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Owning the New Economy: A Guide to Intellectual Property Management for Australia's Clean Technology Sector

Kane Wishart

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Kane Wishart

ANU College of Law

Australian Research Council

Abstract

Australia's history of developing and managing the intellectual property rights of domestic innovations is – at best – mixed. The relevant immaturity of Australia's public sector commercialisation infrastructure has, over recent decades, been the subject of both stinging academic commentary and not insubstantial juridical disbelief. That said, improvements have been observed, and increasingly, private sector involvement in public sector innovation has allowed for a deepening refinement of domestic approaches to IP retention and ongoing management.

Rather than a bare critique of Australia's IP management track-record, or a call for specific law reform, this manual engages at a more practical level some of the foundational questions that ought be asked by entities involved in the 'cleantech' industries. Beginning simply at what is IP and why it matters, this manual examines the models of IP management available to market participants around the world.

The process of IP management is defined and assessed through a commercial lens; assessing the 'pros' and 'cons' of each management choice with a view to equipping the reader to determine which approach may be best adapted to their given clean tech project. The manual concludes with a brief survey of alternative models of Intellectual Property management, including relevant examples from overseas and prominent suggestions arising out of the academic discourse.

It appears inevitable that the global warming challenge will prompt specific legislative, regulatory and multi-lateral responses by nation states, however, the ultimate form of any such response remains a highly contested political and social issue.

Accordingly, the structure of this manual, and the discussion points raised herein, seek introduce the reader to some of the more contentious debates occurring around the world at the intersection between IP and climate change.

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This Manual on Intellectual Property Management in the clean technology sector is undertaken as part of Associate Professor Matthew Rimmer's ARC Future Fellowship on Intellectual Property and Climate Change.

Dr Rimmer's research stretches across issues from patent law to copyright to trademark law and beyond, examining how these legal disciplines and the industries they regulate contribute to or constrain action on climate change. It covers issues as diverse as technology transfer and access to technologies, greenwashing and culture jamming.

This manual aims to provide a new resource to researchers and associated services providers engaged in the clean technology sector, as an introduction to some of the concepts and issues of Intellectual Property, and to argue why an at least foundational understanding of these concepts can assist in the success and durability of a clean technology venture. While much has been written academically on climate change, there is little in the way of practical guidance for those actively engaged in the development of new IP as to how they might best secure, maintain and manage that IP. This project hopes to go some way to filling those gaps in a concise and practically-focused manner.

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1. INTRODUCTION

Intellectual property (**IP**) inhabits a strange and unique place in Australia's public policy landscape. There is more or less bipartisan agreement that properly calibrated, intellectual property policy plays a vital role in fostering innovation and driving growth in the economy. However, there appears to be an equally bipartisan lack of appreciation of what intellectual property is, how it operates within the economy, and what economic ramifications may follow on from otherwise subtle changes to the nation's intellectual property laws and policy settings.

It is unsurprising then, to find that the same level of confusion can often spill over into the public discourse around IP. Often discussion of IP gets caught up as collateral in broader debates regarding the economy, trade-liberalisation and international organisations. When this happens, commentators often gloss over the foundational principles of what IP is, and how it operates, and move straight over to the top to discuss those broader debates from a beginning premise that Intellectual Property Rights (**IPRs**) are either axiomatically "good" or "bad". Inasmuch, members of the public can perhaps be forgiven for often having a moral position with respect to IP despite not necessarily having a strong understanding of what IP is.

This brings us to the first important goal of this manual: first, what is IP? what are the important forms of IP? And most importantly, why should any of it matter to someone trying to get on with the job of commercialising their promising clean tech innovation?

1.1 What is Intellectual Property?

The Australian Government agency which administers the regulation and grant of IPRs in Australia is IP Australia. IP Australia defines IP rather succinctly, stating on its website that IP is:

> *…the property of your mind or proprietary knowledge. It can be an invention, a trade mark, a design or the practical application of your idea.*[1]

Even from this attempt to provide a simple description of IP, a point of potential confusion emerges. IP Australia use the perhaps unintuitive phrase 'property of your mind' in describing IP. This is illustrative of one of the core tensions at the heart of intellectual property, which can often be difficult to conceptualise.

On one hand, IP undoubtedly has many of the characteristics of 'property'. Much like a car, house, or laptop computer, IP is 'owned', and the owner(s) of that IP are at liberty to exploit or dispose of that property as they wish. The property can be bought or sold. The owner can provide access to the property on certain terms (often referred to as a 'license'), and such terms may be exclusive or non-exclusive. The owner(s) rights in respect of that property are in practice absolute: they may choose to be the sole user of that property, to the exclusion of all others, or they may choose to have nobody exploit the property, and have it (either literally or metaphorically) sit fallow, gathering dust[2].

But on the other hand, it is unhelpful to merely describe IPRs in the language of real or personal property. Because in one very important way, they are quite distinct from tangible property. IPRs are not physical objects over which ownership can be readily

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[1] IP Australia, *Understanding Intellectual Property* (30 July 2015) <http://www.ipaustralia.gov.au/understanding-intellectual-property/>

[2] The treatment of IPRs as simple property rights is a subject of intense criticism: see for examples the collected publications of Peter Drahos and John Braithwaite.

understood. Intuitively, people understand what it is to sell their car: they agree on a price, sign the relevant title papers, and hand over the keys. Quite literally, the new owner will drive away with the property, which is now wholly theirs, and the former owner, having sold the property, can have no future claim to it. What does it mean though, to sell a patent or a trademark to someone?

The World Trade Organisation defines IPRs perhaps less confusingly, as follows:

> *Intellectual property rights are the rights given to persons over the creations of their minds.*[3]

So rather than being the "property of your mind", IPRs are to be understood as *rights* which are given to *persons* over the creation of *their minds*. That is to say, that IPRs are not property rights in the sense of being to physical objects, but are instead rights to the creations of a mind, sometimes termed as being 'artistic or intellectual endeavours'. Often, IPRs are referred to as a form of 'intangible' property rights, to make the distinction with other forms of property clear.

With IPRs so framed, the sequence can be understood as follows. A person or group working together, conceive of something new. These 'creators' are able to define their creation, and have determined that it is in fact new, by comparing it against everything else already in the world. These creators may be entitled to a set of rights in respect of their creation, their innovation. These rights can be understood in many respects as being analogous to property rights. The way those rights are described may differ depending on the nature of the innovation: if the innovation is an artistic work, it may be protected by copyright; if the innovation is a new molecule for treating cancer, it may be protected by a patent. While these IPRs are different in important ways, but they have in common the same core property right tenets: the exclusive right to exploit (and its corollary, the right to exclude others from exploiting) that new innovation.

But why have IPRs at all? What purpose do they serve?

IPRs are often described as providing a "balance" between competing interests in a marketplace. Justice Brennan of the High Court of Australia in the case of *Parkdale v Puxu*[4] referred to a "careful balance" which sits at the heart of IP legislation such as the *Patents Act* and *Designs Act*: namely, the interests of IP owners on the one hand, and the interests of consumers of the goods and services which embody that same IP, on the other.
The underlying rationale for IPRs can be surmised as follows:

- the creation of IP often involves intellectual effort that may be resource intensive, and an IP creator ought be able to recoup the cost of that expenditure;
- the creator of IP has provided a public good, by virtue of having created something 'new', and deserves recognition in the form of some form of control or proprietorship over the ultimate fate of their creation; and
- absent such recognition or opportunity to recoup their costs, IP creators may be disincentivised from future acts of creativity or innovation.[5]

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[3] World Trade Organisation, *What are intellectual property rights?* (2015) https://www.wto.org/english/tratop_e/trips_e/intel1_e.htm

[4] *Parkdale Custom Built Furniture Pty Ltd v Puxu Pty Ltd* (1982) 149 CLR 191 at [224]

[5] It is important to note that the so-called "incentive" theory of IP is the subject of some considerable controversy. See for example, Jill McKeough, Kathy Bowrey and Phillip Griffith (eds), *Intellectual Property*

However, balanced against this rationale, are good public policy reasons to limit the extent to which IPRs are conferred upon creators. Putting aside the validity or otherwise of the above presumptions, it is clear that consumers benefit from competition in the sale and supply of goods and services. The granting of an IPR provides a potential monopoly to the creator, or to the licensees of that IPR from the creator, inhibiting competition in the market for the good or service embodying that IPR. Accordingly, in all jurisdictions including Australia, there are set "terms" in legislation, after which an IPR will expiry. Unlike other forms of property, where the set of rights endure and run with the physical object through each consecutive owner, the granting of an IPR comes with a date of final expiry, after which the artificial 'monopoly' created by the IPR will end.

In this sense, an IPR can also be described as a form of regulation, rather than a bare property right. Describing intellectual property using the language of regulation is preferred by some economists[6], who see IP as no different to other forms of government intervention into the free market, where the "competitive norm" is departed from in order to achieve "socially desirable"[7] ends. It may be that to a business-person or head of a clean-tech start up, this is a more comfortable way to understand IP. Not as a property right *per se*, but as a form of regulation on the behaviour of persons and companies in the market.

Justice Holmes explains in the copyright case *White-Smith*[8] that:

> *The right to exclude is not directed to an object in possession or owned…it restrains the spontaneity of men when but for it there would be nothing of the kind to hinder their doing as they saw fit. It is a prohibition of conduct remote from the persons or tangibles of the party having the right*".

References to "getting the balance right" abound in discussions around IPRs, echoing the competing public policy rationales set out above. Sometimes getting the balance right may means as little as increasing or decreasing the term of expiry for a given form of IP. Other commentators seek to examine the justification for and future regulation of IPRs in the context of broader discussions of competition policy, privacy, digital rights, public health, international aid or environmental issues such as biodiversity and climate change. Some of these debates will be explored in a later part of this manual.

Having established what IP is, it may be illustrative to set out each of the different 'kinds' of IPRs available in Australia, as well as briefly touching on the legislation and regulation relevant to their use, before turning to consider how each kind of IPR might be relevant to someone involved in the clean-technology sector.

1.2 Trademarks

A trade mark is defined as:

> *is a sign used, or intended to be used, to distinguish goods or services dealt with or provided in the course of trade by a person from goods or services so dealt with or provided by any other person*.[9]

Commentary and Materials (Lawbook Co, 4th ed, 2006) at 15 who observe that "*the computing industry took off in the 80s and 90s with weak, if any, intellectual property protection, but this did not lead to any shortage of innovation*".

[6] Lemley, Mark A., *IP and Other Regulations* (April 2, 2015). Stanford Law and Economics Olin Working Paper No. 476; Stanford Public Law Working Paper No. 2589278. See: http://dx.doi.org/10.2139/ssrn.2589278

[7] Ibid, at 3.

[8] *White-Smith Music Publishing Co v Apollo Co* (1908) 209 US 1 at 19

In Australia, the principle legislation governing trade marks is the Trade Marks Act, however, given that trademarks are used "in the course of trade", it is perhaps unsurprising that the Australian Consumer Law and related common law also bears on their regulation and use.

Trade marks are a form of registered IPR, meaning that to obtain the protections associated with the IPR an applicant must make an application to register their trade mark. An application needs to include a representation of the trade mark, which is usually a word or image (less commonly, so-called 'non-traditional' trade marks can include more abstract ideas such as a colour scheme, shape or scent).

Importantly, a trade-mark registration must specific the goods and services that the trade mark is intended to be used to distinguish. This is to allow for the co-existence of, for example, a trade mark for 'ready to roll' in association with baked goods, registered by one company, and a trade mark for the same mark in association with synthetic lawn turf, registered by another company. The goods and services specified are assigned to discrete 'classes' of goods and services under an international convention[10], which allows for the convenient determination as to whether or not two given trademarks concern goods or services of similar, or unrelated, classes. [11]

One of the implications of the trade mark definition, namely that a trade mark is a sign that is "used to distinguish goods or services", is that a trade mark cannot be merely descriptive. The test is that the mark must be "inherently adapted to distinguish"[12] the goods of the applicant from those of the applicant's competitors.

This has particular implications for companies operating in the clean technology space.

One of the pioneering lawyers in the clean technology space, Eric Lane, describes the present as an "Eco-mark Era", reflecting the sharp increase in applications for trade marks in the United States incorporating terms such as 'Green', 'Clean', 'Eco', 'Environment' and 'Enviro'[13]. Lane observes that this increasingly pervasive use of 'clean' and 'green' will have implications in terms of adjudicating whether a proposed trade mark is "merely descriptive" of the product being sold.

By way of example, it may have been that in decades past, a company supplying mains grid electricity could have obtained a trade mark for 'Green Energy', with 'green' being no more than the chosen colour and branding they've decided to use to distinguish their company from other traders in the same space. These days however, a trade mark office is likely to consider green energy to be descriptive, given the pervasive connotation the phrase has in reference to renewable power generation.

Those operating in the clean technology sector should consider carefully how they wish to brand their venture, and in particular, whether their branding is inherently capable of distinguishing their goods or service as against other traders, against the backdrop of an increasingly "clean technology savvy" consumer base.

