ISO/TC 197 Business Plan template
Drafting Instructions -- Introductory Information

Main objective of a TC Business Plan

The main objective of a Business Plan (BP) of a technical committee is to provide a concise and up-to-date overview in a user-friendly format for interested stakeholders from within and outside the committee of important business, technological, environmental and social trends in the field addressed by the work of the ISO committee. The BP shall provide an analysis of these trends as well as an explanation of the linkages between them and the priority areas in the standards development work of the committee.

The BP of a TC covers the activities of any subcommittees under the TC. Each active TC is required to prepare and maintain its own BP.

The types of stakeholders of a committee addressed by a BP are

- the management layer of organizations and companies making a contribution to standardization
- standards developers and standards developing organizations
- regulators
- users of standards
- the interested public.

The BP contains information which needs to be keyed into this BP template as indicated in the relevant **Drafting Instructions**. Other information (e.g. regarding the work programme and project target dates, the list of published standards, the committee structure etc.) is included dynamically via hyperlinks from the BP template to committee-specific information available from ISO's main website *ISO Online*. The target dates of the following project stages will be accessible:

- Technical enquiry (DIS) [stage 40.00]
- Approval (FDIS) [stage 50.00]
- Publication [stage 60.60]

To ensure that the information accessible through the BPs is current and therefore reliable, it is of utmost importance that the ISO committees provide up-to-date information to the ISO Central Secretariat on their work programme, the target dates of their projects and the structure of the committees.

Committees can include in their BP in addition to the hyperlinks pointing to sections on *ISO Online* hyperlinks to own databases with more detailed project information.

BPs of newly established TCs

Newly established technical committees are required to prepare a BP within 18 months after their provisional establishment, in parallel with their standards development work. The BP of a new TC will be reviewed and approved by the Technical Management Board (TMB).

Legend:
Pink: Drafting instructions for which P-members of ISO/TC 197 should pay special attention.
Blue: Text extracted from the latest version of the ISO/TC 197 Business plan that the Secretary and Chairman of ISO/TC 197 consider still relevant
Yellow: Text extracted from the latest version of the ISO/TC 197 Business plan that needs to be updated.
Text in red: Note to the P-members of ISO/TC 197

Maintenance of existing BPs
The BP of a technical committee shall be reviewed by the TC at each plenary meeting and preferably once per year. The review may result in the reconfirmation or the revision of a BP. An approval is not required by the TMB.

Approval of new or revised BPs
The approval of new or revised BPs shall normally be by consensus, but requires as a minimum support by a simple majority of the P-members casting a vote. New or revised BPs shall be submitted to the secretariat of the Technical Management Board (e-mail: tmb@iso.org) in revisable (i.e. Word) and PDF-format for appropriate follow up.

All approved BPs will be made available by the ISO Central Secretariat on a publicly accessible area of an ISO server for public review, comment and information. The site includes an e-mail link to the committee secretariat. This allows any interested party to provide responses to the committee regarding its BP.

Drafting Instructions
Please do not change or delete any unshaded headings or text in the remainder of this document. This is intended to provide all ISO/TC BPs with consistent structure, headings and introductory text for readers and users.

Please do not delete or modify any hyperlinks contained in the BPs.

Consider including graphical elements to represent market structures, information on trade or the structure of the committee.

Delete all shaded boxes with "Drafting Instructions" throughout this document when you have completed developing the BP.

Drafting Instructions
- Open the Header and enter the correct ISO/TC number for your committee.
- The date on which this version of the document was last saved will be added automatically.
- Enter the version of the document. Indicate "Draft" and the number of the draft version if the document is in a draft stage, or indicate "Approved BP" if the document has received its final approval from the ISO/TMB.
- The page numbers for this version will be added automatically.
- Close the Header above to register the changes you have made.
- Enter the correct number and title of your ISO/TC below.

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BUSINESS PLAN
ISO/TC 197
Hydrogen technologies

EXECUTIVE SUMMARY

Drafting Instructions
The executive summary shall contain a concise description of

- the main fields and the overall size of the markets addressed by the committee (i.e. the committee's environment)
- the benefits already realized and/or expected through the availability of the standards
- the main objectives and priorities in the work of the committee

This section shall normally not exceed one page.

This section is to be drafted by the ISO/TC 197 Secretariat and Chairman, once the input from all P-members are received. Should P-members be willing to input into this section, they are welcome.

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1 INTRODUCTION

1.1 ISO technical committees and business planning

The extension of formal business planning to ISO Technical Committees (ISO/TCs) is an important measure which forms part of a major review of business. The aim is to align the ISO work programme with expressed business environment needs and trends and to allow ISO/TCs to prioritize among different projects, to identify the benefits expected from the availability of International Standards, and to ensure adequate resources for projects throughout their development.

1.2 International standardization and the role of ISO

The foremost aim of international standardization is to facilitate the exchange of goods and services through the elimination of technical barriers to trade.

Three bodies are responsible for the planning, development and adoption of International Standards: ISO (International Organization for Standardization) is responsible for all sectors excluding Electrotechnical, which is the responsibility of IEC (International Electrotechnical Committee), and most of the Telecommunications Technologies, which are largely the responsibility of ITU (International Telecommunication Union).

ISO is a legal association, the members of which are the National Standards Bodies (NSBs) of some 140 countries (organizations representing social and economic interests at the international level), supported by a Central Secretariat based in Geneva, Switzerland.

The principal deliverable of ISO is the International Standard.

