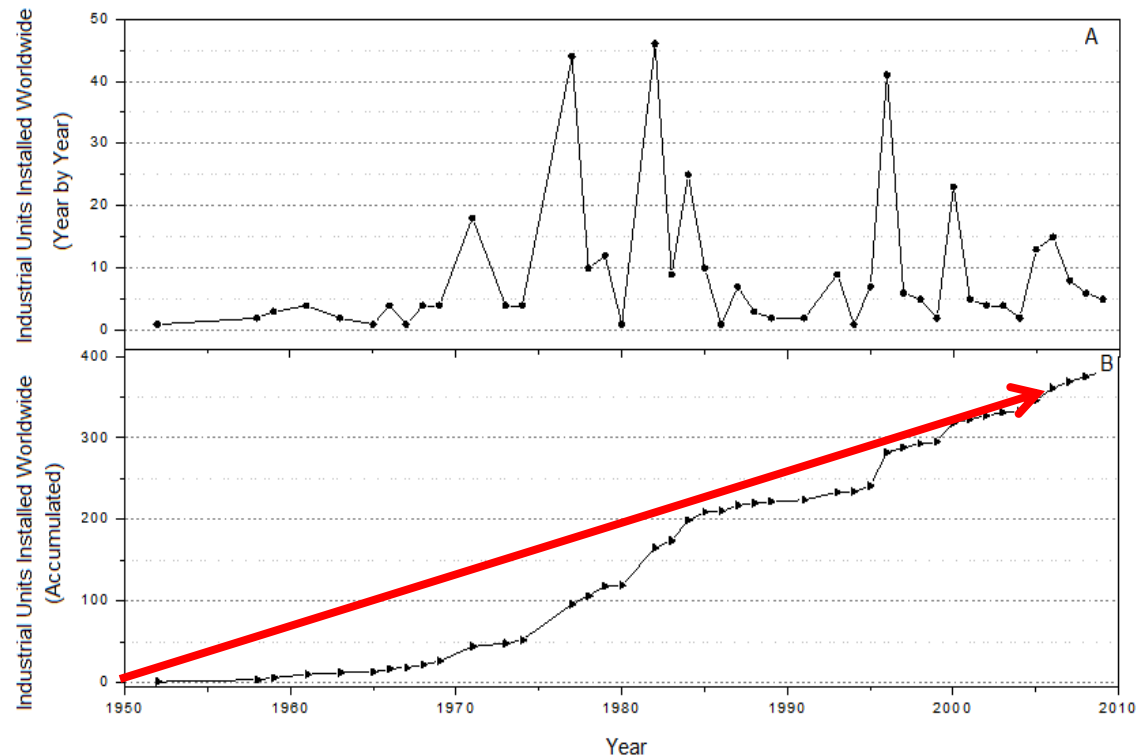


Global Interest over the Gasification Technology

An Worldwide Gasification Database (WGD) was created in 1999 by NETL (National Energy Technology Laboratory), and, the WGD was updated in 2010.

In 2010, a survey was launched that pointed out that the world had improved its capacity in gasification processes from 45.0 MWth (in 2004) to 56.2 MWth (in 2007), and finally to 70.8 MWth thermal equivalent of syngas (in 2010). This latter amount was generated from 144 plants in operation worldwide, employing a total of 412 gasifiers.

Approximately 15 new gasification plants started up their operations: (i) 11 units are designed for production of chemicals; (ii) 02 (two) units are reserved for energy generation, whereas; and, (iii) 02 (two) plants employ the Fischer-Tropsh synthesis route to produce liquid fuels.



Considerations about the Interest on Gasification Technology in Brazil

1. In the Brazilian case, which has its energy matrix heavily based in green technologies and renewable energy sources, e.g., hydro and biofuels, there is a comfort zone that generates a false sense of energy security (SCHAEFFER et al, 2008).
2. These **renewable energy sources** are less polluting than the traditional energy sources (e.g. incineration or combustion); on the other hand, these **sources are extremely dependent on weather conditions, potentially liable to the same impacts from the phenomenon (the climate change), which seeking to avoid the problem, falls victim to the remedy.**

If green technologies are effectively adopted focusing on climate interference and greenhouse gases mitigation, which might reconcile cleaner energy production without influence of the climate changes. There is just one option for this:

The GASIFICATION of carbonaceous materials.

