Toolkit
Using Inventions in the Public Domain

Tool 5
Freedom to Operate

WIPO

Tool 5/ Freedom to Operate

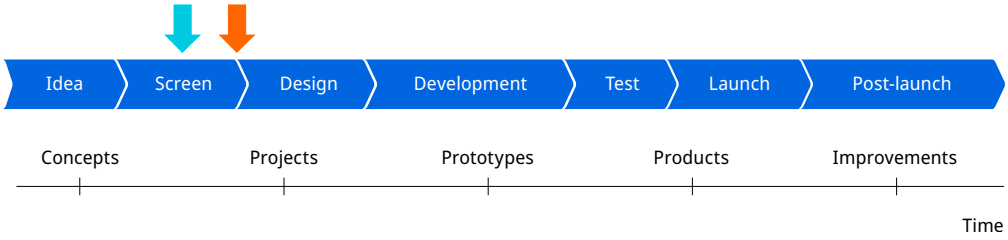
In this document we will focus on how to use the Freedom to Operate (FTO) tool, and how to interpret the results.

FTO is discussed briefly in the WIPO publication *Using Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020), in particular in Module III, section 6.1 "Patent intelligence based on patent database searches, patent statistics and report." It is also the subject of the WIPO companion publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020), which describes in detail how to search and analyze published patent documents using the tools of FTO determination, to address questions such as whether one or more patents exist that could be relevant to your new product development (NPD) plans. If you are new to doing an FTO determination, we strongly recommend reading this publication in its entirety before starting to use this tool. Even if you have done FTO searching and analysis before, this publication is a useful refresher, and you will likely pick up a few tips.

The FTO tool provided in this toolkit uses principles of FTO determination, applied broadly, to provide a heuristic tool for evaluating your product or service in view of any potentially relevant patent rights that currently exist, could come into existence, or no longer exist. We recommend using the FTO tool to perform a preliminary determination early during the Screen stage, as shown in Figure 1. At this stage, you will gain useful information and insights that you can use for decisions during the Design and Development stages. It is easier to make changes while you are still working with concepts and early designs and have not committed to a specific design yet. Because the patent literature is constantly evolving as new patent applications are filed and new patents are granted, we recommend using the FTO tool at each subsequent gate to provide updated information to use in decision-making throughout the NPD process.

Although this tool can provide useful preliminary information based on an informal technical analysis, you should consider having qualified professionals carry out more extensive FTO searching, and conduct the legal analysis required for FTO determination, before making any design decisions that will commit the NPD process to a specific path.

Figure 1: **The FTO tool is needed before entering the Design stage, because serious consideration of the landscape of IP rights is needed before designing a product or service. Here, the blue arrow shows the FTO tool being used in the Screen stage of an NPD initiative after you have determined what is necessary to gain a competitive advantage, although it can be done earlier and then reviewed and updated. The orange arrow indicates that the review must be completed so the results can be used in making the Go/No Go decision at the gate between the Screen and the Design stages.**



What is freedom to operate?

Freedom to operate means you are free to use your product or service as you have planned, without incurring legal liability for this use. Legal liability can arise from the unauthorized use of protected intellectual property (IP) owned by a third party. Unauthorized use of protected IP means using it without permission from the IP owner. The terms "infringe" and "infringement" are commonly used to refer to unauthorized use of protected IP.

The FTO tool starts by considering your product or service as an invention, to enable you to compare it with the inventions you may find disclosed in patent documents. An invention is "a product or a process that generally provides a new way of doing something, or offers a new technical solution to a problem" and a patent is "an exclusive right granted for an invention."[1]

The FTO tool is designed to help you search for patent documents that you should be aware of, in case any of them indicate the existence of IP rights that could impact your plans for using your product or service. An additional benefit of using the FTO tool is that some of the patent documents you find during an FTO search may provide useful technical information or product ideas which could help you improve your own NPD process.

When you use the FTO tool, it is important to remember a few basic patent principles:

- First, a patent grants the patent owner a "limited monopoly" that is territorial and time-limited. The IP laws and practices of the country that granted a patent will determine the scope of patent rights that are granted to the patent owner, and the patent owner can enforce these rights only in that country, and only for the period of time when that patent is in force in that country.
- Second, the enforceable patent rights granted to the patent owner are defined by the patent claims which recite the "patented invention" of that patent. The claims must provide a clear description with sufficient technical detail to inform the public what the patented invention is. A patent document may include additional information such as extensive technical descriptions and other inventions, and these disclosures are crucial for understanding the patented invention. However, it is the *claims* of the patent that define the patent rights that have been granted to the patent owner. This means the patent owner can exclude others from making, using, selling, etc., the patented invention defined in the claims of an enforceable patent. The WIPO publication *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020) summarizes these two principles, stating "a patent grants the patent owner the right to stop or prevent others from practicing the patented invention without the patent owner's consent in the country that granted the patent, at any time when the patent is in force." Thus, FTO determination ultimately focuses on claims in a patent document, in order to evaluate what enforceable patent rights might exist, and where and when.

1 www.wipo.int/patents/en/faq_patents.html

An FTO determination should inform you about any enforceable patents that could impact your ability to use your product or service according to your present NPD plans. Therefore, you would want to carry out an FTO determination for your product or service because you want to know if you can make, use, sell or import your product or service, in the countries and time periods you want, without infringing enforceable patents owned by others.

The goal of using the FTO tool is to search for patent information that could be useful for your NPD project. The goal is not to find a public domain invention, or to assert that you have complete FTO. Instead, the goal is to gather information you can use to make informed decisions about how to design your product or service and carry it through the NPD process as you have proposed.

For example, the results of FTO determination may lead you to decide to change a design specification to make it different from a patented invention you found. In another example, you may find a patented invention that would meet one of your design specifications, and you decide you want to license that patent in countries where you plan to operate. Keep in mind that there are many good reasons for taking a license to gain permission for authorized use of a patented invention that has already been developed and tested by the patent owner, including: to gain access to a patented invention that you know you want to use in your product or service; to preserve flexibility by gaining access to a patented invention that you might want to use; to start a collaboration with the owner of the patented invention; or for peace of mind if you are not sure whether you would actually have any legal liability.