An International Standard embodies the essential principles of global openness and transparency, consensus and technical coherence. These are safeguarded through its development in an ISO Technical Committee (ISO/TC), representative of all interested parties, supported by a public comment phase (the ISO Technical Enquiry). ISO and its Technical Committees are also able to offer the ISO Technical Specification (ISO/TS), the ISO Public Available Specification (ISO/PAS) and the ISO Technical Report (ISO/TR) as solutions to market needs. These ISO products represent lower levels of consensus and have therefore not the same status as an International Standard.

ISO offers also the International Workshop Agreement (IWA) as a deliverable which aims to bridge the gap between the activities of consortia and the formal process of standardization represented by ISO and its national members. An important distinction is that the IWA is developed by ISO workshops and fora, comprising only participants with direct interest, and so it is not accorded the status of an International Standard.

2 BUSINESS ENVIRONMENT OF THE ISO/TC

2.1 Description of the Business Environment

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The following political, economic, technical, regulatory, legal and social dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this ISO/TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

Drafting Instructions

Provide an appropriate list as described above. Describe any dynamics that may be relevant to your specific ISO/TC, but do not feel compelled to describe dynamics in all of the categories in the series above if they are not relevant. This list may include descriptions of:

- The state of the art in the field addressed by the scope of the ISO committee;
- Recent or expected technological changes and major innovations related to the industry sector, products or materials addressed by the scope of the ISO committee;
- Recent or expected changes and major innovations in the disciplines or practices addressed by the scope of the ISO committee;
- Categories of relevant stakeholders (for example, industry, government, public interest groups, investors, lending institutions, employees, customers, suppliers, contractors, media, consumers, local communities);
- The concerns and perceptions of relevant stakeholders;
- Social, safety, health, environmental or cultural issues related to the sector, products, materials, disciplines or practices addressed by the scope of the ISO committee;
- Other relevant international, regional or national standards or voluntary initiatives;
- Real or potential technical barriers to trade related to the scope of the ISO committee, due to diverging national, regional or other standards and/or technical regulations. If possible, an estimation of their financial impact on trade should be provided.
- Other regulatory and legal issues, such as the existence of international, regional and national legislation/regulations, product bans, coverage by patents, etc.

2.1.1 Hydrogen has the potential to become a key component of a renewable, sustainable energy system of the future. The benefits of hydrogen make it a versatile energy carrier and a fuel that could be extensively used in a near future. Indeed, hydrogen can be produced from a variety of primary energy sources (sunlight, wind power, biomass, hydroelectric power, fossil fuels), transported, stored and used in a number of energy applications (home and office heating, generation of electricity, transportation applications, etc.).

2.1.2 When burned directly as a fuel or converted to electricity, its principal by-product is water, which can safely be returned to the environment. Hydrogen has therefore the potential to substantially contribute to the reduction of climate changing emissions and other atmospheric pollutants.

2.1.3 ISO/TC 197 was originally created to accompany the development of the technologies that are related to the use of hydrogen as an energy carrier and fuel. At present, the only significant use of hydrogen in the energy field is in the space programs. Liquid hydrogen and liquid oxygen are combined as propulsion fuel for the space shuttle and other rockets. Hydrogen is also fed to the fuel cells on board the space shuttle providing heat, electricity and drinking water for the astronauts.

2.1.4 The widespread use of an energy system based on hydrogen faces many economic and technological barriers. Most of the technologies that are required to implement this sustainable energy system are either in their development or demonstration phase, and they have not reached commercialization yet.

2.1.5 On the other hand, hydrogen is currently widely used in the industrial sector. The current major uses of hydrogen are the petrochemical and chemical industries. Hydrogen is produced and used in refineries, and it is widely used for the synthesis of chemical raw materials (production of ammonia, ethylene and methanol). Hydrogen is also used in smaller quantities in electronics, steel and glass making and food hydrogenation. The existing industrial sector is therefore the basic market on which new hydrogen technologies related to energetic applications will develop.

2.1.6 Even though, ISO/TC 197 was created to promote the increased use of hydrogen as an energy carrier and fuel, the existing and new industrial applications should no longer be neglected by ISO/TC 197. These applications would certainly benefit from the implementation of international standards to harmonize the state-of-the-art, hence ensuring a safe use of hydrogen. **Note to the P-members: Should the TC consider industrial applications right now or set them as low priority items?**

2.1.7 With regard to the energetic applications, hydrogen is likely to play its first important role as a fuel for distributed power generation and as an electricity storage medium for renewable energy. Hydrogen powered fuel cells could be used to provide on-site electricity, home and office heating and even drinking water. In the longer term, hydrogen could be produced from renewable primary sources such as hydropower, sunlight and wind power. Hydrogen produced from solar and wind power would then be stored and reconverted to electricity when these intermittent renewable sources are not generating power. As an electricity storage medium, hydrogen could also lower the cost of peak electricity. Hydrogen produced from off-peak or surplus power could be used to store energy.

2.1.8 The road vehicle sector is also a promising avenue that will lead to an increased use of hydrogen technologies. Indeed, fuel cells for cars are getting close to commercialization~~. (Daimler-Chrysler announces it for 2004).~~ The use of hydrogen as an additive to existing fossil fuels or as a fuel for internal combustion engines would result in reduced pollution and increased performance. Road vehicles powered with hydrogen fuel cells would meet the requirements of zero-emission vehicles, hence providing an opportunity to significantly reduce the pollution levels in urban areas.

2.1.9 In the long term, hydrogen could also be used as a fuel for airplanes, boats and locomotives. The high energy content per unit of weight of liquid hydrogen makes it an attractive fuel for aircraft.

2.1.10 The introduction of hydrogen in the energy sector, in close link with the industrial sector, will bring to the market place technologies for the production, storage, transport, measurement and use of hydrogen. The production technologies that are mostly used are natural gas steam reforming and electrolysis. In the long term, the technologies with the best potential for producing hydrogen to meet future demand fall into three categories: the thermochemical technologies (gasification and pyrolysis of biomass) and the photobiological and photoelectrochemical technologies.