Approach via Patent Documentation: Statistic Relevance

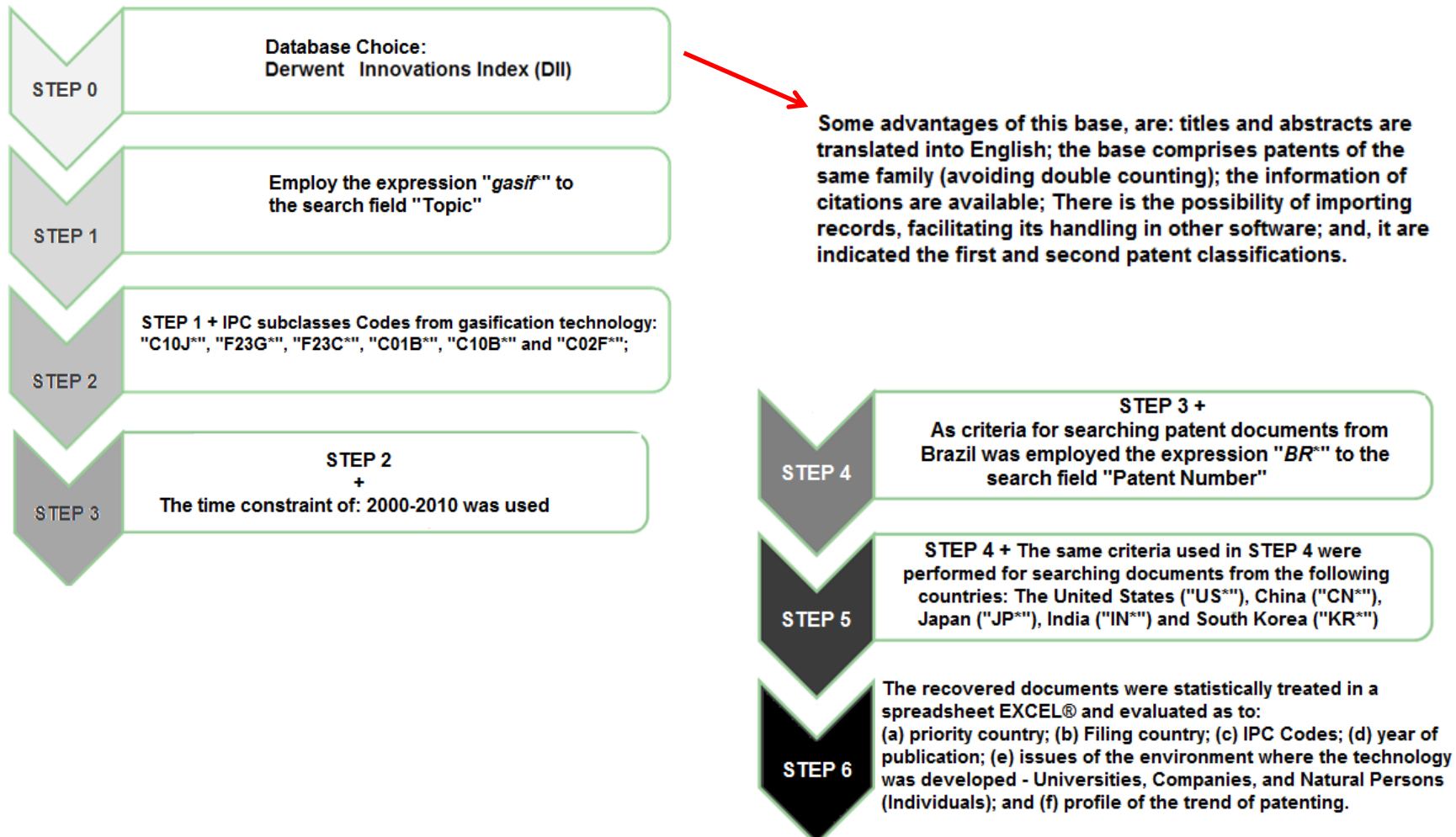
- Each publication of a patent document could be the base for new technical developments by other inventors. Without publication there would be no chance for the public to get information about new technical developments;
- Patent documents contain descriptions of scientific and technical concepts as well as practical details of processes and apparatus. Patents generally disclose technological information by describing the inventions in accordance with the requirements of the applicable patent law and by indicating the claimed novelty and inventiveness by reference to the existing state-of-the-art;
- According to recent WIPO statistics, the number of patent applications filed each year in the world is nearly one and a half million.
- The practice has shown that information contained in patent documents can be very useful, for example, to: (i) identify alternative technology and its sources; (ii) identify existing or prospective industrial property rights (ownership, etc...), particularly to avoid infringement actions; (iii) monitor activities of competitors both within the country and abroad; and (iv) identify a market niche or to discover new trends in technology or product development at an early stage.



METHODOLOGY



Methodology



RESULTS

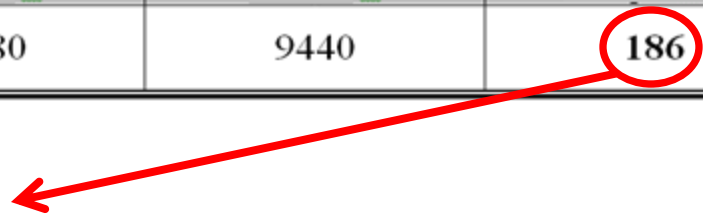
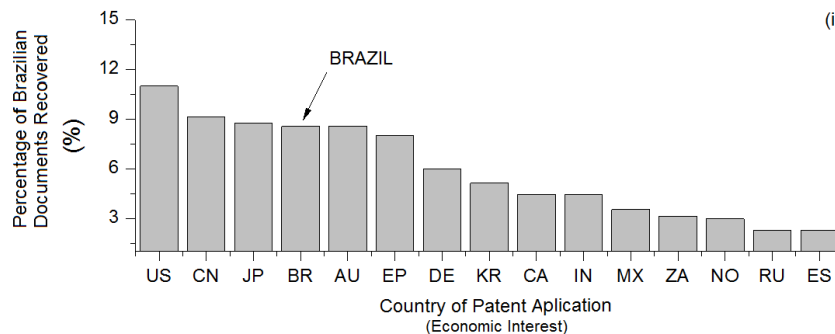