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[9] *Trade Marks Act 1995* (Cth) s17

[10] *Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks (as amended on September 28, 1979)*, entered into force 6 September 1982.

[11] IP Australia provides a convenient search engine for determining what classes a particular good or service might fall into, available via their website at http://xeno.ipaustralia.gov.au/tmgns/facelets/tmgoods.xhtml

[12] *Trade Marks Act 1995 (Cth)* s41; see also Cantarella Bros Pty Limited V Modena Trading Pty Limited [2014] HCA 48

[13] Eric L. Lane, *Clean Tech Intellectual Property: Eco-marks, Green Patents and Green Innovation* (Oxford University Press, 2011), Chapter 7

Of regulatory concern in this space is the related concept of 'green-washing', whereby a company makes a false or misleading claim as to the cleantech credentials of their goods or service by association with 'green', 'clean' or similar words in their branding, when in fact their products are not especially environmentally friendly.

The Australian Competition and Consumer Commission (**ACCC**) have been keeping a close-watch on potential instances of green-washing and have been surprisingly successful to date in policing this form of misleading conduct. Most recently, Holden was censured by the Federal Court of Australia for its 2007 marketing campaign which claimed its new Saabs were "Grrrrrreen" and promised that "Carbon emissions [were] neutral across the entire Saab range"[14]. In support of this claim, the advertising carried with it a claim that the carbon emissions were offset by way of "planting 17 native trees per car sold". The ACCC took the time to crunch the numbers, and determined that, on average use, 17 native trees may, at best, offset the carbon emissions of the car for the first year. The ACCC alleged that consumers would have been misled into presuming that the car was carbon-neutral for the life of the car, and the Federal Court of Australia agreed, ordering GM Holden to pay not only costs, but to plant 12,500 additional trees to make good the original offer for each of the Saab cars already purchased.

In this there is a lesson not only for new market entrants, but for existing companies seeking to diversify into the clean technology space[15].

1.3 Designs

Designs law has been referred to as the "less glamorous cousin"[16] of the other IPRs, perhaps owing to the relatively narrow space of intellectual and creative endeavour to which it applies. In Australia, the law governing designs protection is best understood by first looking to the laws origins. In many respects, designs protection has its origins in both the law of copyright as well as aspects of patent law. As with a patent, a registered design confers a monopoly on the design owner, who may then exclusively exploit their work for a period of time. While a registered design may supplement a registered patent, it is not a substitute: a registered design will only protect those specific features of the design which are new and distinctive. In some instances, the design of a good might be registered despite that good being non-patentable (for example, it may be a new and distinctive design for an existing third-party good).

Under Australian law, a design is defined, in relation to a product, as meaning "*the overall appearance of the product resulting from one or more visual features of the product*"[17].

In order to be registered, a design must be 'new and distinctive' when compared to previously published designs or designs previously used in Australia[18].

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[14] *ACCC v GM Holden Ltd* [2008] FCA 1428
[15] A phenomenon already well underway. See: https://www.ge.com/about-us/ecomagination
[16] Above 5, at 529.
[17] *Designs Act 2003* (Cth), s5

Although often discussed as an afterthought in broader discussions of IPRs, designs protection has certainly played a role in the growing clean technology sector. One of the best examples of early adopting of clean technology is the rapid dissemination of energy-efficient lightbulbs throughout Australia, largely rendering the incandescent globe obsolete[19]. A key point-of-difference of products in this space is that of design, with the underlying technology of energy-efficient globes (increasingly LED technology[20]) the same across different products.

At its core, Designs protection affords an additional layer of IPRs for innovators and creators that might otherwise find themselves with little in the way of protection when they arrive on design-features of an existing product which consumers prefer. In an open-market, imitators would rush to borrow from that design (this is at least part of the broad-ranging set of allegations which Apple made against Samsung in its infamous, global IP battle, with the Australian case including allegations of infringement of four registered designs). By providing a short period of protection, designs protection in Australia allows for those aspects of a design which consumers find particularly appealing to be defended against any such imitation, providing a kind of "aesthetic monopoly" to the original designer.

1.4 Copyright

Copyright is perhaps the most well-known, and certainly one of the more complex, forms of IP. Copyright in its present form provides protection to original literary, dramatic, musical or artistic works[21], insofar as those works are reducible to a tangible form (exceptions to this requirement exist for non-tangible mediums such as television broadcasts, feature films and sound recordings). Commonly cited examples include novels, CDs, paintings, photographs or screenplays.

Copyright is best thought of as the means by which the creative fields can protect their works. Copyright does not require registration, and subsists from the moment of initial creation. Much like other IPRs, copyright can be licensed or otherwise assigned.

At first instance, it may not be readily apparent how copyright would be relevant to the activities of a company or individual in the clean technology sector. However, copyright is a useful IPR for a variety of reasons, including the lack of any need to register the right, as well as the quite considerable length of time it takes for copyright to expiry (under Australian law, 70 years after the year in which the author of the work died[22]).

A clean technology venture may not consider protection for creative works as being necessarily relevant to their endeavours, but it may prove an important complement to other IPRs such as patents in protecting and commercialising a given technology. For example, consider a start-up company seeking to commercialise an industrial-scale solar photovoltaic technology. It may be that an imitator wishing to copy the technology manages to successfully invalidate the patent to the technology in the Court. However,

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[18] Ibid, s15

[19] THE Australian Government is in the process of phasing out incandescent globes, with many such globes currently no longer for sale. See: http://www.energyrating.gov.au/products-themes/lighting/lighting-and-phase-out-general-information/incandescent-light-bulbs-phase-out/

[20] The 2014 Nobel Prize for Physics was awarded to the co-inventors of blue LEDs, but this accolade perhaps hides the long and storied history of IP litigation between the companies employing some of the various inventors, encompassing some 10 LED-related lawsuits spanning six years. See: http://www.wipo.int/wipo_magazine/en/2014/06/article_0001.html

[21] *Copyright Act 1968* (Cth), s10 and Parts III and IV generally

[22] Ibid, s33.

suppose that the technology is relatively idiosyncratic, and that it requires considerable training and know-how to operate. Any manual on its use created by the start-up would be protected by copyright, meaning the imitator cannot simply copy it along with the technology itself. Drafting a new manual may not be an insurmountable challenge, but if it takes significant time or resources for the imitator to complete, it is valuable time in which the start-up has kept the imitator out of the market allowing its original technology to obtain significant market capture.

Perhaps less fanciful examples exist beyond the rubric of physical clean technology products and into the realm of online products and services. Increasingly the market is seeing computer programs and "apps" created with a view to improving individual energy efficiency, provide guidance on the carbon intensity of products, or to regulate the energy expenditure inside a home[23]. The code for that program is protected by copyright in Australia, allowing for the program to resist direct imitators from moving into the same space (of course, it is much harder to resist imitators who write their own code to achieve the same ends: copyright will protect only the code for the program, not the ideas or methods embodied by the program).

While for the purposes of this manual, copyright will not be given as considered a treatment as will patent law, it is important to illustrate by way of the above examples that it is by no means irrelevant to the field of clean technology. In many ways, it could deserve its own separate treatment, and clean technology innovators should consider in what way copyright might subsist in elements of their goods or services, and incorporate any such copyright, once identified, into their intellectual property management plan[24].

1.5 Trade Secrets

Trade Secrets are often considered as something of an anachronism, which belies the continuing and important role they play in certain sectors of the economy. Trade Secrets relate to elements of a business's operation which might, for example, confer a competitive advantage, which that business wishes to keep confidential from its competitors. Common examples of trade secrets include manufacturing techniques, customer lists, engineering schematics or marketing procedures.[25] Perhaps the most infamous examples of trade secrets are the recipes for popular consumer products "Coca-Cola" and Kentucky Fried Chicken's "Original Recipe Chicken".

Trade Secrets are considered a gamble, but if they pay off, they build the foundation for extraordinary success. Google's AdWords algorithm is perhaps the corner-stone of that company's ability to monetise its online ubiquity, earning the company millions. Yet the only protection Google has against its competitors obtaining that algorithm is the ongoing confidence of its employees who work with the algorithm (and, if other companies are any example, strict internal discipline on which employees get access to which aspects of the whole 'secret').

A trade secret is not protected by legislation, and forms part of what is called the 'common law', being the set of principles and 'causes of action' developed by the Courts not just in Australia but dating back to Britain, prior to Australia's federation. In essence, a trade secret is exactly what it sounds like: it is a secret kept by those who have knowledge of it. If an employee of a company were to abscond with or otherwise divulge

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[23] See for example, Alphabet Inc's NEST products <https://nest.com/>

[24] Intellectual Property Management plans will be discussed in more detail further below.

[25] Jill McKeough, Kathy Bowrey and Phillip Griffith, above n 5, 545.

a trade secret, that company would have a cause of action against that employee for breach of confidence[26]. Of course, this may be of limited comfort: if the trade secret is valuable enough, no amount of redress against an individual employee will make up for the company's loss. Accordingly, the risk is obvious. Similarly, there is no form of protection for a company against a particularly skilled imitator. For example, if a talent chemist came along and reverse-engineered the formula for Coca-Cola, there would be nothing stopping her from going out and commercialising their own product with the same recipe. As compared with other forms of protection, where a set of property rights can be enforced against third parties, the only protection to a company is by ensuring the continuing confidence of the trade secret within the company.

However, the benefits of trade secret are not insubstantial. For as long as the company can keep the trade secret as a secret, they may enjoy the benefit of it. As the IPR is not conferred by the state *per se*, it does not naturally expire. Importantly, and as contrasted with patents, there is no duty of disclosure required with a trade secret. In some sectors, where the technology heavily depends on the "know-how" associated with that technology (for example, small-to-medium biotechnology or computing firms), such disclosure may dilute the value of the technology to the point that there is little left to "sell", notwithstanding any monopoly conferred by a patent.

Despite this, many firms elect to rely on trade-secrets in lieu of patenting their innovation. This is often a double edged sword. While disclosure can be avoided by electing to rely on trade-secret, the exposure of the company to having that confidence breached by an employee will continue to subsist, particularly in sectors with high-staff turnover (a common feature of many small-to-medium enterprises).

1.6 Patents

Perhaps the most relevant form of IPR – and indeed, the kind of IPR which the balance of this manual will be principally concerned with – is that of the Patent.

Patents are the form of IPRs which apply to inventions. In essence, a patent is a relatively simple quid-pro-quo between an inventor and the state: the inventor is required to disclose to the public what the new invention is, how it works, and to replicate it, and in exchange the state grants the inventor the right to exclude others from practicing the invention for a set period of time. Accordingly, a patent is a form of monopoly right, as with most other forms of IPR. It may be licensed, assigned or otherwise disposed of as the patentee sees fit.

A standard patent[27] may be applied for through IP Australia, at which point an Examiner will be assigned to determine if it fits the criteria for grant. Examination is however, no guarantee of validity: a third party may (and oft times do) challenge the validity of the patent in a court.

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[26] However, criminal charges may apply in some jurisdictions. For example, in the long running case of *U.S. v Sinovel Wind Group Co.* 14:3013, U.S. 7th Circuit, wherein the U.S. Department of Justice has charged Chinese Wind Turbine company, Sinovel Wind Group Co, for stealing some $800 million of proprietary source code and other trade secrets from Massachusetts company American Superconductor Corp.

[27] There is another form of patent, being the innovation patent, however, this manual will not go into detail regarding innovation patents, save to say that they are a shorter monopoly, with a less onerous requirement for examination: that of being "innovative', rather than necessarily "inventive". The innovation patent system has been less than successful and is currently the subject of a report by the Advisory Council on Intellectual Property recommended that it be abolished. See: http://www.acip.gov.au/reviews/all-reviews/review-innovation-patent-system/

To be patentable, an invention must be:

- Patentable subject matter (discussed further below);
- 'novel' in light of the prior art (which is to say, it is genuinely 'new', when judged against the existing field of endeavour);
- Involving an 'inventive step' (meaning that it was not obvious to move from the prior art to the alleged invention, or put another way, someone skilled in the field would not have been directly lead to the invention as a matter of course in pursuing the 'next logical steps' of progress in that field);
- Fully described in the patent application document, which itself must comply with the form requirements set out in legislation[28].

The patent application consists of two parts. Firstly (although usually listed at the back of the patent) are the claims. Claims are discrete integers which must describe the invention being claimed. This is an important facet of patent law, because in defining the invention, the claims also define the scope of the monopoly. A competitor in a field where a patented technology exists must have regard to the claims in determining whether its own product or conduct would infringe that patent. Accordingly, careful drafting is often called for to ensure that the patent is wide-enough to encompass the invention to be protected, but not so wide that the Examiner or the Court would consider that the claims are not 'fairly-based': that is to say, they go beyond the invention as described in the patent specification.

Which neatly leads to the second part of the patent application, the invention. The specification will ordinarily set out the prior art in the relevant field, define the problem in the field solved by the invention, as well as setting out how the invention was arrived at. The specification provides the *evidentiary* basis upon which the claims defining the invention must be based.