2.1.11 Since safety is a key factor for the acceptability of hydrogen, the development of hydrogen technologies will necessarily be accompanied by the development of means to detect uncontrolled hydrogen leaks. Electronic detectors are the options to be considered.

2.1.12 With regard to the technologies that will facilitate the progression towards a hydrogen based energy system, fuel cells, internal combustion engines and hydrogen burners are being looked at. However, fuel cells are unquestionably the hydrogen utilization technology that will reach the market in the near term.

2.1.13 Major factors that may have an impact on the development of the markets

The major factors that may have an impact on the development of the hydrogen technologies are described below.

2.1.13.1 Customer's demands

The hydrogen demand for all industrial applications is likely to increase in the next years. The market that is expected to have the largest impact on the industrial hydrogen demand is incontestably the petroleum industry. Indeed, refineries are large-volume producers and consumers of hydrogen. Hydrogen is produced during thermocracking and hydrogen is consumed for the desulphurization and hydrogenation of fuels. Refineries currently use about 40 % of the total gaseous hydrogen production and the increased demand for less polluting petroleum products will definitely have an impact on the refinery hydrogen demand. Indeed, the production of better quality motor fuels requires an increased proportion of hydrogen. In addition, heavy crudes (for example, hydrocarbon extracted from tar sands), which are hydrogen-deficient compared to lighter crudes, are making up an increasing proportion of refineries runs. As a result, the availability of hydrogen as a by-product from petroleum refining is likely to decline in the next years while the hydrogen demand increases.

With regard to the energetic applications of hydrogen, the electric power industry is currently experiencing a steady growth in the demand for electricity. The worldwide demand growth is projected to approach 4 % per year through 2015. This projection includes the demand from third world countries including some areas that are not grid connected. Since there is no infrastructure in place, the use of hydrogen technologies could be an interesting option.

2.1.13.2 Social considerations

The public demand for green technologies is a potential factor that could lead to a wider use of hydrogen technologies. However, to be accepted by the public, hydrogen must be considered safe; education is therefore needed to overcome the public perception of fear regarding anything that has to do with hydrogen and the general belief that hydrogen is dangerous (the Hindenburg Effect).

On a more speculative basis, the use of a hydrogen based energy system could have a positive effect on the alleviation of poverty. Indeed, by using hydrogen produced from renewable primary sources such as hydropower, sunlight and wind power, developing countries could reduce their foreign exchange of petroleum products.

2.1.13.3 Environmental considerations

The need for clean urban air and the growing concern with regard to global climate changes will force the society to move toward energy resources that minimize the emissions of atmospheric pollutants (Kyoto 2008-2012).). Hydrogen produced from fossils fuels with sequestration of green house gases in the near-term and hydrogen produced from renewable energy sources such as hydropower, wind power and biomass in the mid-term and virtually inexhaustible supplies of water and sunlight in the long-term has the potential to become the energy carrier and fuel of the future, paving the way for an increased use of hydrogen technologies.

2.1.13.4 Economical factors

The cost of hydrogen and its associated technologies is the major barrier to the successful implementation of hydrogen energy systems. The hydrogen basic cost is currently higher than the cost of conventional fuels. Therefore, reducing the cost of hydrogen and its associated technologies is the biggest challenge of the hydrogen industry. The low cost of natural gas and the fact that carbon dioxide emissions are not currently regulated or taxed have a direct impact on these cost related issues. Nevertheless, the uncertainty concerning the eventual depletion of fossil fuel resources justifies that other sources of energy be looked at; hydrogen could be this replacement fuel.

2.1.13.5 Political changes

As the production of hydrogen from renewable primary sources could reduce their dependence on imported petroleum and help the nations that have made the commitment to reduce their emissions of green house gases, governments could adopt measures that would accelerate the introduction of hydrogen technologies such as CO_2 taxes, laws with regard to zero emission vehicles.

2.1.13.6 Product innovations

Most of the hydrogen technologies in the energy sector are either in their development or demonstration phase, and they have not reached commercialization yet. More research is required to address the most critical issues, which are to increase the efficiency and reduce the cost of technologies and to ensure that all the relevant safety issues have been adequately addressed.

The goal of the research programs that are currently underway is therefore to develop means of producing cheap hydrogen from renewable primary sources, safe storage technologies for both stationary and mobile applications as well as cost effective and efficient hydrogen utilization technologies in the sectors that were identified as the most promising.

2.1.13.7 Technical barriers to trade and regulatory and legal measures

As hydrogen technologies in the energy sector are in their development and demonstration phase, no regulatory and legal measures cover these applications. Regulatory authorities look at the demonstration projects on an individual basis. Since the standardization of hydrogen technologies was undertaken at the international level from the beginning, there are also no technical barriers to trade that result from the adoption of diverging national and regional standards. However, this lack of international standards is a major impediment for the suppliers to bring their technologies to the market place. **Note to the P-members: This section needs to be updated. Your input is requested.**

With regard to industrial applications, the storage and distribution of hydrogen has to comply with many regulations. Indeed, hydrogen falls into the category of dangerous goods and, as a result, the transport and storage are highly controlled by the regulatory authorities.

2.2 Quantitative Indicators of the Business Environment

The following list of quantitative indicators describes the business environment in order to provide adequate information to support actions of the ISO/TC:

Drafting Instructions
Provide a list of relevant quantitative indicators. The intent of these indicators is to:

- understand trends in the sector, products, materials, disciplines or practices addressed by the scope of the ISO committee (such trends may be only indirectly influenced by the ISO committee's International Standards, and are usually influenced by a variety of other factors);
- provide quantitative information that directly demonstrates the possible use and acceptance of the ISO committee's International Standards by the effected business community.