Comparative Line: Mundial Scenario versus Brazilian Scenario

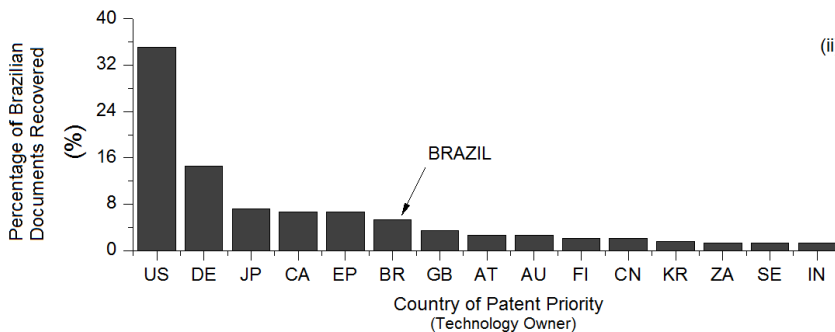
Applying the Methodology



STEPS	STEP 1	STEP 3	STEP 4	STEP 5 (*)
Recovered Documents	25400	12680	9440	186



US, CN, JP, BR, IN, KR (6 countries) represent 47% of All

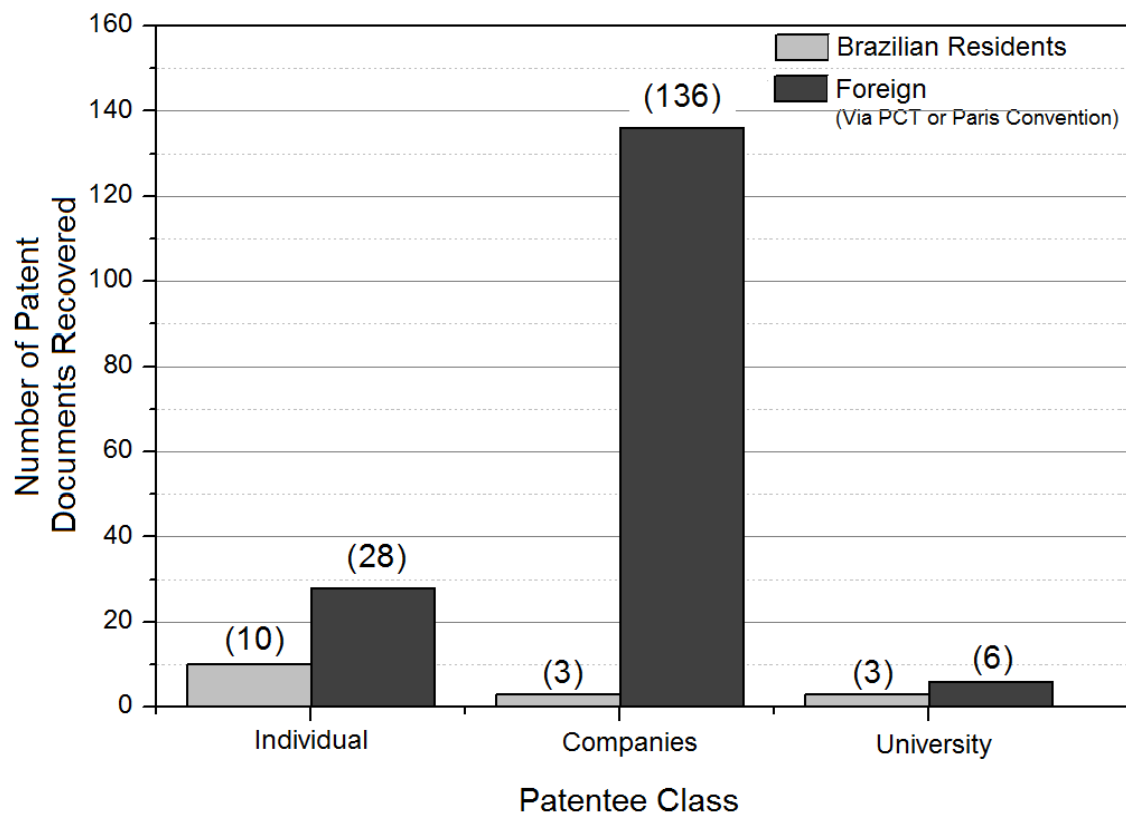


34 other countries represent 53% of All



Comparative Line: Mundial Scenario versus Brazilian Scenario

**PROFILE OF INTEREST
IN GASIFICATION
BETWEEN 2000/2010
(PATENTEE CLASS)**





Comparative Line: Mundial Scenario versus Brazilian Scenario

Year	Brazil (BR)	USA (U.S.)	Japan (JP)	China (CN)	India (IN)	South Korea (KR)	Sum ⁽¹⁾ (BR + U.S. + JP + CN + IN + KR)	World ⁽²⁾	Differential ⁽²⁾
2000	20	39	142	26	10	15	240	211	29
2001	21	43	156	35	12	15	275	257	18
2002	6	48	245	37	6	20	369	333	36
2003	6	72	280	69	15	19	462	426	36
2004	17	56	260	50	13	22	406	390	16
2005	24	60	205	86	17	19	398	346	52
2006	24	64	190	84	34	23	407	341	66
2007	26	109	176	154	37	34	527	389	138
2008	23	179	221	526	64	44	1046	861	185
2009	26	254	193	767	64	61	1345	1195	150
2010	27	227	160	948	46	81	1465	1308	157

Referring to Sum data (BR + U.S. + JP + CN + IN + KR);