This requirement of 'fair basis' is not the only such 'form' requirement. The specification of a patent application must also sufficiently disclose how to put into practice the invention being claimed (if the invention is a method, this would involve setting out how to perform the method; if the invention is a product, this would involve setting out how to manufacture the product). It may be that there is more than one way in which to "practice" the invention being claimed. In such instances, the legislation has a further form requirement, being that the patent application disclose the 'best' method of performing the invention. Interestingly however, there is no requirement that the invention has in fact been performed; courts have opined that an invention may be arrived at "by a happy flash of inspiration", "by accident" (as is all too commonly the case, such as for the infamous drug Viagra), or indeed, simply "remembered from a dream"[29].

Accordingly, the drafting of the patent application will be crucial to whether or not the putative inventor actually ends up with a valid patent. In this way patents sit outside the usual scope of IPRs, which either subsist from the moment of authorship (copyright) or require only a relatively straight-forward registration process, which can be carried out by a lawyer at low cost (trade marks).

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[28] *Patents Act 1990* (Cth), s40

[29] *Advanced Building Systems Pty Ltd v Ramset Fasteners (Aust) Pty Ltd* (1998) 194 CLR 171 at 187 and see also *Wellcome Foundation Ltd v VR Laboratories (Aust) Pty Ltd* (1981) 148 CLR 262 at 282.

A patent application will instead require the services of a patent attorney, specialised professionals, often armed with both a doctorate in a given field (mechanical engineering, chemistry etc) as well as discrete legal training directed to patent drafting. The services of these professionals does not come cheap, and as with any profession, the better quality services often come at a premium cost. A clean technology inventor(s) seeking to commercialise her invention should think carefully about how best to protect the invention, given the up-front cost of protecting that invention by way of the patent system.

Often companies will be faced with an election as to whether to patent a new invention or to rely on trade secret protection, and this election must occur relatively proximate to the act of invention. An inventor who makes so-called 'secret use' of an invention (that is, beginning to practice the invention in secret for a period of time) may be ineligible for the grant of a patent for that invention. Similarly, if elements of the invention (or indeed the existence of the invention itself) are allowed into the public domain, this may similarly deny the inventor the right of grant of a patent, as those public domain references would defeat the grant of patent for want of either novelty or obviousness (depending on the nature of the disclosure).

In the list of criteria set out above, one of the requirements of an invention to be patentable was that the invention is 'patentable subject matter'. This is perhaps an unhelpful description of the requirement to the lay-reader, but perhaps some comfort can be drawn from just how contentious a definition this has been in the realm of patent law, including in various contemporary examples.

To explore what it means for something to be patentable subject matter, this manual will now turn to a case study of how IPRs are dealt with in the biotechnology sector.

2. CASE STUDY: BIOTECHNOLOGY, IPRS AND CLIMATE CHANGE

2.1 What is patentable subject matter?

There is no short answer to what is or is not patentable subject matter. It continues to be a matter of consideration by the High Court of Australia. The Patents Act in Australia rather convolutedly provides[30]:

> *(1) … an invention is a patentable invention for the purposes of a standard patent if the invention, so far as claimed in any claim:*
>
> > *(a) is a manner of manufacture within the meaning of section 6 of the Statute of Monopolies…*

So the legislation tells us that something is patentable if it is a 'manner of new manufacture' within the meaning of a section in the Statute of Monopolies. Not necessarily crystal clear at this stage. Yet, perhaps the 'Statute of Monopolies' which is referred to will provide some guidance. Section 6 of the Statute of Monopolies[31] states:

> *"Provided also and be it declared and enacted that any declaration before mentioned shall not extend to any letters patent and grants of privilege, for the term of 14 years or under hereafter to be made of the sole working or making of any manner of new manufacture within this realm to the true and first inventor and inventors of such manufactures which others, at the time of making such*

[30] *Patents Act 1990* (Cth) s18(1)

[31] The Statute of Monopolies is law which Australia inherited from the United Kingdom, and was passed by the legislature there in 1623 – explaining the rather convoluted and archaic language.

> *letters or grant, shall not use, so as also they be not contrary to the law, nor mischievous to the state, by raising prices of commodities at home or hurt of trade or generally inconvenient.*"

This passage uses relatively archaic language, and brings us no closer to a simple answer to the question of what is patentable subject matter. Thankfully, this question has been the subject of extensive judicial attention in the Courts. Perhaps owing to the vagueness inherit in the statutory language, the question of what constitutes patentable subject matter has been hotly contested over many decades. There is no universal test for determining what constitutes patentable subject matter, other than to consider what constitutes a 'manner of new manufacture' within the meaning of section 6 of the Statute of Monopolies. Over the years, the Courts have taken an increasingly generous view of what is encompassed by the phrase 'manner of new manufacture' to take account of new and emerging technologies.

One of the first significant formulations from a Court was the 1959 case of *NRDC*[32], which concluded that a manner of new manufacture could consist of anything which brought about "*an artificially created state of affairs*", adding that such a state must also offer "*some advantage which is material, in the sense that the process belongs to a useful art…that its value to the country is in the field of economic endeavour*".

This formulation from NRDC seems relatively high, wide and handsome, and has resulted in a wide-array of patentable subject matter being allowed. The NRDC formulation was put more succinctly by the Federal Court in *CCOM Pty Ltd v Jiejing Pty Ltd*[33], where the relevant test was cited as being "*a mode or manner of achieving an end result which is an artificially created state of affairs of utility in the field of economic endeavour*". This test can be considered against the test set down in the United States, in the decision of *Diamond v Chakrabarty*[34], which sets the test for patentable subject matter as simply being "[a]*nything under the sun that is made by man*".

It is often considered that the only exceptions to patentable subject matter, in light of these decisions, will be abstract ideas, or 'conceptual' discoveries, as well as natural or biological phenomenon (being neither made by man nor 'artificial'). In fact, the Australian Patents Act includes an express prohibition on the patenting of human beings and the biological processes for their generation[35].

It is in this context that the High Court of Australia has recently been called on to consider again what constitutes patentable subject matter, in the case of *D'Arcy v Myriad Genetics Inc & Anor*.

2.2 Myriad Genetics

Myriad Genetics has been fighting a series of patent battles both here and overseas for several years regarding its product, BRACAnalysis. This product is a genetic test for the presence of the *BRCA1* or *BRCA2* gene mutations, which are strongly correlated to hereditary breast and ovarian cancers.

The product works by matching a sample from a patient to known, isolated gene sequences containing said mutations. Where a match is found to one or more of the mutations, the kit provides a positive result.

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[32] *NRDC v Commissioner of Patents* (1959) 1A IPR 63
[33] *CCOM Pty Ltd v Jiejing Pty Ltd* (1994) 51 FCR 260
[34] Diamond v. Chakrabarty, 447 U.S. 303
[35] *Patents Act 1990* (Cth) s18(2)

Claim 1 of the patent is to the "isolated" nucleic acid "coding for" a mutant version of the BRCA1 protein. In lay terms, the patent was to the mutated gene sequences, but isolated from the rest of the DNA in which they are naturally found in the centre of each human cell.

The question before the courts was therefore, whether the act of isolating these genes – in effect, removing them from the rest of the DNA inside a cell and keeping them separate – constituted a sufficiently artificial state of affairs within the field of economic endeavour, such that the patent would remain valid.

The Full Federal Court of Australia found that it was patentable subject matter, noting that the genetic code, once isolated from the DNA, is "*chemically, structurally and functionally different to what occurs in nature*"[36].

The High Court, while yet to hand down its verdict, appears less sanguine regarding this purported invention. Justice Nettle compared the isolation of the gene from the DNA as being no different to removing a leaf from a tree[37]. Chief Justice French demonstrated a similar level of scepticism, noting that when the nucleotide sequence is removed from the DNA in the cell, the scientist is in effect "pulling out something which was there before".

It may be that the High Court will bring Australian jurisprudence into line with the rest of the world, which has determined that Myriad's purported invention is not patentable subject matter. In the United States District Court, Justice Sweet noted that the structural and functional differences *"[do] not alter its essential characteristic – its nucleotide sequence – that is defined by nature"*.[38] The United States Supreme Court agreed, noting that "*Myriad's claims [do not] rely in any way on the chemical changes that result from the isolation...the claims understandably focus on the genetic information*".[39]

Myriad Genetics is a case providing an example of perhaps the outer-limits of what constitutes patentable subject matter, as well as being a salient lesson of the continuing controversy which can exist in respect of new and emerging technologies, particular where a company is seen to be commercially exploiting a necessary or vital public good (an issue which is bound to find traction in the clean technology sector, where companies will inevitably find themselves seeking to commercialise innovations of vital importance to at-need populations and groups).

2.3 Marsh v Baxter

Questions of how well Australia's laws are placed to deal with advances in genetics were brought into sharp contrast in the recent case of Marsh v Baxter[40], which concerned two neighbouring farmers in a 'mixed-use' agricultural area. The plaintiffs, the Marsh family, were organic growers, certified by the relevant organic growers certification body[41]. The respondent, Mr Baxter, was a conventional farmer, who utilised as part of his crops, a

[36] *D'Arcy v Myriad Genetics Inc* [2014] FCAFC 115 at [194]
[37] *D'Arcy v Myriad Genetics Inc & Anor* [2015] HCATrans 146 (16 June 2015)– See T56.2480-2515
[38] Association for Molecular Pathology v. U.S. Patent and Trademark Office (S.D.N.Y. 09 Civ. 4515, 29 March 2010) slip op 132.
[39] Myriad (Supreme Court), 569 US __ (2013) slip op 14
[40] *Marsh v Baxter* [2014] WASC 187
[41] NASAA Certified Organic Pty Ltd was the subsidiary certifying organisation of the National Association of Sustainable Agriculture Australia. The organisation came in for some judicial criticism of how the auditing officers (mis)applied the governing NASAA standards in deciding to revoke certification of the Marshes' farm.

genetically-modified canola known as 'Roundup Ready', which is manufactured by Monsanto to specifically tolerate applications of the herbicide, Roundup (also manufactured by Monsanto). The case concerned an allegation by Mr Marsh that his farm was "contaminated" when seeds from Mr Baxter's GM canola crop blew over onto his adjoining farm, which led to Mr Marsh losing his organic grower certification for a significant portion of his farm and produce. Mr Marsh alleged that Mr Baxter had been negligent as to the risk of such contamination occurring.

Both in the original decision, and more recently on appeal, Mr Baxter was found to have acted within the scope of his duty of care as a neighbour, and the Court found that no special duty would accrue simply by dent of Mr Marsh choosing to be an organic grower, especially in circumstances where Mr Baxter's farming practices were perfectly conventional, utilising well-regarded and commonly used farming techniques.

The case garnered a significant degree of community controversy, not least because of the involvement of Monsanto, a company for whom community sentiment is relatively poor, as well as several impassioned anti-GM groups, who describe GM-crops as (for example) 'Frankenstein food' and 'toxic'. Although ultimately a question of definition, it is easy to make a case for climate-ready crops being considered part of the clean technology sector, given the undoubted need for better yielding crops as the distribution of arable land shifts away from population centres around the world.

The case of Marsh v Baxter provides a salient lesson for those seeking to commercialise controversial clean technologies, such as climate-ready crops, that the law does not operate in a vacuum, and nor do governments or regulators. In another example involving Monsanto's GM crops, the company has found itself at the centre of a particularly fierce and ongoing series of disputes with India (a jurisdiction which is particularly resistant to international efforts by the US and others to install strong-IPR regimes) regarding its climate-resilient GM crop patent[42]. India's legislators and courts may be the most visible example of resistance to strong-IPR enforcement, but the same sentiments are expressed elsewhere both in various governments of the developing world, as well as various first-world grassroots movements. Being alive to the shifting sands of community sentiment – and where necessary, advocating on behalf of your technology or field – may well be as important to the success of a clean technology start up as any amount of legal advice or commercial planning.

2.4 Biotechnology and Climate Change: IP lessons to be learned

A key lesson to be learned from cases such as Marsh v Baxter and Myriad Genetics is the degree to which moral and ethical disquiet can sit behind some of the legal debates relating to new and emerging technologies. It is unsurprising perhaps, given the astonishing developments in biotechnology throughout the past century, how much this kind of debate appears to have occurred in relation to biotechnology innovations.

It is certainly the case that one of the key debates in the later part of last century in patent law concerned the implications of extending long-term monopolies to innovations in the pharmaceutical space. This debate was not confined to lawyers and legal academics. Health practitioners examined the tension between their duty to provide the best care to their patients, with the incentives as potential inventors of new medical

[42] For a comprehensive review of the Monsanto climate-ready GM crop patent battle in India, see Rimmer, M (2013) 'India rejects Monsanto's Climate-Resilient Patent claims', Storify, <https://storify.com/DrRimmer/monsanto-india-and-climate-ready-crops>

treatments and products to commercialise those inventions[43]. On an international level, developing countries also focused on the ethical implications of institute 'strong' IP regimes domestically, especially where those regimes might provide monopolies over essential medicines which were beyond the economic reach of their constituents.