ISO/TCs with scopes related to specific industry sectors, products or materials may wish to consider indicators such as:

- Total international trade in the sector/products/materials (in US$) over the last 3 years;
- Imports and exports in the sector/products/materials (in US$) by major geographical regions and/or by countries over the last 3 years;
- Total international trade in new sector/product/material growth areas (in US$) over the past three years;
- Estimated number of companies (world-wide) operating in the sector or producing the products/materials over the past three years;
- Estimated employment (world-wide) in the sector over the last 3 years;

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- Estimated percentage of products in the marketplace self-declared or certified to the ISO committee's International Standards over the past 3 years;
- Real examples of increased income and/or cost savings achieved through implementation of the ISO committee's International Standards;
- Estimated number of organizations (world-wide) requiring compliance with the ISO committee's International Standards by suppliers, contractors and other service providers;
- Estimated number of cases of governmental adoption of the ISO committee's International Standards into legislation, regulations or procurement requirements;
- Total number of the ISO committee's International Standards cited as normative references in International Standards of other ISO committees;
- Total number of national adoptions of the ISO committee's International Standards.

ISO/TCs with scopes related to specific disciplines or practices (for example, units of measure, technical drawings, terminology, banking, statistics, biological evaluation, sterilization, clinical laboratory practices, management systems standards, etc.) may wish to consider indicators such as:

- Estimated number of organizations (world-wide) implementing or certified to the ISO committee's International Standards over the past 3 years;
- Estimated employment (world-wide) related to the disciplines/practices addressed by the scope of the ISO committee over the past 3 years;
- Real examples of increased income and/or cost savings achieved through implementation of the ISO committee's International Standards;
- Estimated number of organizations (world-wide) requiring compliance with the ISO committee's International Standards by suppliers, contractors and other service providers;
- Estimated number of cases of governmental adoption of the ISO committee's International Standards into legislation, regulations or procurement requirements;
- Total number of the ISO committee's International Standards cited as normative references in International Standards of other ISO committees;
- Total number of national adoptions of the ISO committee's International Standards.

Important note to the P-members: This section needs to be completely updated. Each P-member is requested to provide market information as accurate as possible on the total hydrogen production and use in their country and worldwide.

A special attention should be provided to market information related to the use of hydrogen as an energy carrier and fuel, for which no statistics was available at the time of drafting of the previous version of the business plan.

Total international and national trade in the sector (in US$) over the last 3 years, estimated number of companies (national and world-wide) operating in the sector over the past three years and estimated employment (national and world-wide) in the sector over the last 3 years should be provided.

Expected number of gaseous and liquid hydrogen filling stations to be constructed by 2010, expected number of hydrogen fuelled cars and buses by 2010, expected number of commercial and residential installations where hydrogen is used as an energy carrier and fuel by 2010 should be provided.

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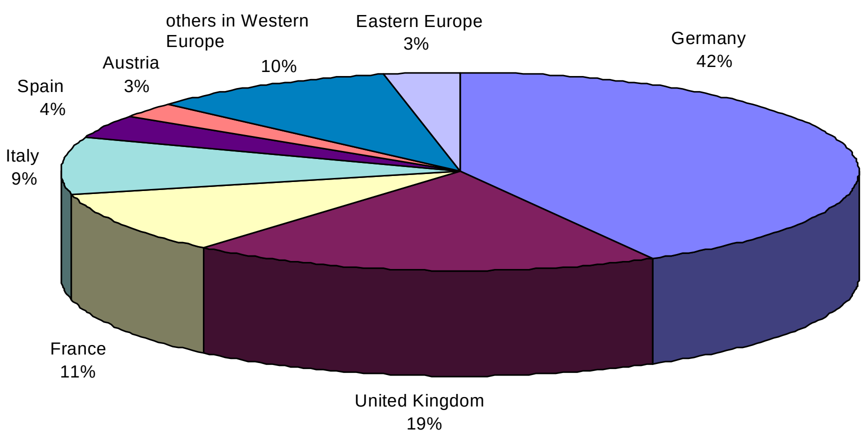
2.2.1 Description of the total market (descriptive and quantitative)

2.2.1.1 More than 45 000 000 tonnes of hydrogen are consumed around the world each year[1]. The hydrogen demand around the world varies by region. North America is the major user (79%) followed by Europe (14 %) and Asia (7%). The Middle East and South America have the potential for producing large quantities of hydrogen from hydroelectricity and refineries. They could also use large volumes of hydrogen. However, available statistics do not provide information with regard to these regions.

2.2.1.2 In Europe, the largest consumer is Germany (42 %), followed by United Kingdom (19 %), France (11 %), Italy (9 %), Spain (4 %), Austria (3 %) as it is shown in the figure below.

Hydrogen demand by regions in Europe



[1] Except where otherwise stated, the information regarding the description of the total market was extracted from the following document: *Le point technique et économique sur les technologies de l'hydrogène : Utilisation – Marchés – Production – Nouvelles applications*, Pierre Hosatte, April 1997