Always keep in mind that this FTO tool only takes you through the steps of a preliminary FTO search, a technical analysis of any potentially relevant patent documents you may find, and a preliminary informal FTO analysis based on comparing technical features of your product or service with technical features of the potentially relevant patent documents. In contrast, the question of freedom to operate is ultimately based on a detailed legal analysis of the potential legal scope of each potentially relevant document in view of a proposed invention, according to the laws and practices of a single country, resulting in a legal opinion regarding FTO for that country. This tool does *not* teach you how to do the required legal analysis or render a legal opinion. Therefore, once you have settled on your design in the Design stage, it would be prudent to seek an opinion from a qualified professional who can carry out the combination of technical and legal analysis required for an FTO determination for your design, for countries of interest for your NPD project. Such a qualified professional for FTO determination would be an attorney specializing in IP (an IP attorney), and in some countries it might be a patent professional such as a patent agent or a patent attorney with limited practice, who has the relevant education and substantive experience working in the field of technology appropriate for your product or service.

The process of FTO determination involves searching the patent literature to find patent documents with claims to inventions that might be similar to your product or service, and then evaluating your product or service in view of patent documents you find. A summary of the steps of FTO determination is provided in Figure 2.

Note that this discussion of FTO determination uses the term “patent documents” to refer to granted patents and published patent applications. We recommend searching for both types of patent documents for the reasons explained below. We also recommend checking the current legal status of any patent document you find.

- It is important to search for granted patents because only granted patents can be enforced by their owners. So, you may be most concerned about finding granted patents and analyzing their claims. When you find a granted patent that may be relevant, you should always check its current legal status to determine whether or not the patent is still in force in the country where it was granted. When a patent is in force (enforceable), there could be legal liability for unauthorized use of the patented invention. However, if a patent is no longer in force (unenforceable) because it expired, was abandoned or withdrawn, was legally revoked or invalidated, disclaimed, etc., it will not affect your NPD plans.
- Your search should also include published patent applications because they indicate what kinds of IP rights the owner is seeking. A published patent application that is currently pending could later issue as a patent with claims to a patented invention that might be relevant. However, if

a published patent application was abandoned or withdrawn or finally rejected, and therefore it never issued as a patent, then it never gave rise to enforceable IP rights. When you find a potentially relevant published patent application, check the legal status to determine whether the application later issued as a patent, or was abandoned, or is still pending.

It is also important to remember that an invention may be covered by multiple patents. An invention may have multiple features or subsystems, such as individual design specifications, that work together to achieve the invention. A patent can be granted for the combination of features or subsystems that work together in a new way to yield a new invention. However, each of these features or subsystems may be covered by one or more different previously granted patents. This means you cannot assume that the question of FTO for your product or service would only involve one single patent. Your FTO search therefore needs to search for the design specifications of your product or service, such as features, subsystems, components or ingredients of the product or service. This has two consequences: first, FTO searching for your product or service is likely to find multiple patent documents that may be relevant to different design specifications of your product or service; and second, each patent has a separate legal existence.

To illustrate from the biofuels example, an FTO search for the mini-refinery using organisms that digest organic waste may find multiple patents relevant to different features of the invention, such as the organisms, pre-processing the organic waste, the machinery (vats, piping), and the sensor and control systems. To illustrate the second consequence, even if you find a useful patent that was revoked and is no longer in force, you still need to do an FTO determination to see if any other relevant patents are still in force that cover specific features of the invention in the claims of the now-unenforceable patent. The question of inventions in the public domain illustrates both consequences because it requires a determination that the invention is not covered by any enforceable patent covering *any* feature of the invention, for the country and time period being considered.

Finally, it is important to be aware that the concept of FTO in its broadest sense applies to *any* type of protected IP that may be relevant to your product or service. Here, the FTO tool focuses on patents that grant exclusive IP rights for inventions. However, other types of IP rights such as trademarks, industrial design rights, copyright or plant variety rights may also be associated with your product or service. For example, if you write a user manual for your product and you want to include a section of the copyright-protected user manual for the sensor you are using, you will need to get permission from the copyright owner for the sensor manual. This is a reminder that you will want to protect any type of IP or trade secret you have created for your product or service (as discussed in Tool 9: IP Audit), and you will want to make sure you are not infringing anyone else's IP rights, regardless of what type of IP it is.

How do you start using the FTO tool?

Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs (2020) uses a three-stage process to determine whether any patent rights exist that could cover an invention (in this case, your product or service), or if the invention is in the public domain and free to use. These steps involve describing the invention, searching the patent literature (FTO search) and analyzing the search results (FTO analysis), as shown in Figure 2, reproduced from the WIPO publication.

Figure 2: How to determine FTO using the WHAT–WHERE–WHEN model, reproduced from *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020).

FTO Stage	Actions to be taken
Identify information needs and describe the invention ↓	– Interview client to learn: · **WHAT** the invention is and **WHAT** the client plans to do with it. · **WHERE** the client plans to use the invention. · **WHEN** the client plans to use the invention. – Prepare Summary Report describing the invention and the client's plans for using it, with information in a suitable format to use for FTO search.
FTO search ↓	– Use Summary Report to develop inputs for FTO search: · **WHAT**. Define features with keywords; patent classification symbols (International Patent Classification (IPC) symbols) for invention; identify non-text features. · **WHERE**. Identify countries to be searched, languages required. · **WHEN**. Define time frames for search, if any. – **Find databases and tools** that will support the search. – **Develop search strategies.** For example search strings using keywords in combination with IPC symbols. – **Carry out FTO searches.** Review, refine, repeat as necessary. – **Identify potentially relevant patent documents** for further analysis. – **Prepare FTO Search Report** with search summary and search results.
FTO analysis	– Carry out informal **FTO analysis** for each potentially relevant patent document identified in the FTO search: · **Infringement analysis.** Construe (interpret) the scope of claims and compare the client's invention with each construed claim. Do any claims appear to cover (read on) the client's invention? · **Legal status determination.** Are there enforceable patent rights or potential future rights? If yes, in what country and during what time frame? – **Prepare Final Report.** Did FTO analysis identify any enforceable patents that could have an impact on **WHAT** the client plans to do with the invention, in any country **WHERE** the client plans to use the invention, during the time **WHEN** the client plans to use the invention? – **Final Report should state technical findings and analysis,** and should *not* use legal language. – Final Report should **discuss risks** associated with FTO determination.