Special purpose legislation and agreements

The latter concern played out in the context of debates in the 1990s on a multi-lateral treaty, the Agreement on Trade-Related Aspects of Intellectual Property Rights, or "TRIPS". In response to these concerns, further international talks within the World Trade Organisation culminated in 2001 in the *Doha Declaration on the TRIPS Agreement and Public Health*, which clarified that the agreement – and the IP regimes implemented in accordance with the agreement – would not prevent member states from implementing public health measures, up to and including the curtailment of certain patent rights. The goal of the Doha Declaration was to ensure access to essential medicines in the developed world, which has continued to be a particularly fraught battleground between those who would advocate stronger IPRs and protection for rights-holders, and those who consider monopolies over potentially-life saving treatments to be unethical.[44]

It is almost certain that similar, discrete instruments will be developed as part of the global response to climate change. Already negotiators have foreshadowed[45] the inclusion of a 'technology transfer framework' as part of any final global agreement on climate change. While the final structure and function of such a mechanism is by no means certain, it appears likely that it will to some extent intervene in what would otherwise be a diffusion of patented technologies from the developed to the developed world via purely market mechanisms. The justification for such a mechanism includes several complex and heavily debated issues, but foremost are the rapidity with which essential technologies for responding to climate change can be spread around the world, as well as the ethical question of ensuring that the developing world are enfranchised in growing their economies in a less carbon-intensive fashion.

Geo-Engineering and ethical implications of un-controlled climate interventions

Ethical issues related to climate-related patented technologies are not confined to questions of international equity and justice: there are also significant ethical questions with respect to some of the potential technologies themselves. As in the biotechnology space, questions of what constitutes patentable subject matter are again likely to be in issue.

One of the more pressing questions in the response to climate change is what role, if any, so-called "geo-engineering" measures will play, and what the ethical implications would be of allowing any such measures. The United Nations Environment Programme defines geoengineering as "the calculated large-scale manipulation of the

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[43] Joseph M. Reisman, *Physicians and Surgeons as Inventors: Reconciling Medical Process Patents and Medical Ethics* (1995) 10 Berkeley Tech. L.J. 355.

[44] For but one of many examples of a battlefield in this broader war, the turn-of-the-century saw South Africa and Global Pharma face off regarding South Africa's plan to import generic medicines from other jurisdictions: see "Drugs, Patents and poor People" *The Economist,* 18 April 2001 http://www.economist.com/node/576903

[45] The Conference of the Parties, the key decision making body under the United Nations' Framework Convention on Climate Change, agreed at its 7th meeting ('COP7') agreed in principle to a 'technology transfer mechanism', which has been further honed at later meetings.

environment".[46] In essence, it is a response to climate change predicated on attempts to reduce the growth in atmospheric carbon having failed, and technological interventions to either draw down carbon from the atmosphere, or otherwise provide a countervailing 'cooling' effect on the climate, to mitigate the effects of global warming.

Geo-engineering provides scope for interesting tension between IP laws and community ethical standards . On one front, the same questions of patentable subject matter enlivened by cases such as Myriad Genetics. One of the technologies touted as a tool in the geoengineering armoury is so called "ocean fertilisation".[47] In essence, this would involve acting to promote the growth of algae blooms which draw carbon dioxide out of the atmosphere, either by 'seeding' the ocean with the key nutrients to promote growth, or by introducing modified algae species able to bloom in hardier environments. It is not necessarily clear however, that such a technology would necessarily be patentable in each and every jurisdiction around the world. In some jurisdictions, including Australia, there are existing prohibitions on the patenting of animals or plants. Questions of whether these kinds technologies ought to be patented (such that they may be readily commercialised and rolled out in response to climate change) are sure to move into frame as plans to roll out these technologies crystalize in the future.

On a broader front of course, is the question as to whether the community is going to countenance the utilisation of geo-engineering technologies at all. There are obvious ethical implications for the use of technologies which seek to directly intervene in the climate. Commentators have cited a variety of risks, ranging from lack of reliable data of efficacy (interventions in the climate do not allow for experimental 'field testing') to concerns about the ability to control those interventions,[48] citing previous examples of ecological 'engineering' such as introduced species which quickly lead to unintended consequences beyond the ambit of the original intervention.

Controversy around new technologies will endure

These questions are yet to be properly answered, and it is enough to say that those seeking to work in the clean technology space must be alive not only to the basic principles of intellectual property law, but also the likely grounds of contest as to how those laws may develop and be honed through the prism of climate related technologies, and the community discourse which will set behind their development and implementation.

While lessons can be taken from previous examples of new technologies testing the boundaries of old laws, such as the examples in the biotechnology space, it is likely that in responding to climate change, new and unexpected ethical and legal challenges will emerge. Enterprises seeking to develop intellectual property management plans and strategies will need to not only be alive to these debates, but where possible, seek to predict the challenges to their business which will arise from those debates and, where appropriate, advocate for changes which align with the business model which they have chosen to adopt.

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[46] United Nations Environment Programme "Geoengineering to Combat Global Warming" (May 2011) http://na.unep.net/api/geas/articles/getArticlePDFWithArticleIDScript.php?article_id=52

[47] Ibid, at 3.

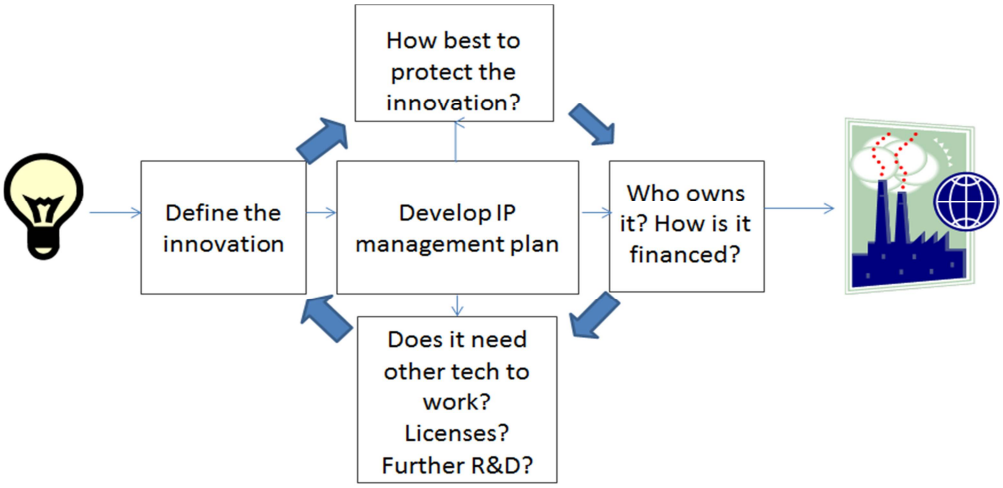
[48] Douglas G. MacMartin, Ben Kravitz, and David W. Keith 'Geoengineering: the World's largest control problem' (presented at American Control Conference, 2014) available at https://keith.seas.harvard.edu/papers/168.MacMartin.ControlProblem.pdf

3. INTELLECTUAL PROPERTY MANAGEMENT

As set out above, Intellectual Property is a field of legal enquiry which encompasses a variety of different 'sets' of rights, which differ depending on the nature of the 'intellectual endeavour' to be protected. Chiefly, the vehicle by which an inventor might best exploit an invention in the clean technology sector is a patent. While the balance of this manual may passingly refer to other forms of Intellectual Property where appropriate, the focus of the following sections of this manual will be on the management of patents specifically (although, many of the lessons on IP management generally will be equally applicable to other forms of IP).

Similarly, the phrase 'clean technology' may be honestly applied to a range of technologies used across a range of sectors, ranging from developments in aquifer technology, innovations in 'biochar'[49] or even smartphone 'apps' to assist in monitoring and reducing individual carbon footprints. For the purposes of this manual, to the extent that it is necessary to define 'clean technology', the phrase is used to refer to any and all innovations which help to reduce – either directly or indirectly – the greenhouse gas intensity of human endeavour and activity (be it economic or social).[50]

One of the central challenges for start-ups the world over is setting out a clear strategy for securing, defending, and (ultimately) commercialising their intellectual property. There are multiple points of friction in this process where a clean-technology start up can encounter problems, and in the usual course, the earlier these issues are addressed, the better the prospects are for commercialising a given innovation.



[49] The NSW Department of Primary Industries defines biochar as: "*Biochars refer to the carbon-rich materials (charcoal) produced from the slow pyrolysis (heating in the absence of oxygen) of biomass.*" (see: http://www.dpi.nsw.gov.au/research/topics/biochar) This technology remains a central pillar of the federal government's vision for reducing Australia's net carbon emissions.

[50] Finding a standard definition for clean technology (sometimes 'green technology') is difficult. WIPO uses the term strictly to mean *"environmentally sound technologies as defined in Chapter 34 of Agenda 21 (The United Nations Program of Action from Rio, 1992)"*. (See: https://www3.wipo.int/wipogreen/en/about/faqs.html). IP Australia prefers the more general cast of any "*environmentally-beneficial invention*". (See: http://www.ipaustralia.gov.au/get-the-right-ip/patents/patent-application-process/expedited-examination-for-standard-patents/green-patents/) The US Patent and Trademark Office defines green technology as encompassing any technology concerning *"environmental quality, energy conservation, development of renewable energy resources or greenhouse gas emission reduction"*. (See: http://www.uspto.gov/patent/initiatives/green-technology-pilot-program-closed) The definition preferred for this manual is cast more broadly, to encompass not only products but also services, which may directly or indirectly contribute to a reduction in greenhouse gas intensity. For a useful taxonomy of what can fall within the scope of clean technology, see: http://www.ecoconnect.org.uk/about-us/definition-of-cleantech/

3.1 Developing the IP management plan

The above chart sets out, in very general terms, the process of developing an IP management plan, or strategy, which encompasses several of these key 'friction' points from early on in the commercialisation process. These steps can be summarised as follows:

Define the Invention

The first step is to define what it actually is that the inventor(s) developed. Is it a product in and of itself? Is it a 'widget' that can be used to enhance the functionality or efficiency of existing products? Is it a service rather than a tangible product, such as a structured energy efficiency audit for the home or a carbon-credit purchasing scheme? Is it a different method or approach which uses existing technology? Being able to clearly define what an invention is will impact what kind of protection an inventor may be able to secure, and is far too often overlooked as too 'obvious' a first step. Much heartache in the commercialisation process can be avoided if an inventor takes the time to sit down and clearly and methodically define what the invention is.[51]

How to best protect the invention

Of course, defining the invention is only the first step. Once defined, the inventor must determine how to best protect it? Well-resourced inventors or start-ups may be well served at this point to seek recourse to a commercialisation officer, patent attorney, or Intellectual Property specialist, but even a lay inventor without those kinds of resources available should take the time to research what might be available given the nature of their invention.

Of course, determining what is available is only one part of the question, particularly given that, in many circumstances, there will be more than one kind of intellectual property protection available. More pointedly, the question becomes: what type of protection, of those available, will best suit the inventor(s) commercial objectives (a collateral question is of course, have the commercial objectives been defined)?[52]

Often the commercial objectives for an invention are obvious: protect the invention, so it may be brought to the market exclusively, to maximise profits derived from the invention, such that any research and development costs are recouped, and the inventor may enjoy the fruits of her labours. Of course, in the clean technology space, while these same commercial realities are likely to dominate for most inventors, it would not be completely surprising if some inventors approach the question of 'commercial objectives' from a more altruistic perspective.

Perhaps the most important question to ask, which will have a telling effect on how the commercial objectives are ultimately defined, and in turn, how the invention may best be protected, is this: how will it be financed? and in turn, who ultimately owns it?

Financing the Commercialisation of the Invention

Firstly: if an Inventor is trying to raise capital to help manufacture the invention at scale and bring it to market, they will need to be able to demonstrate that they've secured

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[51] See for example, J McKeogh and A Stewart, Intellectual Property in Australia, 2nd edn., Butterworths, 1997: "*Failing to protect intellectual property has been acknowledged as one of the main mistakes firms make in their commercial efforts, even though it may seem expensive or unnecessary in the first steps of product development*".

[52] A question best left to a "Manual on Drafting a Business Plan for Clean Technology in Australia". There is an obvious opportunity for a corporate or finance specialist to draft a sister publication to this manual to assist in answering such a question.

that invention (which of course, feeds into the above question, of how best to secure that invention in the first place).

Certainly there are examples within the clean technology space – energy efficient lightbulbs, smart power meters – where the cost-per-unit of production is (relatively) manageable, even for a small-to-medium enterprise. But for most innovation in this space, the sort of clean technology innovation that operates at scale in (for example) the power generation and transmission sector, or the automotive sector, or the IT sector: manufacturing scale-up to industrial or commercially viable levels will demand a sizeable up-front investment in production facilities, in distribution networks, in upskilling and training, and often all with a relatively high cost-per-unit-of-production ratio.

The inventor, unless they outright assign their invention to an established entity, is going to need to attract investment, and investment demands proprietary certainty. Investors may be motivated by altruism more so in the clean technology space than others, but ultimately the capital available to a start-up will be maximised should the Inventor be able to demonstrate that she has 'secured' her IP. This isn't merely about monetising the invention, it's about how predictable the commercialisation trajectory for bringing that invention to market is.