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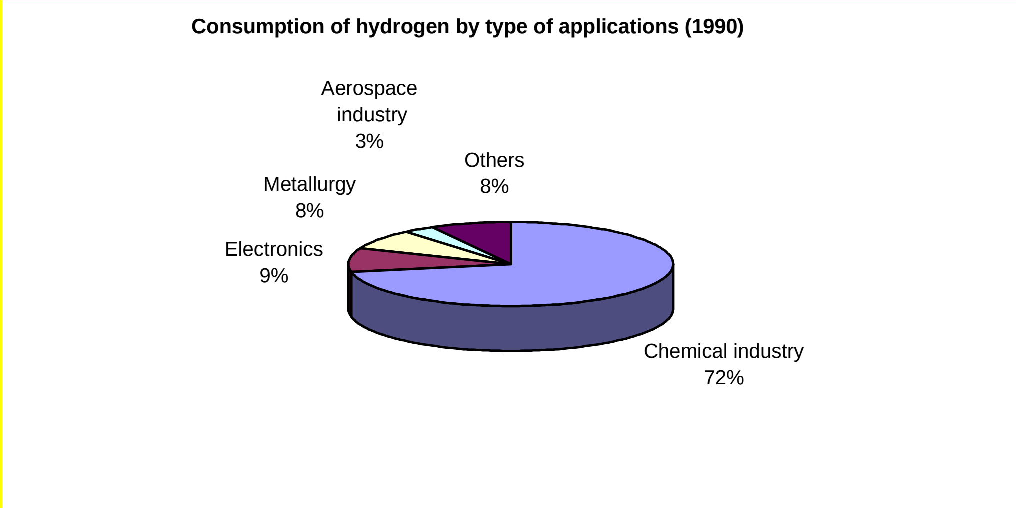
2.2.2 Description of the market structure and the major market players

2.2.2.1 The hydrogen demand varies with the type of applications. Hydrogen is primarily used in the chemical industry (72 %), more specifically in petroleum refining (32 %), ammonia manufacturing (30 %) and the synthesis of methanol (10 %). The rest of the hydrogen demand is from small-volume consumers. Electronics companies accounts for 9 % of the total hydrogen consumption, the metallurgical industry for 8 %, the aerospace industry for 3 %, and other types of industries such as glass making and food hydrogenation account for the remaining 8 % as it is shown in the following figure:



2.2.2.2 Most of the world hydrogen consumption is produced by the consumer at the site where it will be used. As a result, the largest consumers, i.e. the refineries and the manufacturing plants of ammonia and methanol, are also the largest producers of hydrogen. They not only produce hydrogen for their own needs, they also supply hydrogen to small-volume consumers. Hydrogen is also inevitably produced from the production of chlorine. As a result, the chemical and petrochemical industries currently produce about 98 % of merchant hydrogen[2].

2.2.2.3 The volumes of hydrogen sold by industrial gas companies[3], represent only a small proportion of the total hydrogen production. The liquid hydrogen business[4] was developed mostly in North America. The first liquid hydrogen plants were built in the United States to supply hydrogen for the U.S. space program. Subsequent plants were built in Canada, where relatively inexpensive energy supplies are available for the energy-consuming liquefaction process. The companies that dominate the liquid hydrogen business in North America are Air Products and Chemicals, Praxair, BOC Gases and Air Liquide.

2.2.2.4 The largest part of the hydrogen produced in Western Europe is used captively. Merchant hydrogen, delivered in cylinders or tank containers, is a minor market, accounting for about 2 % of total hydrogen consumption, and is delivered primarily in gaseous form. The largest merchant hydrogen supplier in Western Europe is Air Products, with a market share of some 22 %. Air Liquide has about 13 % share, Linde AG 12 %, Messer Griesheim 10 %, BOC Gases 9 % and others the remaining 34 %.

2.2.2.5 In Japan, the liquid hydrogen industry is dominated by Iwatani Industrial Gases and Pacific Hydrogen (a joint venture of Showa Denko, Air Liquide and Teisan).

2.2.2.6 Hydrogen is produced on an industrial scale from natural gas by steam reforming. In this process, thermal energy is used to separate hydrogen from the carbon components of natural gas. Hydrogen is also produced via the partial oxidation of oil products (refineries) and the chlorine-alkaline electrolysis (production of chlorine). Limited quantities of hydrogen are produced from the electrolysis of water. This is presently a very expensive process that is restricted to meeting the needs for extremely pure hydrogen used in manufacturing and in the space programs. Electrolysis of water, however, can play a very important role in the near future in establishing an infrastructure of distributed fuelers for cars and buses, particularly at the beginning of fuel cell cars commercialization when a relative number of hydrogen fuel cells cars is small and it is not economically feasible to introduce large centralized fuelling stations.

2.2.2.7 With regard to the energetic applications of hydrogen, most of the technologies that are required to implement the hydrogen energy system are either in their development or demonstration phase. As they have not reached commercialization yet, no available statistics cover these applications.

[2] The merchant portion of hydrogen includes gaseous product delivered by pipelines and liquid and gaseous hydrogen delivered in cylinders and tank containers.

[3] The information with regard to the volumes of hydrogen sold by industrial gas companies was extracted from the Hydrogen abstract of the Chemical Economics Handbooks, SRI International.

[4] Liquid hydrogen is accounting for 20 % of merchant hydrogen.

2.2.2.8 Should hydrogen be used as an energy carrier and fuel in the next years, the market of hydrogen would however be considerably modified. For example, a fleet of 100 000 cars using hydrogen instead of motor fuel would require about 133 tonnes of hydrogen per day, If we assume a storage efficiency of 75 %, a production of over 175 tonnes of hydrogen per day would be required to supply this fleet of cars. Such production of hydrogen would be equivalent to the current consumption of liquid hydrogen in North America.

2.2.3 Customers (descriptive and quantitative)

2.2.3.1 In industrial applications, suppliers and customers of hydrogen are intimately linked. For this reason, section 3.1 provides a complete portrait of the market structure (suppliers and customers).

2.2.3.2 In the energy sector, there are no customers yet. The car industry will likely be one of the largest customers of hydrogen technologies. Indeed, most car companies are currently investigating fuel cell vehicle systems that use either hydrogen stored on board or carbon-based liquid fuels that are converted to hydrogen by on board reformers. Daimler-Chrysler, General Motors, Fiat, Ford, Honda, Nissan, PSA, Renault, Toyota, Volkswagen are the major companies involved in these research programs.