Describe your product or service as an invention

The **first stage** in the process of FTO determination involves taking steps to develop inputs for an FTO search. Start by describing your product or service as an invention, in such a way that you can use this description for searching the patent literature.

A good place to start is with the description of the product or service that you entered in the "Product or service being developed" section of the Project Charter workbook (see Figure 3, using the biofuels example) and the design specifications based on primary sources that you developed on the "Design specifications" tab of the Voice of the Customer workbook (see Figure 4, using the biofuels example). Your description(s) should be technical descriptions phrased like patent claims. You can also identify technical features that correspond to known patent classification symbols, so you can search for patent documents with similar symbols. You may also want to make notes on where and when you plan to use your product or service, such as target countries and time frames for the Test, Launch and Post-launch stages, in case you want to use this information during the FTO search and/or during FTO analysis.

Figure 3: "Product or service being developed" section from the Project Charter workbook using the biofuels example.

Project Charter

Product or service being developed
We are developing a mobile mini-factory that converts organic matter from municipal or farm solid waste into biodiesel, ethanol, or hydrogen. This system utilizes a fungus - or potentially other organisms - to extract valuable oils from municipal solid waste and agricultural waste. The components and subsystems of the mini-refinery are commercially available. We plan to license the fungus or another suitable organism from Remarkable Biofuels LLC or a similar company. Alternatively, we might collaborate with a university or research institute to develop a proprietary organism. Multiple units can be connected to create a larger-scale system. We will sell both the production unit and the consumable organism. The system will be equipped for remote monitoring and control and will include on-board diagnostics to identify emerging or existing issues. We will develop our own suite of sensors and software for operations, preventive maintenance, and troubleshooting.

Figure 4: Design specifications from the Voice of the Customer workbook using the biofuels example.

Design specifications based on primary sources

	Customer requirements	Specifications	Importance
Performance	Wide range of waste that can be treated	Moisture content, size, relative mass	2.333333333
	Efficiency of biofuel production	Energy output/energy consumption	2.5
	Flexible production rates	Speed range in hours	1.333333333
	20 to 50 year usable life	Years	2.666666667
	Meets regulations and standards for fuels	Relevant standards, highlighting British Thermal Units (BTUs), viscosity, and emissions	3
	No adverse environmental or health impacts	Emissions, particle size, organisms must be safe	2.666666667
Ease of use	Does not require much training	Training time	2.666666667
	Ease of transport	Size of vehicle needed	1.333333333
	Little maintenance and monitoring time required	Labor time per month	2.5
	Customer support	Customer support hours and personnel	2.333333333
Price	Purchase price	Currency	2.6
	Operation costs	Cost per month	2.4
	Payback period	Years	3
Other	Better than competing technologies	Cost per liter of fuel	1.8
	Addressing skepticism of customers	Independent test laboratory results	2.6
	Energy independence	Barrels of imported oil not needed due to one unit running full-time for one year	2.4

Because the Screen stage is still early in the NPD process, you are probably not making, using or selling the product or service you want to develop. However, you have already developed a preliminary design for that product or service, and you may even have written design specifications for that design. You probably have in mind the kinds of technologies, parts, components, subsystems and so on you will use to implement the design. That means you have enough information to develop terms for an FTO search.

It is useful to begin with the patent documents already identified during the competitive advantage analysis. Figure 5 is an extract from the "Patents" tab of the Competitive Advantage workbook using the biofuels example. These patent documents can be used to find terms that would be useful for a keyword search, and patent classification symbols for a classification-based search.

Figure 5: Patent documents identified on the "Patents" tab of the Competitive Advantage workbook using the biofuels example.

Examples of relevant patents and patent applications identified

Patent number, publication number, or application number	Title	Assignee	Relevance	Priority date and notes on legal status
KR1020180029825	Method for manufacturing liquid biofuel using waste solid organic matter and liquid biofuel manufactured thereby	Seong Goo Kim	A new method for manufacturing liquid biofuel from solid organic waste. The solid organic waste is liquefied, combined with a liquid fuel, and processed into a liquid biofuel in an economical and eco-friendly manner.	Priority date 11/04/2017 Application rejected: decision to refuse a patent issued 29/11/2018
US20120192482	Techniques for processing waste materials into useful products	Thomas Asher	Municipal solid waste or source-separated organic waste undergoes a separation treatment that segregates organic and inorganic components. The resulting organic slurry is then subjected to a second separation treatment, which "separates the wastewater, oil/grease, and organic material in the organic slurry from one another. The wastewater, oil/grease, and organic material are further processed to produce useful products, including animal feed additives, and raw materials for cosmetics, fertilizers/composts, and renewable fuels for generating renewable energy."	Priority date 30/01/2012 Application abandoned as of 30/06/2013
US20130228623	Systems and methods for incentivizing food waste recycling	VIRELLA E O	A collection machine for gathering food waste and waste cooking oil. It is unclear whether the apparatus processes the waste.	Priority date 04/03/2013 Now U.S. patent no. US 9,117,205 granted 05/08/2015
US20110165639	Refinery process to produce biofuels and bioenergy products from home and municipal solid waste	BriJen Biotech, LLC	A method for generating one or more biofuels or bioenergy products using home or municipal solid waste as raw materials. This method includes physicochemical processes, and the treated solid biomass is used as a source for biofuel synthesis by fermentative and/or methanogenic microorganisms.	Priority date 17/08/2009 Application abandoned as of 10/01/2015
US20130084159	Waste container	Kirk Warren and others	A waste container for the collection, storage, and transport of waste and refuse material, particularly useful for organic waste.	Priority date 06/08/2012 Now US patent no. US 9,481,513 granted 01/11/2016

Start with these previous descriptions of your product or service, with guidance from any known relevant patent documents, and draft a technical description of the product or service in the style of a patent claim. Guidance for drafting patent-style claims to describe a product or service can be found in the *WIPO Patent Drafting Manual* (2022) in Module IV, and *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020) in Module III.