Ownership of the Invention

There is often an intrinsic assumption by inventors that they will have exclusive ownership over their invention. But this assumption can be dangerous. Most Intellectual Property is just that: property. It can be traded, assigned, bought or sold, and its ownership a matter quite distinct from its creator. For an inventor whose invention was developed in the course of her employment, it may be that an explicit clause in her contract renders any such invention the property of her employer[53].

Another consideration is where there may be multiple 'inventors'. The days of the backyard inventor toiling away in the workshop are, if not completely over, increasingly consigned to history. The modern innovation story is one of teams, sometimes sprawling and interchanging, working over long periods of time to develop new technologies. It may not always be clear who were the key personnel at the point of 'invention', especially where people may have come into and left the relevant development team over time. An inventor should be cautious when making an assessment of ownership as part of developing their IP management plan, and consider whether any collaborators may have a claim to inventorship of the given invention[54].

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[53] The question as to whether a university researcher's invention was the property of that researcher or the university was the subject of detailed judicial consideration in the case *University of Western Australia v Gray and others (No 20)* (2008) 246 ALR 603, wherein Justice French (as he then was) determined that, absent an explicit contractual right, the duty owed by the staff member was a duty to research, not a duty to invent.

[54] A similar dispute to the UWA v Gray case occurred in the United States, but involving multiple co-inventors seeking to commercialise their technology out of the universities' technology incubator: see *The Curators of the University of Missouri v. Suppes, Sutterlin, Renewable Alternatives LLC, and Homeland Technlogies LLC* (2009) 2:09-cv-0412-SOW and *The Curators of the University of Missouri v. Suppes, Sutterlin, Renewable Alternatives LLC, and Homeland Technlogies LLC* (2009) Case No. 09BA-CV0231; one of the defendant co-inventor's opined in a newspaper editorial that poorly run university commercialisation bodies harm domestic innovation, contending that "*technology has at least a reasonable change of commercialization when it is under the control of inventors who truly understand the technology*': see Suppes, G (2010) 'Current System Patently Stupid: MU Needs to Release Tech Back to Inventors', *Columbia Daily Tribune,* 16 February, http://www.columbiatribune.com/news/2010/feb/16/current-system-patently-stupid/

The other consideration when it comes to questions of ownership is that of financing. An inventor should consider whether they may owe any obligations to anyone else, aside from their employer or any potential 'co-inventors'. In some cases, seed capital or other funding streams may have been secured at earlier points in the life of a project, which involved contingent rights that crystalize upon development of a new product or method. Such rights may be simply to a guaranteed return-on-investment upon commercialisation of the invention, or they may be a part-claim to the invention, or in some cases, a bare-assignment of any inventions once protection has been secured.

Is third-party technology or resourcing required for the Invention to 'work'

In many instances, an invention may appear to stand on its own as a discrete product or method, but in fact may rely on inputs in terms of both resources and existing technologies, in order to be produced, deployed, or outright function. Prior to determining an IP Management Plan, the inventor ought ask herself whether there will be a need to license any such existing technologies (or, if resources permit, to outright buy the rights to any such technologies) in order for her product to work. This question may in of itself bear out some detailed investigation. It may be that the end product is itself discrete, but that one or more components of a product require licensed products or components in *their* individual manufacture. That is to say, it will be important for the inventor to define, clarify and fully characterise the production chain for an inventive product.

Another consideration may be where inputs appear to be available to use by virtue of pre-existing agreements (for example, at universities or other public sector institutions) that allow for the exploitation of a technology or product for research purposes.

Eric Lane describes the practice of licencing green patents from universities and national laboratories as an avenue to jump-start' a new clean-tech business[55]. Lane cites one example of an Ohio startup, Xunlight 26 Solar, which licensed a thin-film manufacturing technology from the University of Toledo which provided a "foundation" block from which to develop its own proprietary solar panel technology. By identifying and licensing an existing patented technology early on the company's life cycle, Xunlight 26 Solar was able to avoid "starting from scratch", potentially saving years and significant resources in terms of its own research and development pathway.

Such examples are not mere exceptions. Indeed, a key issue in the clean technology sector is the interoperability of technologies in this space: for example, to rig a wind turbine doesn't require recourse to a single patented technology, but several. Often a clean tech start up may find itself with part of a broader solution and will be eager to reach out to partner with other firms to bring that solution to market. It may be that an inventor cannot head out on the commercialisation pathway alone: a partnership or joint venture with another company may become necessary (and for those with limited financial backing, may come with additional benefits in terms of resourcing and scale).

What is the pathway to market

Having turned their mind to defining the invention, determining the commercial objectives of the invention, considering what (if any) funding will be required and where to source it from, who owns the invention, whether any licenses or other arrangements need to be put in place in order to commercialise the invention, and how best to protect

[55] Lane, E. above n 13, Chapter 4, part II.

the subsisting intellectual property in their invention, an inventor may be forgiven for thinking they've done all they need to in developing their IP Management plan.

However, this process is by no means the end; it is in fact merely what is required to arrive at a beginning. Tellingly, the chart set out above is a circular, continuous process. Each input feeds into the next and back into the IP Management Plan. This is to reflect a key principle of IP management: an inventor must continually revisit their plan, testing their assumptions, filling out the detail as more data comes to hand, and considering afresh whether the direction that they have arrived at remains the most readily adapted to their invention. Importantly, an inventor should always be consider what the future development pathway might be for that invention:

- what improvements might be possible to it in 2, 3, 5 years' time?
- Will it be important to separately protect those improvements and any IP that subsists in them ahead of time?
- How will the product or service be used not just today, but in years to come?
- How flexible or adaptable will the product or service be in light of any changing use in the marketplace, and will there need to be additional innovations to help adapt the product or service to those market needs?

It would be difficult to understate just how important this kind of prospective, and continuing, planning can be to the successful commercialisation and management of intellectual property, not just in the clean technology space, but generally. Indeed, given the funding volatility apparent in the Australian clean technology sector, it will become even more crucial that a given inventor or clean technology start up maintains a clear and adaptable sense of their IP management plan and strategy, to ensure that the commercialisation 'trajectory' can be sufficiently tweaked as and when circumstances change.

Litigation: what are the risks?

Part of a successful IP management plan will include an appraisal of the patent landscape in which the given venture will operate.

A patent, like other forms of IPR, can be described as a bundle of "rights". Often these rights are referred to as positive and negative rights. The positive rights relate to the "property"-like nature of an IPR. A patent can be assigned or transferred, it can be used to create interests over, or to underwrite the value in your company (including for the purposes of public float or takeover), or it can be licensed or mortgaged to realise capital. The negative right is the right to enforce against third parties, which usually means, to litigate.

Accordingly, an IP management plan should take account of two things. The risks and potential consequences of a competitor or third party having a patent which they might seek to enforce against the inventor or the start-up, and conversely, whether it is necessary or desirous to "clear the way" for the new clean technology by seeking to invalidate an existing patent, or (more simply) a license from the patentee.

In either instance, it will be important to seek independent legal advice to be properly appraised of the risks of litigation. But a survey of the patent landscape in the first instance can provide at least some clarity within an IP management plan of the kinds of litigation risks a new clean technology venture may face.

Determining which patents may represent an infringement risk requires a thorough understanding of the clean technology to be commercialised, including a forward-looking consideration of all of the ways in which that technology may be used. As noted above, a patentee has the exclusive right to exploit its patent. Any exploitation of the subject-matter of the patent by a third party may constitute an infringement. The Patents Act in Australia defines 'exploit' broadly, as including:

a. *where the invention is a product - make, use, sell or otherwise dispose of the product, offer to make, sell, hire or otherwise dispose of it, use it or import it, or keep it for the purpose of doing any of those things; or*

b. *where the invention is a method or process - use the method or process or do any act mentioned in (a) in respect of a product resulting from such use.*[56]

Being found by a court to have infringed a patent brings with it significant commercial risks. Most basically, a court may award damages (being pecuniary compensation for the patentee as redress for any loss suffered because of the infringement) or an account of profits (which involves determining the profits gained by the infringer by dent of the infringing acts, and having those profits paid to the patentee)[57].

Perhaps more troubling for a start-up or inventor seeking to commercialise a new clean technology, is the scope for a permanent injunction. A permanent injunction is a court order requiring the infringer to cease carrying on the activity which constitutes an infringement of the patent. If the alleged infringing act is a necessary component of the technology being commercialised, such an order may be fatal to the venture in a way that mere pecuniary penalties are not.

The clean technology sector differs in important ways from other, heavily litigated sectors (such as the pharmaceutical sector) in that most innovation is incremental, building on or improving existing technologies. While this reduces the likelihood of a competitor having an existing patent which covers the whole or a substantial whole of a new clean technology, it increases the complexity of the inquiry that must be undertaken. Several of the components, or the parts which make up a new clean technology, may in fact be patent protected, while other parts or components may have long since passed into the public domain.

The earlier example of a wind turbine is again pertinent, with most turbines involving several components, many of which are protected and the subject of cross-licensing agreements. Litigation in the wind turbine space has been rife[58]. General-Electric (**GE**) remains in a long-spanning dispute with Mitsubishi with respect to various wind turbine components alleged to infringe GE patents[59], and has more broadly engaged aggressively in litigation both against its major competitors and individual inventors[60].

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[56] *Patents Act 1990* (Cth), Schedule 1.

[57] Ibid, Section 122(1).

[58] See Matthew Rimmer, *Intellectual Property and Climate Change: Inventing Clean Technologies* (Edward Elgar Publishing Limited, 2001) 222-223

[59] See for example, *General Electric Co. v. Mitsubishi Heavy Indus., Ltd* (2010) S.D. Tex No. 2:09-cv-00229; *General Electric Co. v. Mitsubishi Heavy Indus., Ltd.* (2010) N.D. Tex., No. 3:2010-cv-00276; and *Mitsubishi Heavy Indus., Ltd. v. General Electric Co.* (2010) W.D. Ark., No. 5:10-cv-05087

[60] See *General Electric Company v. Wilkins* (2014) Fed Cir. No. 2013-1170 (on appeal from E.D. Cal.); for detailed commentary on the dispute see Lane, E (2014), 'In GE Wind Patent Fight Federal Circuit affirms Wilkins Inventorship story is incredible' *The Green Patent Blog,*

Examples of entities vigorously enforcing a patent are not confined to dominant companies seeking to defend market share: examples abound of opportunistic litigation from smaller companies and commercialisation boutiques, as well as so-called non-practicing entities[61], seeking to realise value from a patent not through direct exploitation, but via litigation and resultant damages/licensing royalties. GS CleanTech, a subsidiary of the commercialisation boutique GreenShift, has engaged in extensive litigation across multiple jurisdictions for its biofuel patent, directed towards recovering by-products of ethanol production[62].

For those unfamiliar with litigation the prospect of enforcement proceedings being brought against a new technology can be unsettling; particularly in circumstances where significant time and effort has been put into the commercialisation of that technology, or when the inventor sincerely believes the technology to be a bona fide invention.

Aside from seeking legal advice as an adjunct to the development of an IP plan, an inventor or start up should be mindful of the range of options available if they identify a potentially problematic patent in the field in which the new technology will be introduced, or in circumstances where enforcement proceedings have been threatened.

The simplest solution may be to do nothing. The patentee may not be especially litigious, and of course, may not be aware of or consider the new technology to be infringing. Such a course of action not only introduces uncertainty, but it runs the risk however of being held liable for infringement further down the track, potentially after significant resources have been committed to commercialising the technology.

Other options include approaching the patentee to either purchase the relevant IP or negotiate a license. While this may incur upfront or ongoing costs, it may involve the uncertainty and costs of future litigation. Another (not uncommon) course of action for larger companies is to simply acquire the patentee. In the pharmaceutical sector, some entities now appear to be expanding their IP portfolios by way of mergers and acquisitions just as much (if not more so) than by way of internal research and development[63]. While the costs of such an acquisition are high, they provide the benefit of not only clearing the way for the new technology, but obtaining a patent which may provide additional protection to that technology (not to mention any additional patents or assets which may have been held by the acquired company).

Settlements may occur early on in, or prior to the commencement of, litigation, as a way to end in future dispute by way of (usually) a lump sum payment. These can be in the form of a traditional license agreement, but may simply be an agreement not to sue on the patent in exchange for one-off compensation.

Beyond these commercial outcomes though, there is always the prospect of willingly proceeding to litigation. If legal advice is obtained which provides good prospects of either proving non-infringement of a patent, or alternatively, invalidating that patent, it may be that proceeding to trial is the best option available (particularly in circumstances

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http://www.greenpatentblog.com/2014/05/22/in-ge-wind-patent-fight-federal-circuit-affirms-wilkins-inventorship-story-is-incredible/

[61] Also referred to more derisively as 'patent trolls' in some commentary.

[62] Discussed in Lane, E (2010), 'Don't Mess with GS: GreenShift's Ethanol Patent Enforcement Roadshow', *The Green Patent Blog*, http://www.greenpatentblog.com/2010/05/17/dont-mess-with-gs-greenshifts-ethanol-patent-enforcement-roadshow/; see also Rimmer, M. above n 58 at 226.