3 BENEFITS EXPECTED FROM THE WORK OF THE ISO/TC

Drafting Instructions
Provide a list of specific benefits, in quantitative terms where possible, that have been realized or are expected from the work of this ISO/TC. This list could include descriptions of:

- The main priorities in the work of the committee and how the priorities are related to trends in the business, technological, environmental and social environment of the field addressed by the work of the ISO committee;
- How the standards developed by the committee led to or are expected to lead to cost savings through implementation of them;
- How the standards have removed or are expected to remove technical barriers to trade and open markets in various regions of the world;
- How they responded to or are expected to address relevant social, safety, health or environmental concerns;
- How they contributed or are expected to facilitate the harmonization of national and regional standards;
- How they supported or are expected to support the implementation of other International Standards;
- Whether standards are cited or are expected to be cited as normative references in other International Standards.

3.1 The standardization efforts of the technical committee ISO/TC 197 will facilitate the emergence of a renewable, sustainable energy system based upon hydrogen as an energy carrier and fuel. As standardization is undertaken simultaneously with technology development, ISO/TC 197 work will facilitate the early demonstration and implementation of the hydrogen technologies that will be required to move hydrogen into widespread energy applications.

3.2 The development of standards before the introduction of systems corresponds to a tendency that is established more and more firmly in standardization. In the past, when a standard was written, it was based on the product that met the demands of the greatest number of consumers. A proactive approach is more and more essential and there are clear advantages to have the standards prepared simultaneously with product development and even before the development of new products.

3.3 The development of hydrogen technologies in the energy sector is done gradually and this development must be founded on standards, which will guarantee the reliability and the safety of the equipment and the systems that will eventually be brought to the market. The early establishment of standards is likely to guide the technological developments and should accelerate the public acceptance of hydrogen as an efficient and safe energy source. In a context of increased trade, the standards developed by ISO/TC 197 will ensure the harmonization of requirements, namely in terms of performance and safety.

3.4 In the industrial applications, the standardization efforts of ISO/TC 197 should enable a better understanding of the relevant safety issues. The work of ISO/TC 197 could therefore lead to a cost reduction and a larger use of these technologies. **Note to the P-members: Does the TC want to focus on industrial applications right now or later?**

3.5 More specifically in both the energetic and industrial applications, the work of ISO/TC 197 is intended to fulfill the following needs:

- to warrant safety by implementing consensual rules to minimize avoidable risks to persons and goods to an acceptable level;
- to eliminate barriers to international trade and to simplify the arduous regulatory process by providing hydrogen-specific standards in order to allow the early implementation of the rapidly emerging technologies;
- to control variety by allowing to select the optimum number and types of products, processes and services to meet prevailing needs;
- to harmonize testing methods and quality criteria for the use of hydrogen in all its forms;
- to ensure protection of the environment from unacceptable damage due to the operation and effects of products, processes and services linked to hydrogen.

4 REPRESENTATION AND PARTICIPATION IN THE ISO/TC

4.1 Countries/ISO members bodies that are P and O members of the ISO committee

4.2 Analysis of the participation

Drafting Instructions
Provide text that addresses the following issues (include graphical presentations, if appropriate) :

Legend:
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Text in red: Note to the P-members of ISO/TC 197

- The participation among developed countries, developing countries and countries with economies in transition, and the possible reasons for the lack of participation by any of them;
- The participation based on regions of the world, and the possible reasons for any imbalance;
- The lack of participation by specific countries or regions known to have significant business, trade or experience in the field addressed by the scope of the ISO committee, and the possible reasons for this lack of participation;
- The types of international organizations in liaison with the ISO committee;
- Specific ISO member bodies, international organizations or regions of the world that the ISO committee would like to contribute to its work;
- Any identified lack of participation or representation of the concerns of significant companies or other stakeholders via ISO member bodies, and the possible reasons for this lack of participation;
- Any efforts to improve representation and participation in the ISO committee, including actions to encourage participating ISO member bodies to better incorporate the concerns of specific stakeholders in their positions and delegations.

Note to the P-members: This new section needs to be developed. Your input is requested.

5 OBJECTIVES OF THE ISO/TC AND STRATEGIES FOR THEIR ACHIEVEMENT

5.1 Defined objectives of the ISO/TC

Drafting Instructions

Provide text describing the objectives of the ISO committee. This section should identify priority areas in the work of the committee and link the priorities in the committees' work with the major trends in the business, technological, environmental and social fields and markets addressed by the committee.

In developing these objectives it is helpful to keep in mind the following key criteria, otherwise known as “SMART targets”: Try to make your objectives Specific, Measurable, Achievable, Results-oriented, and Time-bound.

Example of a possible objective:
The TC will elaborate a package of International Standards in the XXXXX sector including aspects 1, 2 and 3, but excluding aspects A, B and C (as aspects A, B, and C are not sufficiently developed yet for standardization purposes), which will be available by 2005-05-31. International Standards concerning aspects A, B and C will be developed once the state of the art is better defined.

5.1.1 The current standardization effort is focused on new technologies in the energetic applications. Since these new technologies are in the development or demonstration stage, the main objective of the technical committee is to help bringing these new technologies to the market through pro-active standards that are aimed at removing the technical barriers of cost-ineffective regulations.

5.1.2 The technical committee's efforts are centred on standardizing to ensure safety and meet end-use requirements at an affordable cost. This work should speed-up the regulation process by providing international standards that define the minimum requirements applicable to these rapidly emerging technologies. Thus, the focus of the technical committee's work is cost-effective safety for new end-uses.