Search criteria: "gasif*" + ("C10J*" and "F23C*" and "F23G*" and "C01B*" and "C01C*" and "C01D*" and "C01F*" and "C01G*" and "C01H*" and "C01J*" and "C01K*" and "C01L*" and "C01M*" and "C01N*" and "C01P*" and "C01Q*" and "C01R*" and "C01S*" and "C01T*" and "C01U*" and "C01V*" and "C01W*" and "C01X*" and "C01Y*" and "C01Z*" and "C01AA*" and "C01AB*" and "C01AC*" and "C01AD*" and "C01AE*" and "C01AF*" and "C01AG*" and "C01AH*" and "C01AI*" and "C01AJ*" and "C01AK*" and "C01AL*" and "C01AM*" and "C01AN*" and "C01AO*" and "C01AP*" and "C01AQ*" and "C01AR*" and "C01AS*" and "C01AT*" and "C01AU*" and "C01AV*" and "C01AW*" and "C01AX*" and "C01AY*" and "C01AZ*" and "C01BA*" and "C01BB*" and "C01BC*" and "C01BD*" and "C01BE*" and "C01BF*" and "C01BG*" and "C01BH*" and "C01BI*" and "C01BJ*" and "C01BK*" and "C01BL*" and "C01BM*" and "C01BN*" and "C01BO*" and "C01BP*" and "C01BQ*" and "C01BR*" and "C01BS*" and "C01BT*" and "C01BU*" and "C01BV*" and "C01BW*" and "C01BX*" and "C01BY*" and "C01BZ*" 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and "C01ZT*" and "C01ZU*" and "C01ZV*" and "C01ZW*" and "C01ZX*" and "C01ZY*" and "C01ZZ*"

Differential between: Sum⁽¹⁾ World⁽²⁾.

Increased interest
protection in several
countries

Source: By Authors
Database: Derwent Innovations Index

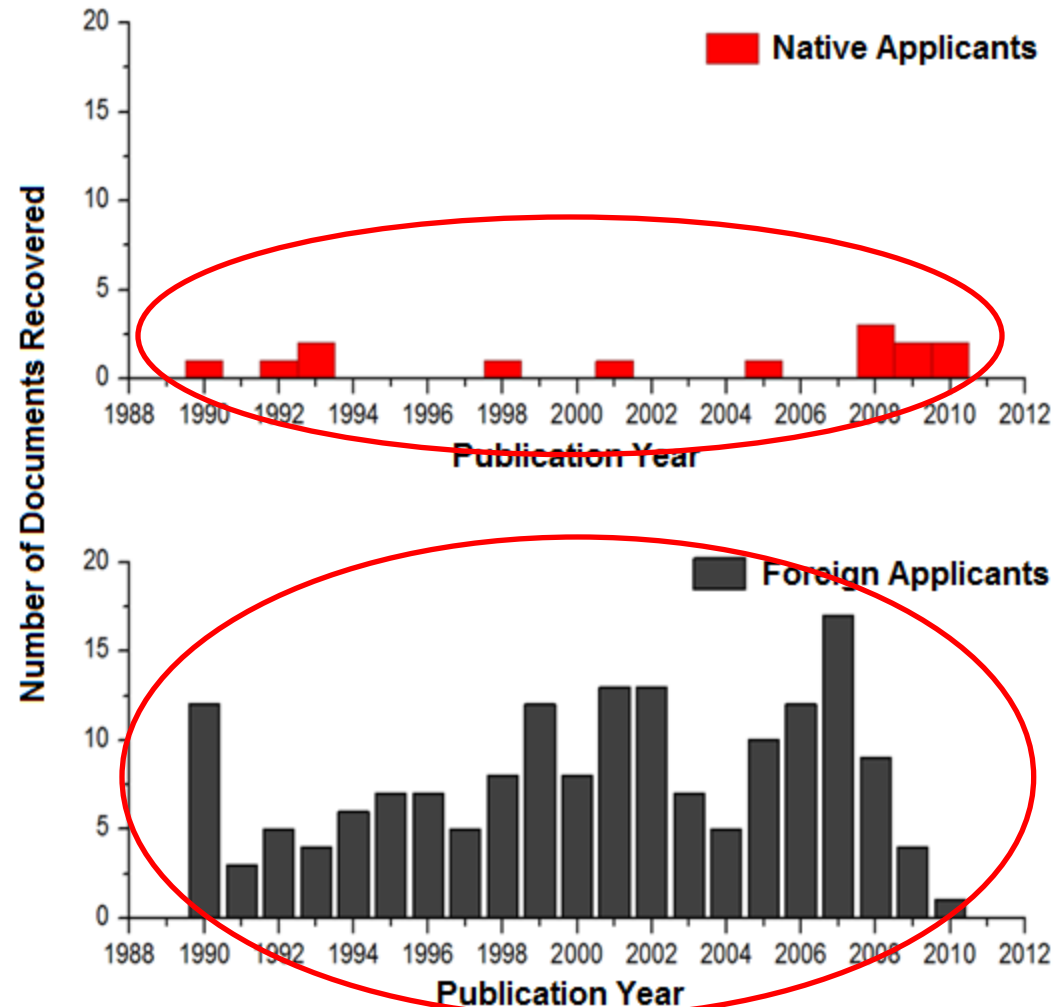
Comparative Line: Mundial Scenario versus Brazilian Scenario