[63] CNBC, 'Big pharma M&A may keep booming, CEOs say', Power Lunch (16 April 2015) http://www.cnbc.com/2015/04/16/big-pharma-ma-may-keep-booming-ceos-say.html

where commercial approaches have been rebuffed or only available on unfavourable terms).

3.2 IP Management – key principles

In short, successful management of intellectual property requires three things: clearly identifying the technology that the inventor(s) wish to protect and commercialise; adopting a strategy as to how best protect and commercialise that technology; and managing the resources and various legal rights necessary to successfully produce that technology and bring it to market.

Securing the innovation and having an IP management plan gives surety that if (or more usually when) copycat producers come along to borrow on the ingenuity of an invention and bring it to market themselves, the inventor will have enforceable legal rights to bring to bear.

This is important even if the inventor has no intention of suing potential infringers, if for example a green start-up company is focused on simply moving their paradigm-shifting clean technology to market as quickly and broadly as possible, and is willing to live with or embrace copycat production for the sake of increasing supply to the marketplace, giving their inventive product or service the best chance for high-rate adoption and market capture (reaping the commensurate reduction in carbon emissions associated with the relevant economic activity).

No matter the commercial objectives of the inventor or start up, that control, that choice as to how the innovation ought best make its way to the marketplace, ought be the inventors. This isn't just a proprietary question, but also one of logistics and of resource allocation: if there has been a lesson of Australian innovation over the past decades, it is that the best person to be working on the future trajectory of a given technology or invention is the person or team who developed it; who came up with it in the first place.

4. COMMERCIALISATION AND MANAGEMENT OF INTELLECTUAL PROPERTY IN AUSTRALIA

Australia's services sector and high-tech industries have long been touted as the 'future' of the economy, particularly in recent years as Australia's manufacturing base continues to shrink.

In the latter years of the Gillard government, the then-Minister Kim Carr was touting a new era of innovation with the establishment of 'Industry Innovation Precincts', a conceptually exciting policy where industry-led national networks were "designed to bring together relevant industry and research capability elements from across Australia in areas of competitive advantage and emerging opportunity"[64].

These precincts were envisaged to bridge a long-recognised but rarely conquered divide between the innovative ideas being developed in the nation's universities and public sector institutions, with a far less developed private sector capacity to invest in and nurture new start-ups and IP-based spin-outs through to market. In the 2014-15 budget, the incoming government announced that the idea, barely formed, was already dead, with the programme to close on 31 December 2014.

The Abbott Government appeared just as eager to embrace programmes upon which the 'innovation-friendly' imprimatur could be printed. In response to the most recent inter-generational report[65] (which tellingly, gave global warming only a cursory treatment), the former Treasurer Joe Hockey launched the '#ChallengeofChange' campaign, aimed at convincing Australians to work longer, and to embrace the structural changes occurring within the economy, in particular the transition out of commodities and manufacturing and into services.

The emphasis on encouraging innovation as a panacea for better economic growth is a consistent theme. However, it remains unclear how the current Government will drive that change, and whether a re-examination of Australian intellectual property laws - or the setting up of some form of specific purpose regime for specific sectors - will be a part of that policy rollout.[66]

The Industry Innovation precinct example above is hardly a solitary one. Throughout the last two decades, the Australian innovation story has been one of extraordinary achievement and innovation by scientists and engineers - at Universities around the country as well as at public institutions such as CSIRO - who succeed despite a frustrating lack of specialist knowledge and capacity both within university administrations and in the broader economy to help commercialise new ideas into fully realised, marketable services or products.

This gulf was brought into focus within the legal sphere by the case of University of Western Australia v Gray (***UWA***), which ostensibly involved a dispute regarding the

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[64] http://www.industry.gov.au/INDUSTRY/INDUSTRYINNOVATIONPRECINCTS/Pages/default.aspx

[65] The Treasury (Cth), *2015 Intergenerational Report: Australia in 2055* (5 March 2015)

[66] One of the final acts of the former Treasurer was to ask the Productivity Commission to undertake a wide-sweeping inquiry into Australia's Intellectual Property laws. The ambit of the Commission's inquiry includes an examination of other reports and committee findings that bear on IP, to determine if those recommendations should be implemented, and to examine Australia's approach to treaty-negotiations, to ensure that Australia's negotiating position reflects an appropriate balance between protecting rights holders and fostering growth, innovation and competition. It may be that the Commission's report will be a much needed circuit-breaker after a long period of legislative and policy inertia. For more see <http://www.pc.gov.au/inquiries/current/intellectual-property>

terms of an academic's employment relationship.[67] However, in doing so, the case gave rise to questions of what a role a university should play in the broader economy, and brought into stark contrast the problems facing innovators who have an otherwise patentable idea in getting that idea commercialised and brought to market.

These questions go to the core of innovation policy and patent policy, and how the law may best serve the commercialisation objectives of Australia's innovation community. In particular, the case was in many ways a warning that Australian Universities were ill-equipped to handle large patent portfolios, commercialise those portfolios or act as public sector analogues of private sector 'tech incubators'.

The choice facing Australian policy makers was to either drive a reconceptualization of Australian universities as commercial entities, or to allow greater cooperation and collaboration with the private sector to take on that role on behalf of universities. As Justice French surmised in UWA:

> *"UWA and other universities might well consider the alternative of deriving benefits from inventions produced by their staff by offering highly competent and experienced commercialisation services in exchange for a negotiated interest in the relevant intellectual property. That alternative offers many benefits in terms of incentives, harmony and certainty that are not available through the enforcement of legal rights..."*.[68]

4.1 Taking stock of Australia's innovation challenge

So what is the magnitude of the challenge set out before the clean technology sector?

One of the key reports in this space is the Global Cleantech Innovation Index, titled "Nurturing tomorrow's transformative entrepreneurs", the second edition of which was published in 2014 (**GCI Index**). This is a publication jointly put together by the World Wildlife Fund and the CleanTech Group, an international clean technology consultancy. It represents perhaps the most polished, incisive and empirical stock-take of where innovation and development in this space is likely to emerge over the coming decade.

Highlighted over page is one particular table, which is taken from an analysis across a range of metrics measured by the GCI Index to analyse each country's performance in terms of clean technology innovation. Australia is lagging at number 22 (the intervening rows in the table have been edited for the sake of brevity).

Having discussed above the extent of policy and legislative inertia in Australia in respect of climate change, one may be forgiven for thinking this is relatively high result.

However, when compared to Australia's innovation capital in other sectors, Australia is punching well below its weight range. Unfortunately, it is this kind of analysis and these kind of metrics which investors may have regard to when choosing where to direct their funding for clean technology ventures.

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[67] See *University of Western Australia v Gray and others (No 20)* (2008) 246 ALR 603.

[68] Ibid, at [14]

Global Cleantech Innovation Index 2014 Factor Table

2014 Rank	Country	2014 Score	Inputs to Innovation	Outputs of Innovation	General Innovation Drivers	Cleantech-Specific Innovation Drivers	Evidence of Emerging Cleantech Innovation	Evidence of Commercialised Cleantech Innovation
1	Israel	4,34	2,87	5,81	2,86	2,88	8,92	2,70
2	Finland	4,04	2,90	5,18	2,83	2,97	7,59	2,77
3	USA	3,67	3,13	4,21	3,29	2,98	6,41	2,01
4	Sweden	3,55	2,98	4,12	3,59	2,37	5,56	2,68
5	Denmark	3,45	3,13	3,76	3,15	3,12	3,23	4,29
6	UK	2,84	2,77	2,91	2,82	2,71	3,87	1,95
7	Canada	2,83	2,84	2,83	3,34	2,34	3,34	2,32
20	Singapore	2,14	2,47	1,82	2,52	2,41	1,21	2,42
21	India	1,95	1,92	1,98	1,39	2,44	2,10	1,87
22	Australia	1,94	2,52	1,36	2,54	2,49	1,12	1,60
23	Hungary	1,88	2,13	1,62	1,55	2,71	1,49	1,75
24	Portugal	1,80	2,00	1,61	1,40	2,60	0,85	2,37
25	Brazil	1,79	1,90	1,67	1,95	1,85	0,31	3,03

Source: The Global Cleantech Innovation Index 2014: Nurturing tomorrow's transformative entrepreneurs - 2nd Ed

4.2 The role of the Australian university and public sector commercialisation

Monotti and Ricketson, in their authoritative text on university commercialisation,[69] examined stated policies and objectives of universities and identified some traditional motifs: the university as a teaching institution; a research institution; and a community institution.[70] However, throughout the 1990s and early 2000s, another motif emerged: the theme of universities as an 'enterprise,'[71] with 'the language of academic tradition and collegiality...often replaced...by that of commerce and management'.[72] A study in 2000,[73] revealed that internal governance had largely moved 'away from collegial to managerial models...closer to those of large public enterprises or large commercial corporations.'[74] This corporatisation of university structures has not always lead to commercially focused decision-making or policies that facilitate day-to-day business thinking. This may very well be the missing link in bridging the gap between the antecedent role of universities as 'protectors of the intellectual commons,'[75] and the emergence of the enterprise or 'entrepreneurial university.'[76]

The commercialisation landscape in Australia differs from its counterparts internationally. However, Australia has followed the global trend of an increasing interoperability between public sector and private industry research. A recent study in the US published in *Health Affairs* found that over half of researchers in the life sciences maintained some

[69] A Monotti and S Ricketson *Universities and Intellectual Property – Ownership and Exploitation* (Oxford University Press, 2003).
[70] Ibid, 29 [2.26].
[71] Ibid.
[72] Ibid, 38 [2.32].
[73] S Marginson and M Considine, *The Enterprise University: Power, Governance and Reinvention in Australia* (Cambridge University Press, 2000), 1.
[74] Monotti and Ricketson, above n 69, 39 [2.34].
[75] Monotti and Ricketson, above n 69, 43 [2.43].
[76] See generally Burton K Clark, *Creating entrepreneurial universities: organizational pathways of transformation* (Pergamon Press, 1998).

form of financial ties to private industry.[77] As the influx of private funding of university research has increased, [78] a concomitant flow of intellectual property rights has found its way out of the public sphere into private entities often part-owned by a variety of stakeholders, including (more often than successive governments may like to admit) foreign multinationals.

In the United States, universities are for the most part private enterprises that enjoy public funds on more of a project-specific basis than the historically government run tertiary sector in Australia. Even still the United States grappled with a situation similar to that of contemporary Australia, where research institutions had failed to commercialise a substantial number of inventions either through want of expertise or ill-defined incentives for undertaking the potentially costly process of commercialisation without guarantees of future dividends.[79] A nationally uniform policy was called for and thus, now all research institutions in the US that operate wholly or partly using public funds are subject to both the *Bayh-Dole Act*,[80] and the *Stevenson-Wydler Act*.[81]

The US statutory regime allows for the transfer of exclusive control over publicly funded inventions to universities for the purpose of further development and commercialisation. The universities then retain control to license rights to an invention to third parties on terms as they see fit. However, one of the more interesting features of the US regime – reflecting the importance placed on public interests tied up in the IP system – is the idea of 'March-in' rights. These operate to allow the government to license the invention to a third party, without the consent of the patent holder or original licensee, where it determines the invention is not being made available to the public on a reasonable basis. Under the Stevenson-Wydler provisions, this ownership can be conferred upon the employer inventor. Hence, concerns about anticompetitive practices such as patent squatting are alleviated to a degree, and publicly funded research organisations are encouraged to develop their own internal commercialisation expertise, so as to retain control of and hence the benefit of publicly funded inventions.[82]

The resultant success of the US framework has been the basis for multiple calls for reform in the Australian context.

4.3 National laboratories

The other side of Australia's innovation story is happening in institutions such as the CSIRO. Much touted for successful commercialisations such as Wi-Fi[83], CSIRO has successfully spun-out new ideas in a variety of industries, ranging from agricultural innovations to new medical devices. CSIRO set up an independent business development and commercialisation arm, not unlike the commercialisation bodies run by various university institutions, which manages both the process of commercialising nascent innovations into marketable products, as well as maintaining the sizeable royalty

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[77] Darren E Zinner et al. 'Participation Of Academic Scientists In Relationships With Industry' (2009) 28 *Health Affairs* 1814, 1816.

[78] Research Australia 'Trends in Health and Medical Research Funding' (Report, Research Australia Limited, April 2009) p 16.

[79] Andrew F. Christie et al. 'Analysis of the Legal Framework for Patent Ownership in Publicly Funded Research Institutions' (Report, Commonwealth Department of Education, Science and Training, 2003) 12.

[80] Bayh-Dole Act of 1980 35 USC § 200-212 (Cornell, 2009) ('Bayh-Dole').

[81] Stevenson-Wydler Technology Act of 1980 15 USC § 3701 (2009) ('Stevenson-Wydler').

[82] Pat K. Chew *Faculty-Generated Inventions: Who owns the Golden Egg?* (1992) Wis L. Rve 259, 261.

[83] include short descriptor of technology and backstory.

proceeds from those innovations, providing an independent pool of revenue to either invest in further research or (as is the case of late) return a dividend to the government. Royalty revenue from the licensing of CSIRO-derived IP peaked at A$279 million in 2011-12[84] (largely on the back of CSIRO's wireless technology), with revenues in excess of A$600 million over the past years.