5.1.3 More specifically, the objectives of the technical committee in the next years are the following:

Note to the P-members: The priorities of the TC needs to be re-established. P-members are invited to present their proposals. In order to help you, please find below a potential list of new work items.

- **Hydrogen system components —Hydrogen Detectors**
- **Liquid hydrogen — Service stations**
- **Dispensers**
- **Interface between the service stations and road vehicles**
- **Hydrogen tank components — Pressure regulator, solenoid valve, pressure relief device**
- **Metal hydrides storage systems for onboard applications**
- **Metal hydrides storage systems for large stationary applications**
- **Hydrogen system components —Check valves**
- **Hydrogen system components —Manual shut-off valves**
- **Hydrogen system components —Automatic shut-off valves**
- **Hydrogen system components —Pressure indicators**
- **Hydrogen system components —Pressure regulators**
- **Hydrogen system components —Pressure relief devices (valves and burst discs)**
- **Hydrogen system components —Rigid pressure lines**
- **Hydrogen system components —Flexible pressure lines**
- **Hydrogen system components —Filters**

- **Hydrogen system components —Fittings**

1. Elaboration of standards on the product specification of the hydrogen fuel. As the end-use technologies develop, the need to define the characteristics of the hydrogen fuel based on the application may arise.

2. Elaboration of generic standards that will provide the guidelines for the development of a hydrogen distribution and storage infrastructure. Storage technologies for mobile and stationary applications (multimodal containers, nanotubes and metal hydrides), refuelling stations, hydrogen pipeline, etc. should be standardized.

3. Elaboration of standards or collaboration to the development of the standards on the end-use applications (fuel cells, internal combustion engines, hydrogen burners).

4. Collaboration to the development of standards on hydrogen devices dedicated for use onboard road vehicles (road vehicle fuel tanks, fuelling connectors).

5. Elaboration of standards on the relevant properties of hydrogen and the safety considerations related to the presence of hydrogen

6. Elaboration of standards on the hydrogen production technologies from renewable primary sources such as hydropower, solar energy, wind power and the small-scale hydrogen production technologies from fossil fuels such as small-scale steam reformers.

7. Elaboration of standards on detection devices (electronic detectors) and safety related devices (pressure relief valves, shut-off valves, pressure regulators, etc.) of generic use to be used in hydrogen systems.

5.2 Identified strategies to achieve the ISO/TC's defined objectives

Drafting Instructions
Provide text that addresses how the ISO committee has used or intends to use specific strategies to achieve its objectives and how these objectives are related to the major market trends (see section 2) and the overall priorities of the work of the committee. Such strategies may include:
- Prioritization of projects (for example, developing terminology standards first, then test methods, etc.);
- Use of available national, regional or other standards (such as CEN standards via the Vienna Agreement) as source documents on which to base International Standards;
- The way in which the ISO committee work will be conducted (for example, correspondence, physical meetings, teleconferences, e-mail, Internet, need for translation in meetings, etc.);
- Necessary co-operation and liaisons with other ISO committees and/or external standards developing organizations;
- Use of the various ISO deliverables (International Standards, Technical Specifications, Publicly Available Specifications, Technical Reports, International Workshop Agreements);
- Specific needs for pre/co-normative research to support the ISO committee's work program should be indicated so that an analysis can be made to detect any timing or funding difficulties;

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- The specific structure of the ISO committee (TC, SCs, WGs) and why the ISO committee chose this particular structure should be explained.

5.2.1 The priorities of ISO/TC 197 are driven by the hydrogen technologies in the energy sector that are likely to reach the market in the near term. As the distributed power generation and the road vehicle sectors have been identified as the early market niches, all the standards that are required to allow the smooth introduction of the hydrogen technologies in these sectors of activity shall be the top priority of ISO/TC 197.

Note to the P-members: The paragraphs need to be rewritten once the priorities have been established. Your input is requested

5.2.2 For hydrogen to be widely used in industrial applications, distributed power generation and road vehicles applications, there was a need to define the specifications of the product to ensure access to a product of quality. ISO 14687 was therefore developed to meet that need of the market. However, as the end-use applications develop, the need to define the characteristics of the hydrogen fuel based on the application may arise. ISO/TC 197 should therefore allocate the resources that would be necessary to revise ISO 14687 if the most promising end-use applications such as the fuel cells and the internal combustion engines require the definition of additional requirements for the hydrogen fuel.

5.2.3 As the guardian of all generic safety aspects for hydrogen technologies, the development of generic standards on the hydrogen distribution and storage infrastructure should be the top priority of ISO/TC 197. There is definitively a need to implement international standards to harmonize the requirements applicable to refuelling stations and storage technologies of gaseous and liquid hydrogen for both mobile and stationary applications (e.g. multimodal containers). The development of standards on solid-state transport and storage technologies such as nanotubes and metal hydrides should also become a priority when these technologies become more mature. However, as the analysis of the market has shown that the aircraft applications are not likely to develop in a near future, ISO/TC 197 intends to put on hold the activities related to the airport hydrogen fuelling facilities. As a result, the latest results of ISO/TC 197 WG 4 will be published in an ISO /PAS Publicly Available Specification to make the information available to all interested parties until the subject of using liquid hydrogen in commercial aviation gains an increased interest.

5.2.4 The next item on the priority list of ISO/TC 197 would be to develop standards or collaborate in the development of the standards on the most promising end-use applications. As fuel cells are seen as the most promising technologies for both distributed power generation and road vehicle applications, ISO/TC 197 should be involved in the development of fuel cell standards to ensure that the relevant hydrogen safety issues of these technologies are addressed. For the same reason, ISO/TC 197 should also collaborate to the development of standards on hydrogen devices dedicated for use onboard road vehicles such as fuel tanks, fuelling connectors.