- it is noted that all countries seem to be doing pretty well in respect to the development of the gasification technology in their own territories. Brazil is an exception. One realizes that Brazil does not appear very interested in the issue of patent protection for gasification.
- Still under the same prism - increasing development in technology around the world - highlights the behavior of India (IN), South Korea (KR), United States (U.S.) and China (CN). Moreover, both countries ended the year 2010 in a frantic race seeking patent protection for gasification technology. For example: India (IN), South Korea (KR), United States (U.S.) and China (CN), respectively increased: 360% (IN), 440% (KR), 482% (U.S.) and 3546% (CN);
- In Brazil, the interest decreased in the last years: **-62,5% (BR)** .



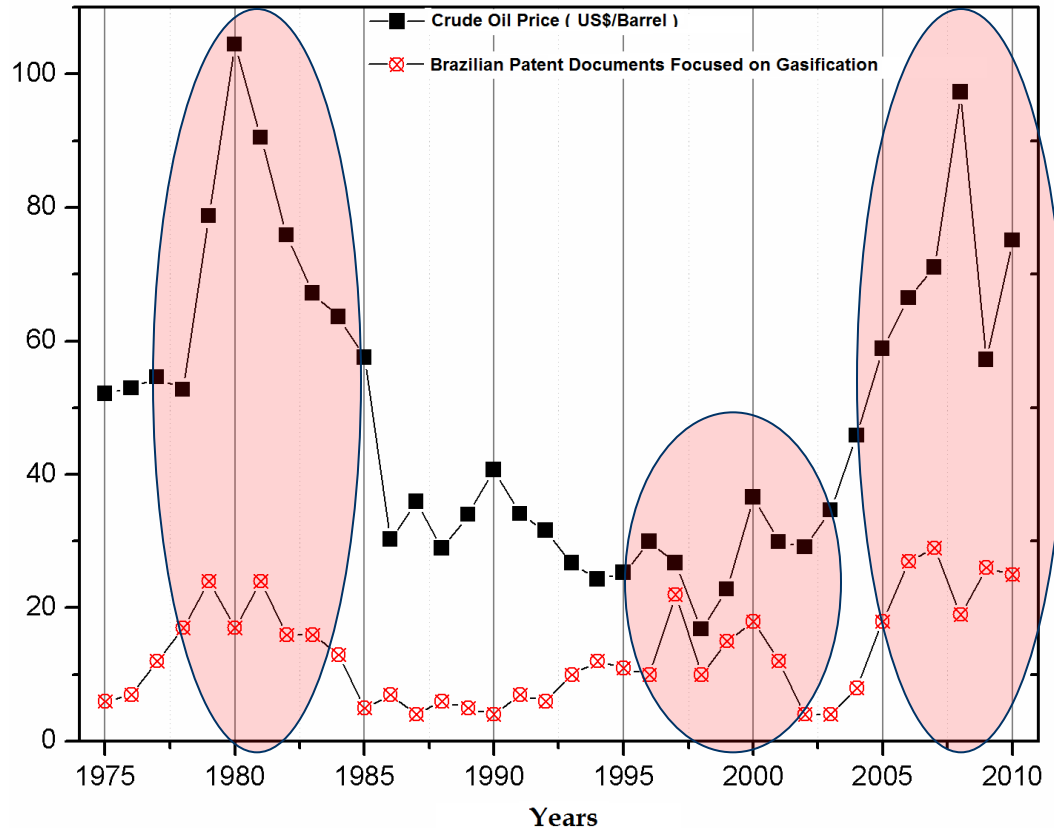
The Brazilian Scenario

Profile of Temporal
Distribution of Interest
on Patenting of
Gasification
Technologies in Brazil
(1990-2010)