The CSIRO has already shown promising signs of being a key driver of innovation in Australia's clean tech sector, with significant spin-outs already having been achieved. In Newcastle, CSIRO has set up the National Solar Energy Centre, a key development projecting partnering with industry to investigate solar thermal technologies and their ability to scale-up to commercial power generation. Windlab systems is another CSIRO spin-out, which has projects on both sides of the Pacific aimed at mapping wind resources to optimise the placement and design of wind-farms[85]. The VAMCAT system - developed by CSIRO in Queensland and trialled in collaboration with China - is a catalytic turbine which captures fugitive methane emissions, oxidising the methane and converting it into additional energy.[86]

4.4 Private sector approaches: reflecting on Australia's maturing biotech sector

To note that much innovation has occurred within and associated with Australia's universities is not to discount the significant role played by industry in Australian commercialisation. Ultimately, while public policy can provide the framework and regulatory settings for a sector to mature, and while public sector institutions can provide a foundational level of research and development (and skilled workers) to draw upon, to achieve innovation at scale will usually require a robust and mature private sector to provide not just investment, but business know-how, in the scale-up and roll-out of new technologies. The Clean technology sector can take great heart from developments in other innovative sectors, and none more so than the example of Australia's biotechnology sector.

Many who work in the innovation space were excited by the announcement in 2014 that Scientific American Worldview had ranked Australia 4th in the world for biotechnology innovation.[87] This represented a jump from a previous ranking of 7th, with the score noting Australia's performance across several metrics including productivity, intellectual property protection, intensity, enterprise support, education/workforce, foundations, and policy and stability. This result provides a sharp contrast to Australia's ranking on the GCI Index shown in section 4.1 above.

Questions of enterprise support, a lack of clear educative and workforce skilling up pathways, and constant policy volatility and instability have all contributed to a net dampening effect on growth in clean technologies here in Australia. At an institutional and a cultural level, Australia's economy lags behind many of its competitors in this

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[84] CSIRO Annual Report 2012-2013, http://www.csiro.au/~/media/CSIROau/Corporate%20Units/CSIROau_Annual_Report/1213/CSIROAnnualReport_2012-13.pdf

[85] ECOS, April-May 2009 edition, http://www.ecosmagazine.com/?act=view_file&file_id=EC148p22.pdf

[86] Spark, CSIRO newsletter, March 2012 - http://www.csiro.au/news/newsletters/Energy/Spark/1203/html/vamcat.html

[87] Scientific American Worldview: a global biotechnology perspective, 2014 edition, http://www.saworldview.com/scorecard/2014-scientific-american-worldview-overall-scores/

sector. Metrics like those set out above, however, should give equal measures of hope: for having identified some of these key impediments to development in the clean technology sector, a roadmap might emerge as to how legislators, business and individual entrepreneurs can best work together to reform the sector and provide the kind of environment that will drive true and sustainable growth in domestic innovation.

4.5 Public Private Partnerships

Since the late 1980s the phenomenon of public private partnerships (or '**PPPs**') has matured, especially with respect to large scale infrastructure projects and other Australian Government procurement activities. As a result, there is an increasingly mature workforce of procurement managers, legal and commercial professionals, public sector workers and financiers who are familiar with and increasingly comfortable in working within the confines of PPPs.

PPPs have several advantages, but chiefly in circumstances where a project comes with a very large capital cost, with development timelines spanning multiple years. The appeal of bringing together the stability of government cash flows with sources private sector capital unconstrained as to budgetary or policy settings, coupled with the spreading of risk over multiple public and private sector participants and the lure of longer-term, safe, high-quality and stable revenue streams for private sector participants, has resulted in a steady upswing of PPPs as the vehicle of choice for large-scale infrastructure delivery.

However, one interesting change overseas has been the increasing use of PPPs not merely for legacy infrastructure projects (such as rail, roads, harbours, etc) but as an instrument for the conduct of targeted Research and Development.

Margaret Chon, one of the leading academics examining the intersection of intellectual property and PPPs, contends that governments and the public sector will often lack the sufficient resources to provide material support to, or indeed, distributional mechanisms for, new innovations[88]. PPPs provide an opportunity to address these structural failures in the public sector and to ensure production and dissemination of public goods in key areas (such as, for example, clean technology).

In terms of IP management, PPP projects require a clear delineation between the 'Background IP' of each of the PPP participants (being the *pre-existing* IP that each participant owns and will be contributing to the activity of the PPP, including usually a clearly drafted cross-licensing instrument of everyone's Background IP to each other) and the 'Foreground IP', being the new IP generated in the course of the project (there can be many different instances of foreground IP generated in the course of the project) which will usually vest in only one of the participants, with potential royalty flows back to other participants as required.

PPPs are not necessarily simple instruments to form or carry on as a going concern. Margaret Chon describes in detail the difficulties in bringing together distinctly different actors who will often speak in different structural, cultural and operational, 'languages' or discourses. Chon notes that PPPs may not only consist of public and private actors, but also often differently motivated private actors[89]. Setting up common frameworks and the communicative structures necessary for a PPP to succeed is often a continuing and

[88] Margaret Chon, 'PPPs in Global IP', in Graeme B. Dinwoodie (ed) *Methods and Perspectives in Intellectual Property* (Edward Elgar Publishing, 2013) 261 at 262
[89] Ibid, at 283.

difficult task: extending far beyond any initial heads of agreement or financing arrangement.

Despite such caution, the US experience[90] in particular suggests that clean-technology PPPs may provide a ready-made alternative to traditional venture capital funding arrangements for commercialising public sector IP, especially for the Australian clean technology space where traditional venture capital is often difficult to engage[91].

4.6 Industry Innovation Precincts and technology incubators

Several of the key challenges which newly formed start-ups and innovators face – setting up their IP management plan, gaining access to funding, selecting the right protection strategy, securing that IP early to give surety to investors – could be readily overcome by providing expert assistance to the inventor as early on as possible. The ideal environment for fostering innovation is one which directly connects Australia's innovative capital with the relevant supporting expertise (and of course, venture capital) available elsewhere in the market, so that all of the relevant stakeholders and experts can work together from the beginning to develop a cohesive strategy for commercializing the invention.

It is in that context that the 'Industry Innovation Precinct' policy under the Rudd-Gillard government was developed. Unfortunately, it has since been scrapped and replaced by the less ambitious, less resourced and differently constructed 'industry growth centres' as part of the former Abbott government's 'Industry Innovation and Competitiveness Agenda'.

At the heart of Australia's innovation malaise is the paucity of genuine commercialisation support offered by universities (at least relative to comparative systems overseas) and the lack of genuine integration between private sector actors, investors and professional services with Australia's R&D sector and start-up ecosystems. The development of the 'Industry Innovation Precinct' policy, although largely conceptual, showed significant promise as a 'field test' for the kind of policy that can help facilitate the green-shoots developments of a more organic, and ultimately self-sustaining, entrepreneurial and innovation culture in Australia.

There are signs that this kind of culture is slowly developing, outside of university institutions. The venture capital story in Australia is an increasingly positive one, and other sectors, most notably the Information and Communications Technology sector, are undergoing something of a 'boom' in terms of domestic innovation.

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[90] The United States has made PPPs a central pillar of its international response to climate change. In June 2015, President Obama launched 'Climate Services for Resilient Development', a PPP targeted at tackling climate change within the developing world. Including $34million in seed funding from the US government, the PPP including partnerships with the American Red Cross, Asian Development Bank, Esri, Google, Inter-American Development Bank, the Skoll Global Threats Fund, and the U.K. Government. See: https://www.whitehouse.gov/the-press-office/2015/06/09/fact-sheet-launching-public-private-partnership-empower-climate-resilien

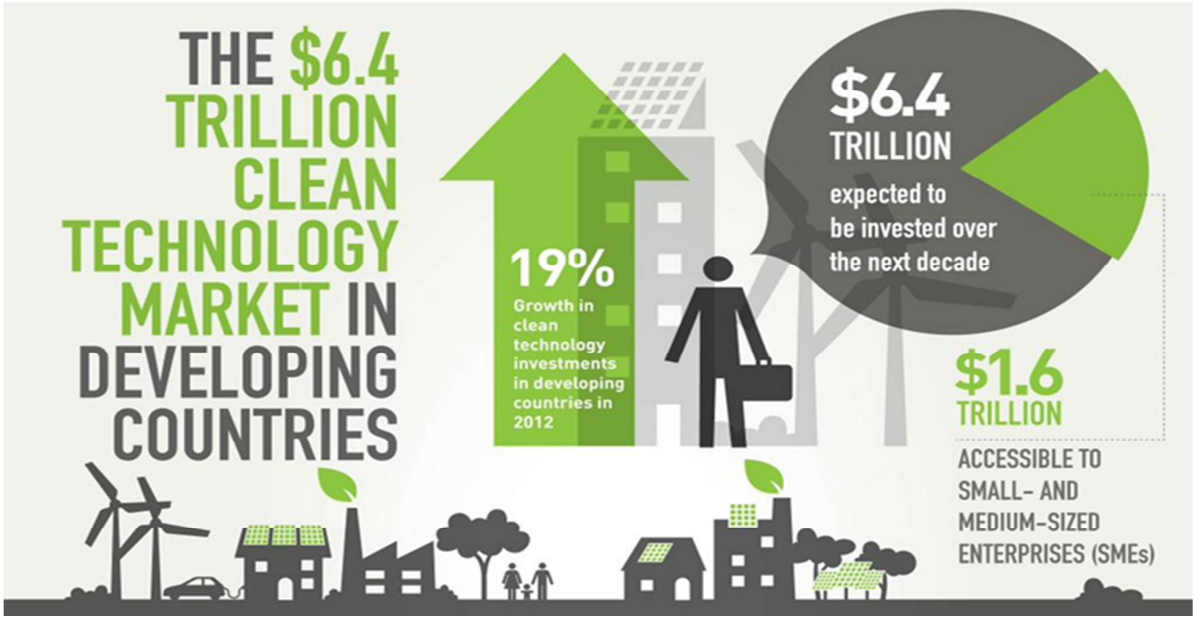
[91] For a practical insight into the approach of a non-profit actor to handling IP within PPPs structured with various private-sector actors, see: Brooke S, CM Harner-Jay, H Lasher and E Jacoby (2007) *How Public–Private Partnerships Handle Intellectual Property: The PATH Experience* in *Intellectual Property Management in Health and Agricultural Innovation: A Handbook of Best Practices* (eds. A Krattiger, RT Mahoney, L Nelsen, et al.) MIHR: Oxford, U.K.

For example, Sydney has become a regional hub for start-up incubators and accelerators,[92] an otherwise United States' staple whereby innovators are brought under the auspices of 'start-up mentors' who can connect the dots of venture capital, securing IP, developing a business plan and spinning out a finished 'company' in a culture firmly rooted in entrepreneurial spirit, experience, and a track-record of success.

The challenge for adopting a similar model in the clean-technology space is one of scale, but this is not to say that incubators and accelerators can't play a valuable role as a template for how universities and other public sector institutions can best promote and facilitate commercialisation of innovations produced by their researchers.

4.7 Role of multinationals in fostering and securing IP for domestic innovation

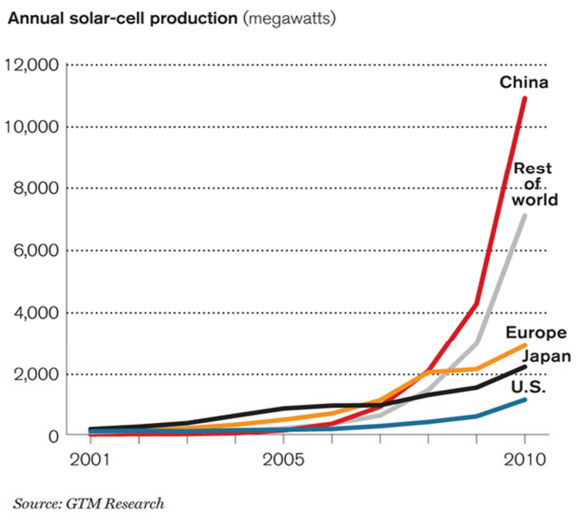
There is capital out there for clean technology, both domestically and crucially, internationally. The question of course is who will be moving into the space afforded by that capital: will it be Australian innovation, or other goods and services? And as a corollary to that, will the innovation developed in answer to this funding windfall be the best value for money available? It is fair to say that Australian innovators who focus on developing a clear and coherent IP management plan early on in the development pathway for their invention will be far better placed to access funding than those who do not.



This image was published by the World Bank's InfoDev program http://www.infodev.org/

The opportunities in terms of capital sources internationally are in many respects almost incomprehensible. Even despite decades of intransigence in terms of diplomatic action on climate change, the market is responding, and states are increasingly looking to fund 'clean' development trajectories, especially in the developing world.