Start by drafting a technical description of the design specifications for the product or service you want to develop, and how you will achieve them. First, draft a claim that describes the entire product or service in terms of everything that is required or essential. For a product, draft a claim to the product (a machine, a device, an apparatus, or a chemical composition of food or medicine) that includes all of the required parts and the functions each performs, described in a general way. For a process or method, describe all of the steps required for the process, and include the components needed for each step, such as structures, functions or ingredients. A service might be described as a method for performing a service or providing a benefit, in terms of a series of actions (by humans and/or machines and/or computers) and how they function together to produce the service or benefit. Your product or service could be a way to make something, described by a claim to a method of making or doing something, or a system for doing something, with all of the steps and components that are required.

Then draft narrower, dependent-style claims such as claims to specific versions of your product, or specific ways of making or using your product or service. These claims could focus on some of the most important design specifications. For a product, you could draft additional claims with details about specific parts or ingredients you plan to use in the versions of the product that you think is the most promising. A service might be described as a method for performing a service or providing a benefit, with more detail about certain steps in the method. These dependent-style claims with more specific detail are important because they can provide a defined picture of the product(s) or service(s) you want to develop.

An example of how to write patent-style claims with your design specifications is provided in the biofuels example. Figure 6 shows draft claims describing the project for biofuel production using mini-refineries, based on the design specifications.

Figure 6: **Claims describing the project for biofuel production using mini-refineries based on the design specifications, from the "Inputs" tab of the Freedom to Operate workbook using the biofuels example.**

Patent documents to consider	1. A vessel-based method for producing biofuel or bioenergy product(s) from organic solid waste, comprising: hydrolyzing materials from the solid waste to produce treated and available carbon sources; and synthesizing one or more biofuel or bioenergy products in bioreactors through microbial action, using the hydrolyzed waste materials as a carbon source.	2. The method of claim 1, wherein the waste material comprises municipal or other solid biowaste material.	3. The method of claim 1, wherein the solid waste organic material is selected from at least one of switchgrass, leaves, and wheat straw.	4. The method of claim 1, wherein the microorganisms include an extremophilic fungus.

Draft claim 1 cites a "vessel-based method for producing biofuel or bioenergy product(s) from organic solid waste" and lists the essential steps and ingredients, namely "hydrolyzing materials from the solid waste to produce treated and available carbon sources" and "synthesizing one or more biofuel or bioenergy products in bioreactors through microbial action, using the hydrolyzed waste materials as a carbon source." Claim 3 cites specific desirable types of solid waste as "switchgrass, leaves, and wheat straw." Draft claims 2, 3 and 4 cite specific design specifications from the initial design. Claim 2 cites desirable sources/types of solid waste as "municipal or other solid biowaste material." Claim 4 cites a desirable microorganism as "an extremophilic fungus." Here, claim 1 shows how you could describe the mini-refinery process as a whole, to search for patent documents that might disclose an invention with most or all of the same features. Claims 2, 3 and 4 show how to use details that help you find patent documents that might be relevant to design specifications for the specific way you plan to make your product or service.

It is important to include **subsystems and components** in an FTO determination. You cannot just look at system-level patents, trying to find documents that match all of the features of your product or service. You also must describe subsystems and components of your product or service, so you can look for patent documents that might match only some of the features of your product or service, because these might be relevant for the subsystems and components. Even if you intend to integrate systems, parts and components purchased from others, you should include them in your FTO analysis.

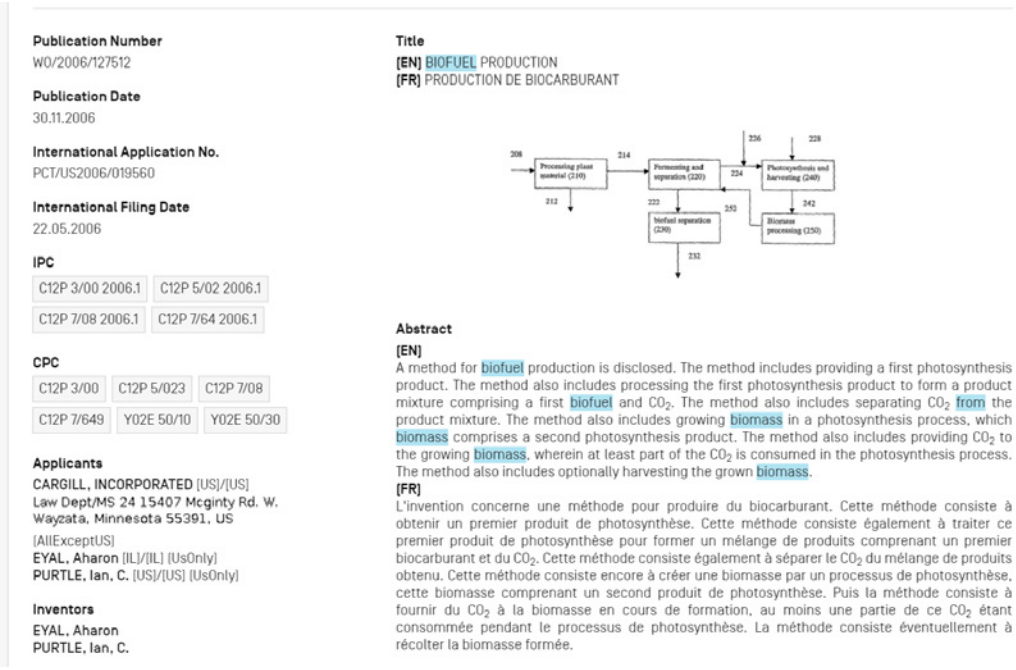
To include subsystems and components in your FTO determination, first do a **functional deconstruction** of your invention to identify where you should be searching. Functional deconstruction is an important part of using Tool 10: Technology Forecasting, and that tool description contains details of functional deconstruction and how it would be applied in the biofuels example.

The framework for doing a functional deconstruction is described in Module III of *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020), section 2 "Preparing for search: Deconstructing the invention." That framework is shown in Figure 7, reproduced from the guide.