5.2.5 Moreover, the establishment of general guidelines for the safe use of hydrogen and the definition of the properties of the hydrogen fuel should not be neglected by ISO/TC 197. As the education of the regulatory bodies and the public in general is an important aspect of the acceptance of the hydrogen technologies, ISO/TC 197 should allocate the resources to make these documents available.

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5.2.6 The elaboration of standards on detection devices (electronic detectors) and safety related devices (pressure relief valves, shut-off valves, pressure regulators, etc.) of generic use to be used in hydrogen systems should also be considered by ISO/TC 197.

5.2.7 Finally, as the hydrogen production technologies from renewable primary sources and the small-scale hydrogen production technologies from fossil fuels develop, ISO/TC 197 should develop standards that will ensure the safe use of these hydrogen production technologies. Small-scale steam reformers and electrolyzers are the technologies that are the most likely to need standardization in the near term.

5.2.8 In order to keep the interest of its member bodies, ISO/TC 197 holds plenary meetings on an annual basis. With regard to the work that has to be done between the plenary meetings, ISO/TC 197 favours the increased use of the electronic mail. All correspondence to the member bodies is in English with the exceptions of the meeting draft agendas, the resolutions adopted during the meetings and the committee drafts that are also translated in French. English is the language used during the meetings.

5.2.9 Drafting of standards should be assigned to working groups under the responsibility of the technical committee, except where the extent of the projects to be done and the need to maintain the efficiency of the technical committee would warrant the creation of subcommittees. The secretariat shall coordinate and facilitate the work within the technical committee, thus implementing conditions for teamwork and synergy. As the number of projects increases, the creation of a permanent editing committee should bring more efficiency to the editorial work of the technical committee.

5.2.10 ISO/TC 197 cannot delegate its responsibilities when safety issues related to the use of hydrogen are under consideration, and in order to achieve its mandate in a most effective manner, ISO/TC 197 should establish liaisons and work in close collaboration with the following ISO technical committees and other organizations:

ISO/TC 197 LIAISONS WITH OTHER ISO TECHNICAL COMMITTEES

ISO/TC 11 *Boilers and pressure vessels*

ISO/TC 20 *Aircraft and space vehicles*

ISO/TC20/SC14 *Space systems and operations*

ISO/TC 22 *Road vehicles*

ISO/TC22/SC21 *Electric road vehicles*

ISO/TC22/SC25 *Road vehicles using natural gas*

ISO/TC 58 *Gas cylinders*

ISO/TC 58/*SC3 Gas cylinder design*

ISO/TC 70 *Internal combustion engines*

ISO/TC 192 *Gas turbines*

ISO/TC 193 *Natural gas*

ISO/TC 203 *Technical energy systems*

ISO/TC 207 *Environmental management*

ISO/TC 220 *Cryogenic vessels*

ISO/TC 197 LIAISONS WITH OTHER ORGANIZATIONS

IEC/TC 105 *Fuel cell technologies*

European Hydrogen Association – Cat. A

National Hydrogen Association (NHA) – Cat. D

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5.2.11 Special work agreements with IEC/TC 105, ISO/TC 22 and ISO/TC 58/SC 3 are presently being made effective considering the strong technical relationships between work items covered by ISO/TC 197 and these technical committees. The general ISO procedure is followed in all other cases of liaison and collaboration with other TCs listed above.

6 FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE ISO/TC WORK PROGRAMME

Drafting Instructions

Describe any factors that could negatively impact the completion or business community acceptance and use of the standards developed by the ISO committee. Examples of such factors could include:

- ISO committee chairperson, secretary, convenor or project leader/editor positions are vacant;
- Expert resources are not sufficiently available (for certain projects);
- Specific expertise for a project is lacking, which could affect the project's development as well as the credibility of the resulting standard in the business community;
- Validation of a test method is dependent upon funding being available to undertake the necessary pre/co-normative research;
- Legal/regulatory issues such as uncertainties regarding a possible EC Directive, which in turn may necessitate modifications of the content and target dates for projects in the work program.

6.1 The lack of International Standards on boilers and pressure vessels has had and will continue to have an influence on the timely completion of the ISO/TC 197 standards that deal with equipment that fall in the pressure vessel category such as multimodal containers, fuel tanks, etc. The work of WG 10 of ISO/TC 11 Boilers and pressure vessels is therefore crucial with regard to this matter.

6.2 The small number of known specialists in the field of hydrogen technologies is an additional factor that can limit the efficiency and the number of work items being processed by ISO/TC 197. Additional work would have to be carried out by the same experts. Consequently, ISO/TC 197 recognizes that its structure must be kept as lean as possible.

6.3 ISO/TC 197 exists because, given the very specific nature of hydrogen and hazards associated with its use, the hydrogen industry needs international standards to enable it to evolve. This implies that standards are developed ahead of the introduction of the technologies into the market. As a result, because of the development stage inherent to most technologies under interest, it is rarely possible to process work items within the time limits recommended in the ISO/IEC Directives. In some cases, the maximum development time of seven years may not be complied with.

7 STRUCTURE, CURRENT PROJECTS AND PUBLICATIONS OF THE ISO/TC

This section gives an overview of the ISO/TC's structure, scopes of the ISO/TCs and any existing subcommittees and information on existing and planned standardization projects, publication of the ISO/TC and its subcommittees.

7.1 Structure of the ISO committee

7.2 Current projects of the ISO technical committee and its subcommittees

7.3 Publications of the ISO technical committee and its subcommittees

Reference information

Glossary of terms and abbreviations used in ISO/TC Business Plans

General information on the principles of ISO's technical work