The Brazilian Scenario



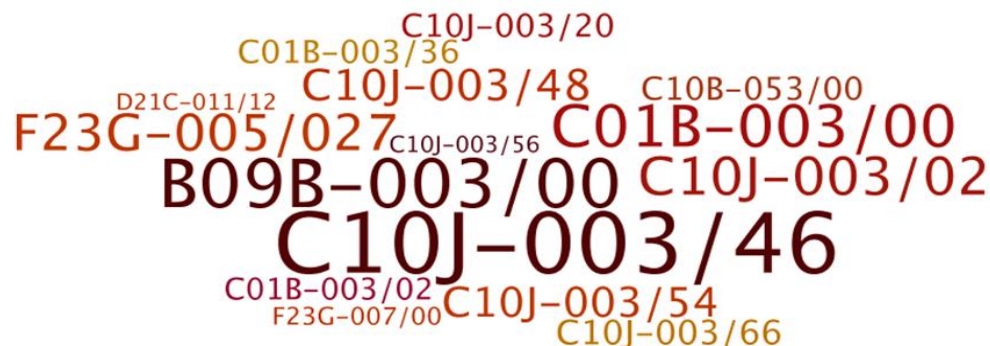
- we can see that there really is some correlation between the price of oil raises and increased interest of protecting gasification technology through patents.
- From this analysis and looking at the data, it can be understood that Brazil is indeed an attractive market for foreign companies wishing to invest in gasification technology, and in addition, that this interest increases as the price of a barrel of oil rises.

Profile Comparison between the Fluctuations in the Price of Oil in face of the Exogenous Patent Filings about Gasification in Brazil



The Brazilian Scenario

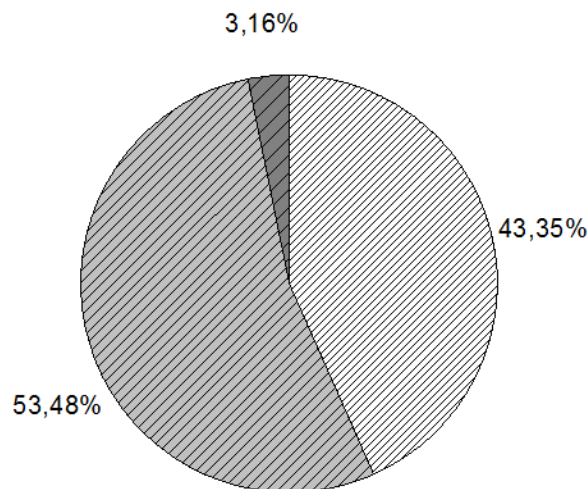
Wordle of "IPC CODES" obtained
Documents patent recovered
for 2000-2010



- From the clusters identification and aiming at selecting the most relevant technological groups, the IPCs were arranged in ascending order of hierarchy, in hierarchical order. So, the bigger the symbol (IPC) the more important it is;
- The main groups are identified: (a) **C10J-003/46**; (b) **B09B-003/00**; (c) **C01B-003/00**; (d) **F23G-005/027**; (e) **C10J-003/02**. These IPCs represent respectively the following technological areas: (a') **Production of combustible gases containing carbon monoxide from solid carbonaceous fuels - Gasification of granular or pulverulent fuels in suspension**; (b') **Destroying solid waste or transforming solid waste into something useful or harmless**; (c') **Hydrogen Production**; (d') **Methods or apparatus, e.g. incinerators, specially adapted for combustion of waste or low-grade fuels - pyrolising or gasifying**; (e') **Production of combustible gases containing carbon monoxide from solid carbonaceous fuels**.

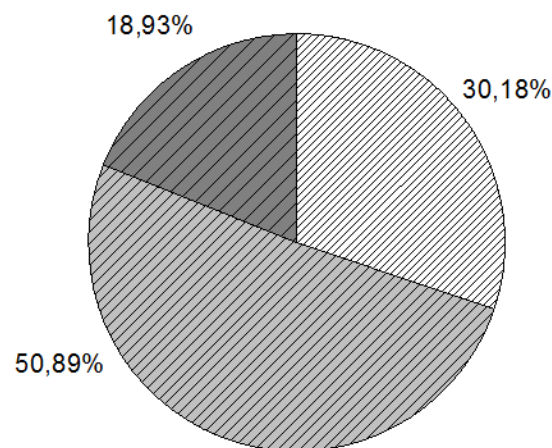


The Brazilian Scenario



Technological Focus

Equipment Process Product



Raw Materials Focus

Biomass Coal/Coke Others

- ✓ Focus on Equipment:
 - 1° Reactor/Gasifier;
 - 2° Chamber, cleaner, etc.