Figure 7: Framework for a functional deconstruction of an invention.

When you read patent documents you have already found, you can gain insights into how to do a functional deconstruction of your product or service. Both the description of the invention and the drawings of a patent document can provide suggestions for your functional deconstruction. See the example below from a published patent document in WIPO's PATENTSCOPE database, which could be useful for the biofuels example.

Figure 8: Example of a functional deconstruction contained in a patent document published in WIPO's PATENTSCOPE database. Additional drawings and the description are found in the patent document.



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Title
[EN] BIOFUEL PRODUCTION
[FR] PRODUCTION DE BIOCARBURANT

Abstract
[EN]
A method for biofuel production is disclosed. The method includes providing a first photosynthesis product. The method also includes processing the first photosynthesis product to form a product mixture comprising a first biofuel and CO_2. The method also includes separating CO_2 from the product mixture. The method also includes growing biomass in a photosynthesis process, which biomass comprises a second photosynthesis product. The method also includes providing CO_2 to the growing biomass, wherein at least part of the CO_2 is consumed in the photosynthesis process. The method also includes optionally harvesting the grown biomass.
[FR]
L'invention concerne une méthode pour produire du biocarburant. Cette méthode consiste à obtenir un premier produit de photosynthèse. Cette méthode consiste également à traiter ce premier produit de photosynthèse pour former un mélange de produits comprenant un premier biocarburant et du CO_2. Cette méthode consiste également à séparer le CO_2 du mélange de produits obtenu. Cette méthode consiste encore à créer une biomasse par un processus de photosynthèse, cette biomasse comprenant un second produit de photosynthèse. Puis la méthode consiste à fournir du CO_2 à la biomasse en cours de formation, au moins une partie de ce CO_2 étant consommée pendant le processus de photosynthèse. La méthode consiste éventuellement à récolter la biomasse formée.

Another method is to search the web for a schematic or diagram of a system, subsystem or part of interest. A third method is to look for videos and multimedia presentations available online and consider how they describe similar features or subsystems (for example, YouTube). A fourth method is to look at the company websites of suppliers or competitors for schematics and parts lists, which in the case of the biofuels example would be other biofuels companies.

FTO search

The **second stage** in FTO determination involves an FTO search of the patent literature for potentially relevant patent documents. *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020) provides detailed guidance for carrying out an FTO search. You would perform an FTO search of patent literature in databases such as WIPO's PATENTSCOPE database and those offered by national and regional patent offices to find potentially relevant documents. Search strategies include searching keywords, patent classification symbols, names such as names of known/potential competitors, applicants and inventors in this area, and possibly also looking at forward and backward citations.

Your FTO search for patent documents should include granted patents and published patent applications. As discussed above, it is important to search for granted patents because you want to know what granted IP rights could be relevant to your plans. When you look at the patents you find for inventions similar to your proposed product or service, you will see that some of them are enforceable patents, but others are expired or abandoned patents. It is also important to search for published patent applications because they indicate what IP rights could exist if claims are allowed and they are eventually granted a patent, or claims that were never allowed and therefore would not raise FTO issues for the claimed inventions. Finally, be aware that some databases preferentially return a published application even when the application was granted as a patent, so you still need to check the current legal status of every document returned by a database.

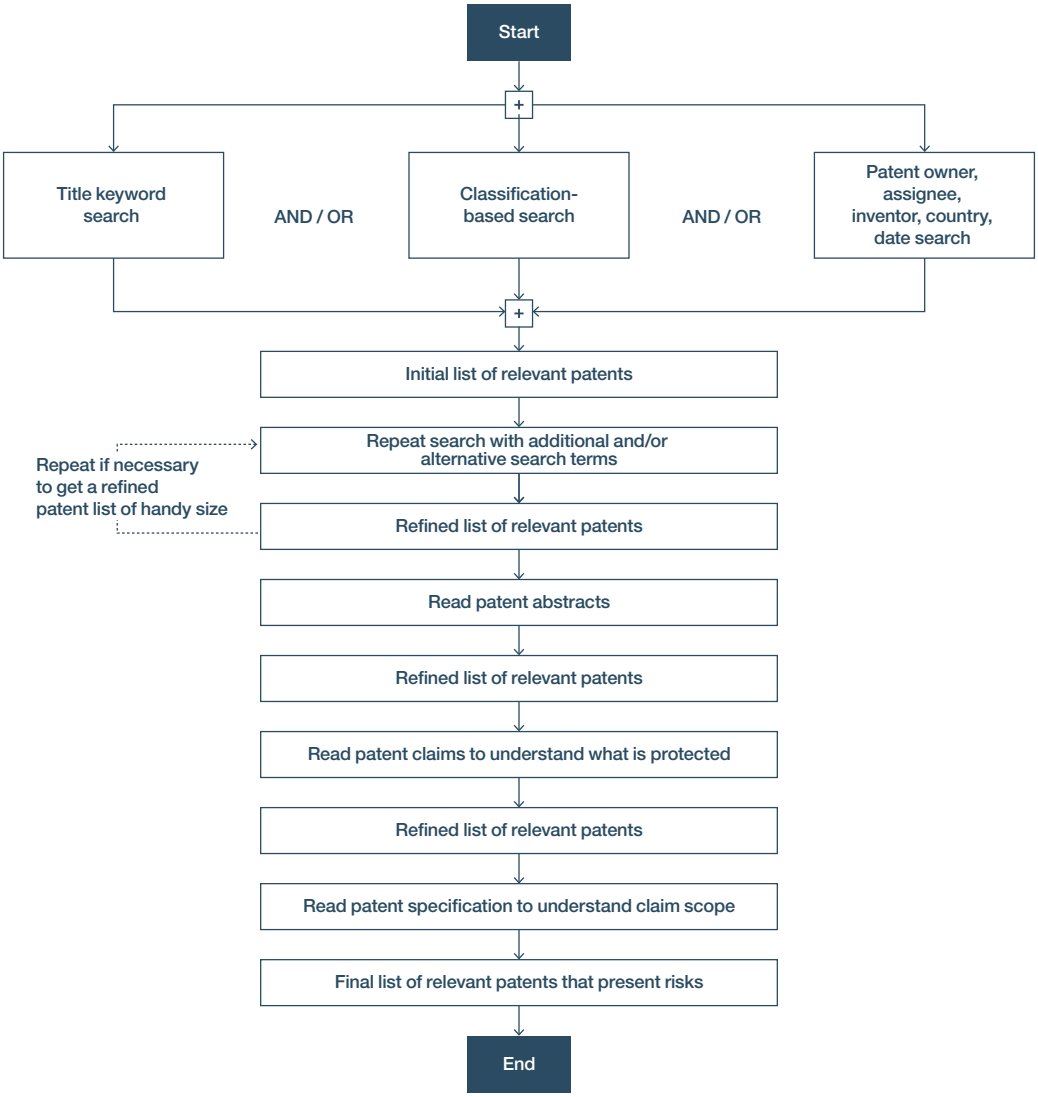
Review the results of your FTO search

If the results of your search do not produce a satisfactory collection of relevant patent documents, or produce too many results, you may want to refine your search. How to do this is described in *Using Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020), reproduced in Figure 9. You might want to look at some of the patent documents in your search results, to consider whether to modify the functional deconstruction of your product or service.

A tip for checking the search quality is that a good FTO search should find relevant patent documents that you already know about. These might be patents for products or methods that you have already licensed as part of the NPD process, or they might be patent documents you found while using the Competitive Advantage tool. If your FTO search does not find these known patent documents, your search strategy could be flawed. You may need to review and revise your search inputs, such as the draft "claims" you used for keyword searching, and consider other search terms.

When you have a collection of search results, use database functions to arrange your search results for efficient review. Such features could include deduplicating functions, or grouping related patent documents in the same patent family. An extremely useful function involves making sure published patent applications are connected to any patent that issued from them. Databases often have multiple entries for the same patent document at different stages, such that a patent application may be published under a publication number and later issued as a patent with a patent number. If your search results tell you that a patent application has issued as a patent but you did not retrieve the patent using these search terms, you should use the patent number to retrieve the patent and look at the granted claims that define the patented invention, in case the granted claims are very different from the previous claims in the application.

Figure 9: Steps to refine your patent search results to get a list of relevant patents of interest, reproduced from *Using Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020).



How do you enter data in the FTO tool?

Begin to enter information on the "Inputs" tab of the FTO workbook. First, list your draft claims in row 2, starting at column B on the "Inputs" tab (entitled "My draft claim 1"). Your claims describe your product or service at multiple levels, and these claims were used to generate search terms for the FTO search. Beginning at column B, enter each of your claims in a separate column. Put the broadest claim with a complete description of your product or service, including all of the required steps and/or components, in column B of row 2. Put each narrower, dependent-style claim in each of the remaining columns, beginning at column C of row 2. These dependent-style claims include more detail about features (components, subsystems) of the invention described in column B, or specific ways of making or using the invention described in column B.

Next, list search results in column A starting at row 3 of the "Inputs" tab (entitled "Patent documents to consider") with one patent document per row. Identify each patent document by its patent number or application/publication number, which usually includes a two-letter country or patent office abbreviation. First, list patent documents from the original list generated by the Competitive Advantage tool. (List granted patents by their patent number, even if you originally found the patent document as a published patent application.) Next, list any additional relevant patent documents you found from the FTO search. You might want

to include detailed notes about the FTO search and/or FTO search results in the "Notes and references" tab, or in a separate document.

Check the current legal status of each patent document and list it in the column on the far right. Your FTO search may have identified a granted patent, and you should determine whether it is still in force, or whether it is no longer in force because it expired, or was abandoned, invalidated, revoked, disclaimed, etc. Your FTO search may have found a published patent application, and you need to know whether this published patent application later issued as a patent and if so, with claims that might represent enforceable IP rights. If the published patent application is still pending, then you do not know if there will ever be IP rights to consider, but if it was rejected or abandoned then it will not be associated with enforceable IP rights. You should include notes about legal status in the "Notes and references" tab.

To develop your closeness rankings and compare claims, you can use a claim chart as described in *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020) in section 4.2. of Module IV. A claim chart template is available in the guide (see Annexes C.2.a and C.2.b). You can create the chart on the "Notes and references" sheet of the FTO tool or add another tab to the workbook. Using such a table to compare claims relating to your product or service with patents and patent applications that seem to have similar claims is a good way to come up with the rankings for "closeness" of claims that you can then enter on the "Inputs" tab of the FTO tool.

Figure 10 shows the "Inputs" tab of the FTO workbook using the biofuels example.

Figure 10: **The "Inputs" tab of the FTO workbook using the biofuels example, showing the patent documents that were analyzed (column A) and each draft "claim" to your product or service (columns B through E), with a rank of the closeness of each document/claim combination entered in the corresponding cell. The current legal status is listed in column L and the average closeness rank for each patent document is listed in column M.**

Compare claims in the patent documents with draft claims to design specifications, rank closeness on a scale of 1 to 10

Patent documents to consider	1. A vessel-based method for producing biofuel or bioenergy product(s) from organic solid waste, comprising: hydrolyzing materials from the solid waste to produce treated and available carbon sources; and synthesizing one or more biofuel or bioenergy products in bioreactors through microbial action, using the hydrolyzed waste materials as a carbon source.	2. The method of claim 1, wherein the waste material comprises municipal or other solid biowaste material.	3. The method of claim 1, wherein the solid waste organic material is selected from at least one of switchgrass, leaves, and wheat straw.	4. The method of claim 1, wherein the microorganisms include an extremophilic fungus.	My draft claim 5	My draft claim 6	My draft claim 7	My draft claim 8	My draft claim 9	My draft claim 10	Current legal status of patent document	Average
KR1020180029825	6	5	6	7							Refused 29/11/2018	6
US20120192482	6	8	7	5							Abandoned 30/06/2014	6.5
US Pat. 9117205	6	4	3	3							Patent granted 25/08/2015. Published as US20130228623	4
US20110165639	5	8	3	6							Abandoned 10/01/2015	5.5
US Pat. 9481513	2	2	1	1							Patent granted 01/11/2016. Published as US20130084159	1.5

How do you analyze data in the "Inputs" tab of the FTO tool?