- ✓ Focus on Operational Conditions:
 - 1° Temperature;
 - 2° Gasifier Agent (steam, oxygen, air, etc.);
 - 3° Hydrodynamic Condition
 - 4° Pressure

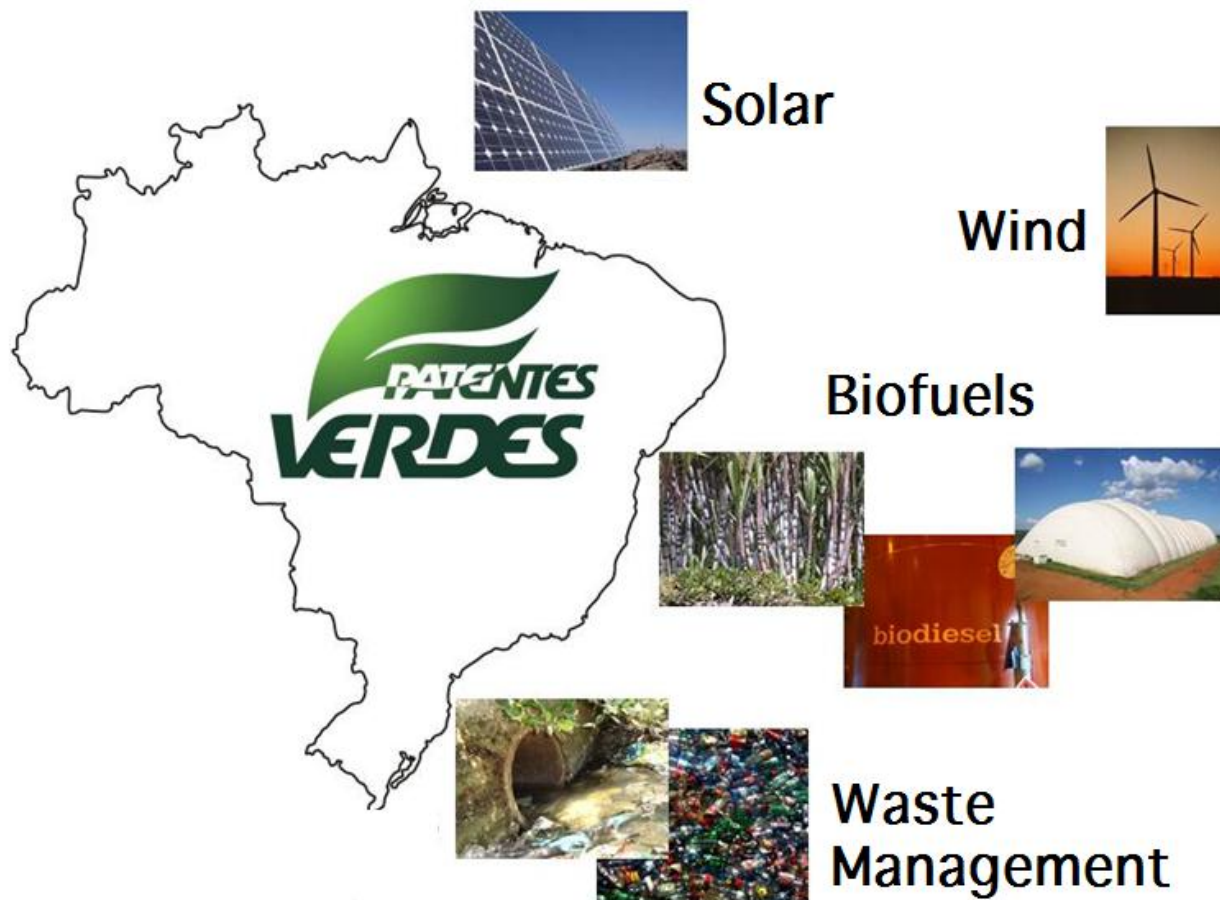
- ✓ Focus on Product:
 - 1° Energy Generation;
 - 2° Syngas (H₂+CO) Production;

- ✓ Focus on Raw Materials:
 - 1° Mineral Coal;
 - 2° Biomasses (residues, wood, etc.)