Data analysis will involve comparing the "claims" describing your product or service with the patent documents you found, and then ranking them on the basis of the closeness of the technical approaches described in each. Embedded functions in the FTO tool will calculate average measures of the closeness of each patent document and provide tabular and graphic displays.

Comparing

The FTO tool will use a modified version of the comparison step of FTO analysis. You will start analyzing data in the "Inputs" tab by comparing the claim set (all the claims) of each patent document in column A with each of the claims describing your product or service. In this comparison, consider how well the design specifications of your product or service would

implement the invention(s) in the claim set of that patent document. You drafted these claims as a technical description of how you will achieve the design specifications for the product or service you want to develop in this NPD project, with your draft claim 1 being a complete description of the essential, required features of the product or service, and the subsequent claims citing details of specific features, components, subsystems or preferred ways of practicing the product or service.

To the extent that the claims cite specific technical features, compare these with the technical features (design specifications) you listed in each draft claim to your product or service. You should note what is the same or similar, and what is significantly different between the claims of the patent document and your product and service. In some cases, the patent document will not cite certain technical features (design specifications) in some of your claims. As described below, you will determine how close the claims of each patent document are to the technical features of each of your draft claims and then assign a rank from 1 to 10.

Figure 10 shows a completed "Inputs" tab using the biofuels example, with rankings entered for the comparison of all of the claims of each patent document with each of the draft "claims" to your product or service.

The comparison you will carry out for the FTO tool is broad, and it is based on treating the claim set of a patent document as a single description of the claimed invention of that patent document, and then comparing this generalized view against each one of the draft claims describing your product or service. In contrast, a formal FTO analysis usually involves an exhaustive claim-by-claim infringement analysis that includes detailed claim construction of each claim of each patent document, interpreting the possible scope of each element (feature) in each claim in view of the entire specification of the patent document, and then comparing a proposed invention with the invention described in each claim, followed by a determination of whether they may be the same invention, according to the all-elements rule as described in *Identifying Inventions in the Public Domain: A Guide for Inventors and Entrepreneurs* (2020) in Module III.4 and III.6. That level of analysis is beyond the scope of the FTO tool.

Analysis and ranking

The FTO tool uses a simplified approach to FTO analysis. For this tool, you evaluate the similarity of your product or service to the invention(s) cited in the claims of a patent document, and then assign a single rank value from 1 to 10 in each cell that corresponds to the entire patent document and one of the draft claims to your product or service. The rank value is your subjective assessment of the perceived similarity or "closeness" of your product or service as described in that draft claim, and the invention(s) in the claims of that patent document.

A rank value of 1 means you compared your product or service as described in your claim with the claims of the patent document, and concluded that your product or service as described in that claim is *not* similar to the invention(s) in the claims of the patent document. A rank value of 1 means you think there is no threat that you would be using the invention of that patent document and therefore that patent document poses no threat to your plans for your product or service.

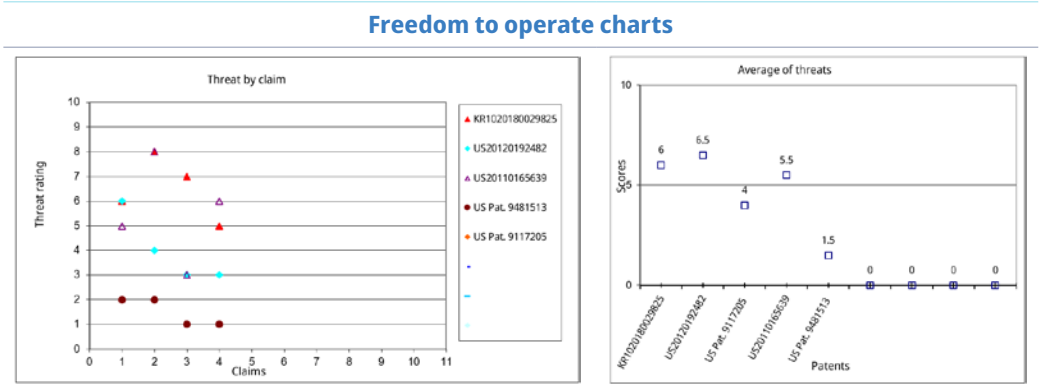
A rank value of 10 means you compared your product or service as described in your draft claim with the claims of the patent document, and concluded that your product or service as described in that draft claim appears to be very similar to the invention(s) in the claims of this patent document. A rank value of 10 means you concluded there is a possibility that using your product or service as described in that claim might be the same as using the invention(s) in the claims of that patent document.

To summarize, a low rank value means you do not find closeness between your claim and the invention(s) cited in the claims of a patent document. A higher rank value indicates where you have perceived some degree of "threat" that you might infringe if you use your product or service in a way that might fall within at least one of the claims of the patent document. A higher ranking also indicates where you might want to license a patented invention.

Remember that this ranking system is merely a way of quantifying your subjective assessment of how close your product or service is to the technology claimed in the patent document you analyzed. This ranking system is based on a technical comparison of your product or service with technical disclosures in the claims of a patent document. The result from this technical comparison is a hypothetical result based on your subjective assessment. This comparison is not a legal analysis and does not support any legal conclusions. Thus, the exercise of comparing, analyzing and ranking does mean any IP rights actually have been infringed or would be infringed.

After you enter a rank value in each cell, an embedded formula in the spreadsheet will find the average rank you assigned to the entire patent document, by taking an average of all the rank values in the row corresponding to that patent document and displaying it at the end of the row. The rank values for each patent document with respect to each one of your draft claims are then imported into the "Results" tab of the FTO tool, where embedded functions generate a "Threat by claim" graph on the left, and an "Average of threats" graph on the right. Each graph reflects a different way of evaluating the possibility that using your product or service might be considered to infringe the claims of any of these patent documents. Figure 11 shows the "Results" tab from the FTO workbook using the biofuels example.

Figure 11: The "Results" tab of the FTO workbook using the biofuels example.



How do you interpret the data in the FTO tool results, and use it in your NPD process?

The data on the "Results" tab of the FTO workbook shows the perceived similarity between your product or service, and the inventions in the claims of the patent documents you analyzed. That is, the data shows your perception of the closeness of the current design specifications for your product or service, and the technical features of inventions in the claims of these patent documents.

For the FTO tool, this similarity is characterized as the potential threat that using your product or service might be similar to, or the same as, using the invention claimed in a patent document. The term "threat" is intended to be a reminder that using the patented invention of an enforceable patent requires permission from the patent owner, and using the patented invention without permission would infringe the patent. A threat level above five (5) for a patent document means you should consider the risk of potential infringement *if* the patent document is an enforceable patent in any country at any time you plan to use your product or service (see below).

The "Threat by claim" graph provides a claim-by-claim analysis of the similarity (threat level) of each patent document for each individual claim. This graph allows you to consider the product or service as a whole (claim 1) or specific design features (claims 2 through 4).

The "Average of threats" graph shows the average similarity (threat level) of each patent document, for all the draft claims to your product or service. This graph allows you to identify patent documents with claims that have higher or lower overall similarity to your product or service.

Interpreting the data in the FTO tool results

It is critical to look at the legal status of each patent document you analyzed. Your top concern is any enforceable patents in a country of interest, during a time period when you plan to use your product or service in that country. Another concern is any published application that was later granted as a patent that would be enforceable in a country of interest, during a time period when you plan to use your product or service in that country. These represent the existence of patent rights that the patent owner can enforce by granting or denying permission to use the patented invention in that country. On the other hand, patents that are no longer in force because of expiration, abandonment, withdrawal, revocation, invalidation, etc., do not represent enforceable patent rights for the invention recited in the claims. Likewise, published patent applications that are abandoned, withdrawn, etc., and never issued as a patent, do not represent enforceable patent rights.

You can use information from the FTO search and subsequent analysis to choose various courses of action. After your analysis, you may decide to take a license to some of the patent documents you identified in the FTO search results. A different course of action would be to alter some of your design specifications to be different from the inventions in the claims of certain patent documents you identified in the FTO search, to avoid potential FTO issues. You might choose different design specifications that do not appear to raise FTO issues. In some cases, you might find that no enforceable patents cover your product or service, which might indicate a public domain invention. Finally, if none of these patent documents from the FTO search completely disclose your current product or service design, you might consider seeking your own patent protection for the combination of features and functions in that design that work together to yield your product or service.

In the biofuels example, the patent documents listed in column A of the "Inputs" tab shown in Figure 10 include one published Korean patent application, two published US applications and two granted US patents, with the current legal status of each patent document listed in column L. The two US patents were granted on the dates listed in column L. The Korean application was refused in 2018 and never issued as a granted patent in Korea. The published US applications were abandoned during prosecution, with the official abandonment dates assigned by the United States Patent and Trademark Office (USPTO) listed in column L. That means the rejected published Korean application and the abandoned published US applications are not enforceable patents that could be infringed.

The graphs on the "Results" tab shown in Figure 11 using the biofuels example show that the granted enforceable US patents had low threat values for the biofuels mini-refinery process for making biofuels and its features (subsystems) as described in claims 1 through 4. Some of the published patent applications were calculated to have higher potential threat values, but they do not pose an *actual* threat because they never issued as patents and do not represent enforceable patent rights. Nevertheless, these published patent applications are a useful part of an FTO determination because all of these patent documents describe useful designs and features, and these documents can also indicate inventors, companies or patent families that you might want to monitor as you continue the NPD process.

Conclusion

If you are at an early stage in the NPD process and do not know exactly how you will implement the design specifications, informal FTO analysis using the FTO tool can provide a way to explore different design choices that are available. You can develop different approaches to designing and implementing your product or service. You can draft a set of claims to describe each different preliminary design and its design specifications, then do an FTO search for each preliminary design and evaluate the results for that preliminary design in a separate FTO workbook. The FTO workbook will display results in numerical and graphical formats that can provide guidance about what technology you may be able to use freely to meet your design specifications, and what technology you should consider licensing if you want to proceed with that design. At this early stage of NPD, informal FTO analysis using the tool can also indicate design specifications you might want to modify before proceeding.

Regardless of where you are in the NPD process, an informal analysis using the FTO tool should be viewed as a way to prepare for conducting a more rigorous and comprehensive FTO determination with the help of FTO professionals. The importance of having qualified professionals carry out comprehensive FTO determinations cannot be overstated.

Your informal analysis using the FTO tool should be *updated at each gate* because as you continue your NPD process, new patents could issue that might be relevant to FTO for your product or service. Existing patents could become unenforceable and no longer have potential impact on your FTO. You should know about any significant changes in the landscape of patent rights any time you make a Go/No Go decision at a gate. Many law firms and independent IP consultants will be able to set up a scan of the patent literature for new developments and alert you if new patents are granted or new patent applications are published that could give rise to FTO issues for your product or service.

After you review the results of informal FTO analysis, decide if you have found any patent documents that you are concerned about infringing. If you are satisfied that you have not found a risk of infringement, and/or that you have taken steps to address that risk, move forward with NPD. If you find one or more patents that seriously concern you, decide if you want to take a license from the patent owner. Or, decide if you can take steps to lower the risk of infringing, such as changing a design specification or designing around the patented invention. Another option is to attack a granted patent and seek to have it revoked or invalidated, but be aware that this can involve costly legal proceedings. If you cannot find a way to lower FTO-related risk at this early stage of NPD, you need to seriously consider how much risk of downstream infringement lawsuits you are willing to bear. If the level of risk is too high and you cannot mitigate it, your best option may be to stop the NPD project.

Remember, the most important goal of carrying out an informal analysis using the FTO tool is to gain as much high-quality information as possible about the landscape of patent rights that could affect your NPD plans for your product or service. With this information, you can make informed decisions throughout the NPD process. Also remember that no matter how good you feel your informal FTO analysis has been, it is not the same as an analysis conducted by a qualified professional such as an IP attorney or other patent professional who is competent to carry out the legal analysis required for an opinion on FTO for your product or service.

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