Alternative Route for Protecting Green Technologies in the Brazilian Scenario

The Brazilian Green Patent Pilot Program



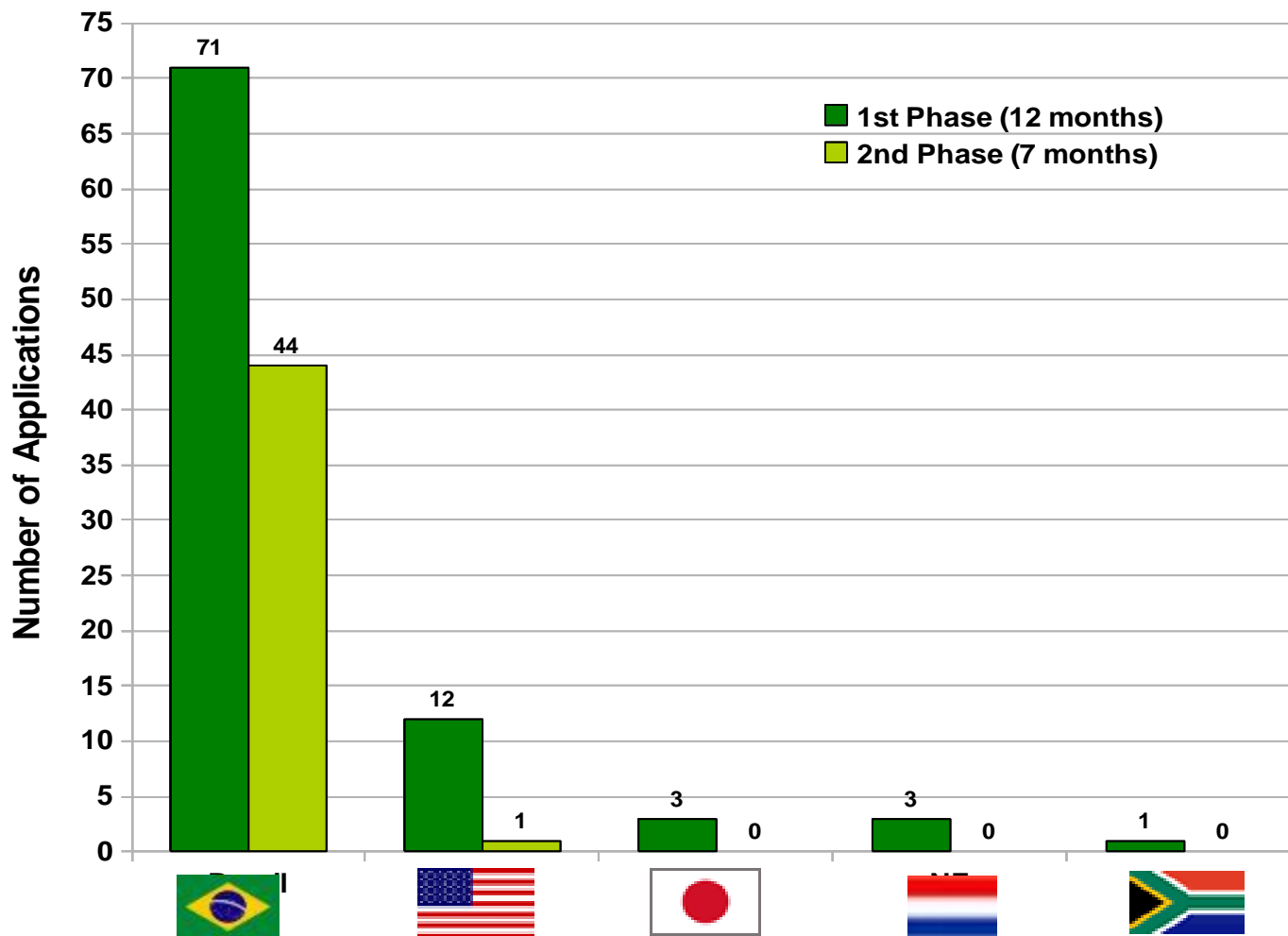
Alternative Route for Protecting Green Technologies in the Brazilian Scenario

Second Phase

- The Second Phase started on April, 2013
- Expected end: April, 2014;
- 100 applications expressed interest in participating of Green Patent Pilot Program*;
- 8 non-granted in Pilot Program;
- 6 applications granted;
- 1 granted patents in about 3 months from request for entering the Green Patent Pilot Program;
- 1 request about GASIFICATION was granted in 9 months.



Alternative Route for Protecting Green Technologies in the Brazilian Scenario



PATENTING TRENDS IN GREEN TECHNOLOGY OF GASIFICATION IN BRAZIL

CONCLUSION (Warning)

1. It is possible to have a clear perception that Brazil experienced a great lack of commitment to acting on gasification in the last decade;
2. The level of patent applications by national stakeholders is very low.
3. On the prism of the Industrial Property Law is inevitably understood that the absence of deposits in the technology sector might drive Brazil to the fateful end of technological dependence;
4. In order to achieve consolidation of the gasification technology in Brazil, an urgent intervention in the sector is mandatory;
5. More specifically in China and Japan, we have seen that the gasification has been considered a strategic technology for both energy generation as in chemical production;
6. In the end, it is expected that this work be tapped for sharpening the curiosity of Brazilian decision makers, and also might provide insights for stimulating technological development and encourage innovation in a very strategic sector such as the green technology for gasification in Brazil.
7. While this does not occur, unfortunately, Brazil remains dependent on foreign technology for the gasification industry.