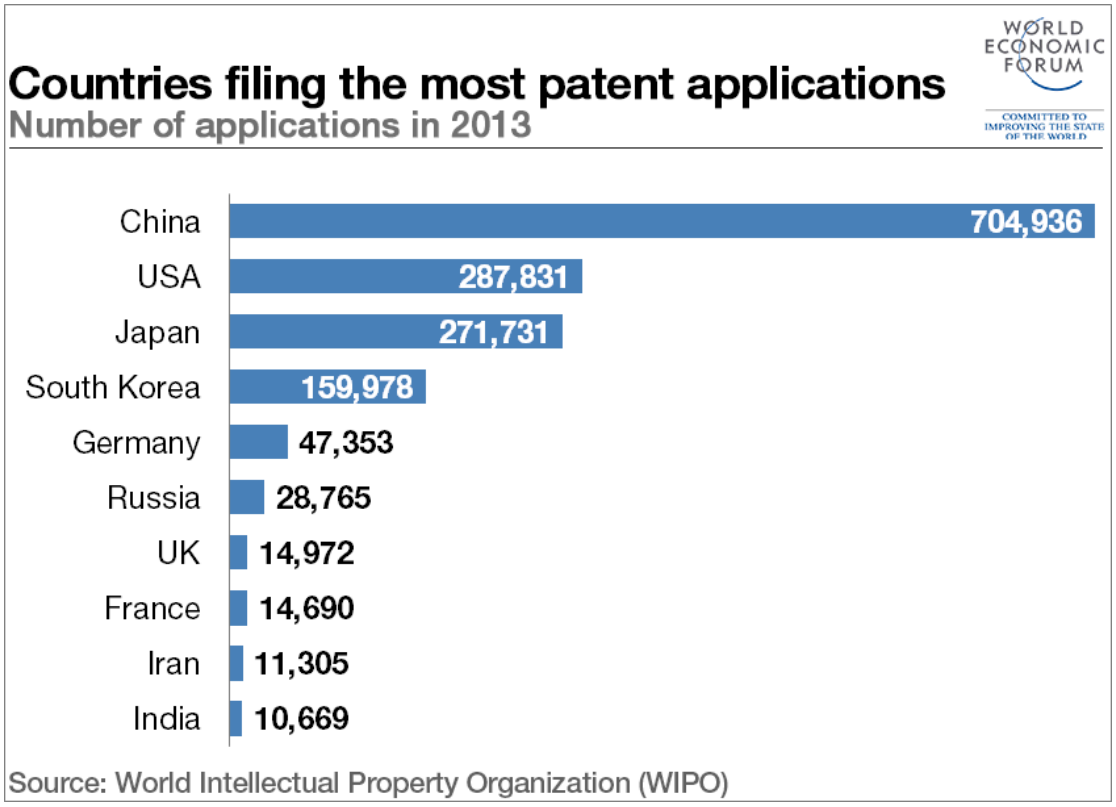
[92] Laura Close, " These are the 10 best startup accelerators an incubators in Sydney" Australia Business Review, published on 2 February 2015, accessed via http://www.businessreviewaustralia.com/leadership/1522/These-Are-the-10-Best-Startup-Accelerators-Incubators-in-Sydney



It is especially hard to argue, for example, with the innovation story coming out of China.[93] While much is often said about the appetite for coal in China, this can sometimes obscure the astonishing take-up of clean technology in China.

As a corollary to this, China is fast becoming a key player in the research and development of clean technology globally. Indeed, after decades of being decried as an IP 'freeloader', the question of IP rights is certainly evolving within the country.

In recent years, China has accounted for more international patent filings than the United States, Japan and South Korea combined, as demonstrated in the below chart[94].



Source: World Economic Forum, see footnote 90.

There is an obvious opportunity for Australian innovators to partner with China in terms of investment and roll-out of technologies: both as a source of funding, and a collaborator in primary research and development.

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[93] Haase, C (2012) *Solar panels are the next space race - China produces more than 10,000 MW of solar cells annually. United States, 1,000 MW,* Environmental, Health and Safety News <http://ehsmanager.blogspot.com.au/2012/01/solar-panels-are-next-space-race-china.html>

[94] World Economic Forum, *Which Country files the most patent applications?* (September 2015) <https://agenda.weforum.org/2015/09/which-countries-file-the-most-patent-applications/>, original source: World Intellectual Property Organization, see: http://www.wipo.int/ipstats/en/#data

5. SURVEY OF ALTERNATIVE, CONTEMPORARY IP MANAGEMENT MODELS

In the main, this manual has focused on traditional notions of IP management, and has presumed the pathway of commercialisation most often adopted by small-scale industry, disproportionately driven by public sector organisations.

Under this framework a firm will (ideally) move through the process of developing an IP management plan as set out above, after which it can set about securing its IP (most often by way of a patent application to IP Australia, again, ideally, by way of the green patenting fast-track), after which it will have the requisite property and security to 'shop' its innovation around to sources of capital or to partner-firms.

Once that capital or strategic partnership is secured, the start-up ought be positioned to consider manufacturing scale-up of production from prototype to finished product, all the while managing the various ancillary costs and development pathways that entails: skilling up the workforce to manufacture the product; skilling up the relevant sales force on how to deploy and use the product; securing relevant branding; trademarks; advertising; developing a marketing strategy; and partnering with associated technologies and brands to try and promote quick consumer take up and stable market share).

It is important to emphasise that this kind of 'template' for commercialisation has been around the Western world for some time and appears to work (although it is important to acknowledge that it is of course difficult the test the counterfactual, as no advanced economy lacks a patent system). This is not to say however that there is academic or public policy unanimity that this process is the best way to promote innovation or to assist in economic growth.

Increasingly, commentators[95] are highlighting that the present policy settings and the lack of any critical mass of innovators in Australia make it difficult for innovators to successfully bring their ideas to market. Absent significant funding from government or managing to attract interest from international investors willing to purchase the IP outright (such as China, where a significant response to the climate crisis is already gathering pace[96]) , the existing patent system may not provide sufficient incentive for small-scale operations to attract the right mix of investment and partnerships to commercialise an idea in the Australian market. In fact, many commentators note that the IP maximalist position[97] of the Australian government only serves to stifle innovation, as it concentrates IP interests into the hands of established interests who may seek to stifle research and development of potential competitors or otherwise seek to commercially exploit any reliance by Australian innovators on patented products, components or methods.

A recent study out of Washington University concludes that "there is no empirical evidence that [patents] serve to increase innovation and productivity, unless productivity is identified with the number of patents awarded...while patents can have a partial

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[95] See for example, Mohannak, Kavoos and Matthews, Judy H. (2011) *Managing specialised knowledge in technopreneurial firms: the Australian Experience* in Huizingh, K, Conn, S, Torkkeli, M & Nitran, I (Eds) *XXII ISPIM Conference: Organizational Future Orientation,* 12-15 June, 2011, Hamburg, Germany;
see also: OECD (2011), *Intellectual Assets and Innovation: The SME Dimension, OECD Studies on SMEs and Entrepreneurship*, OECD Publishing, Chapter 2: Australia http://dx.doi.org/10.1787/9789264118263-en

[96] Zhang, ZhongXiang (2015), *Carbon Emissions Trading in China: The Evolution from Pilots to a Nationwide Scheme*, CCEP Working Paper 1503, April 2015. School of Economics, Fudan University

[97] Rimmer, M. above n 58, at 189.

equilibrium effect of improving incentives to invent, the general equilibrium effect on innovation can be negative".[98] Interestingly, the study notes that while "weak patent systems may mildly increase innovation with limited side effects, strong patent systems retard innovation with many negative side effects".

An Australian innovator may need to look beyond the usual approach, namely, invest upfront in a solid patent, divest interests in the company and IP to attract investment, and hope that their resources are sufficient to bring the product through any validation testing, regulatory approvals and finally to market. Internationally, alternative mechanisms are being not just entertained but deployed, with varying degrees of success. It is useful to briefly survey some of these methods now, and to consider the extent to which they may be of use to the Australian innovator, especially to the extent that the Australian Government and industry may look to adopt similar ideas domestically in the near future.

5.1 Patent Pools

An increasingly common alternative to the traditional model of IP Management is the adoption of patent pool schemes. Patent pools have developed as a response to the complexity and difficulty of managing multi-party cross-licensing schemes for multiple patents. A patent pool is where a collection of patents (owned by separate, individual entities) is grouped together and made available for licensing as a block. Each individual owner will usually automatically hold a license to the group patent pool. The use of patent pools is particularly useful in industries seeking to impose a standard on a given product line.

An example of such a pool was that established to allow for the MPEG-2 standard of digital video[99]. MPEG-2 was a common format for use in the production of DVDs and digital television. The establishment of the pool allowed for the format's ubiquity across the hardware and equipment produced by electronic and technology companies. The patent pool included patents from significant market leaders in the space, such as Sony, LG Electronics, and Samsung[100].

Patent pools are an effective way to avoid stultifying litigation and licensing disputes from bogging down industries that are patent-rich (sometimes referred to as 'patent thickets'), provided that competitors can be persuaded to the merits of establishing a pool, and regulators can be persuaded that a pool once established wouldn't amount to anti-competitive behaviour.

Patent pools have been advocated as a potential tool to overcome the potential for patent thickets in cleantech (such as wind turbines or solar technology), with one suggestion being that the United Nations Framework Convention on Climate Change (**UNFCCC**) and WIPO establish a fund for the purchase of key technology, and providing that technology as part of a patent pool to be licensed on nominal terms[101].

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[98] Boldrin, M and Levine, David K. "The Case Against Patents" *Journal of Economic Perspectives - Volume 27, Number 1 - Winter 2013 - 3-22.*

[99] MPEGLA, *MPEG-2 Introduction* (2009) http://www.mpegla.com/main/programs/M2/Pages/Intro.aspx

[100] Nearly half of the patents included in this pool lapsed in 2012.

[101] Reichman, J., A. Rai, R. Newell and J. Wiener (2008), 'Intellectual Property and Alternatives: Strategies for Green Innovation', Chatham House, Programme Paper, December, http://www.chathamhouse.org.uk/files/13097_1208eedp_duke.pdf

5.2 Patent Fast-Tracks

IP Australia in 2009 announced that it would give priority to environmentally friendly technologies in the patent application system[102]. This concept mirrors those that had been adopted at the time overseas, most notably in the United States Patent and Trademark Office.

The idea, put in general terms is to 'fast-track' green patents to the front of the queue, such that the period between application and acceptance can be shortened as much as is possible. While typically, a patent application may take upwards of a year, this form of 'expedited examination' can see an application take as little as four to eight weeks.

A related program run through the United States Patent and Trademark Office is the 'Patents for Humanity' program[103]. Patents for Humanity was an awards competition aimed at identifying and rewarding innovators whose technologies helped to remedy global humanitarian challenges. Award recipients received 'acceleration certificates' which allowed for expedited proceedings with the USPTO[104].

IP Australia's Green Patenting program is importantly, not a lowering of patentability thresholds, it is simply a commitment to – as it were – bring green patents to the front of the queue. In the context of attracting investment, and providing certainty to those capital sources, this is obviously an advantageous set-up.

There has unfortunately been a lower-than-expected take-up of green patenting fast-track in Australia (except for an initial uptake of the program for various carbon-capture and storage technologies). There has been a slow ramp-up in recent years in terms of access to the green patent fast-track process, but this build up has developed from a very low-base.

It may be observed that the poor take-up of green patenting is exemplary of the poor facilitation of clean technology innovation in Australia. Prominent business commentators[105] have lamented that Australia is 'falling behind' in terms of the current global innovation boom, laying the blame that the feet of Australian Government policy and the high costs of innovation domestically. Suffice to say, the low take-up of IP Australia's Green Patenting scheme demonstrates that there are other pressure points in Australia's commercialisation landscape, other than the speed of patent application processing, that's leading to the apparent domestic innovation shortfall in this area.

It should be noted that the relatively low take up of green patenting in Australia does buck the international trend. As set out in the GCI Index discussed in 4.1 above, environmental patent filings for the 40 countries investigated increased by nearly 100

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[102] IP Australia *Fast-tracking patents for green technology* (December 2013) <http://www.ipaustralia.gov.au/get-the-right-ip/patents/patent-application-process/expedited-examination-for-standard-patents/green-patents/>

[103] USPTO, *Patents for Humanity* (July 2015) uspto.gov <http://www.uspto.gov/patent/initiatives/patents-humanity/learn-more>

[104] The shortcomings of the Patents for Humanity scheme as a measure for incentivising proliferation of desired technologies is discussed in detail in: Rimmer, Matthew, *Patents for Humanity* W.I.P.O.J. 2012, 3(2), 196-221

[105] See Kohler, A "Australia is patently falling behind", Business Spectator, published 3 December 2014, http://www.businessspectator.com.au/article/2014/12/3/technology/australia-patently-falling-behind

percent between 2008 and 2011: unfortunately, this may indicate that the Australian experience is relatively atypical[106].

A table[107] is included below summarising some of the key fast-track programmes across key innovation jurisdictions.

Table 1: Description of green patent fast-track programmes

Country	Starting date	Technologies covered
UK	May 2009	All environmentally friendly inventions
Australia	September 2009	All environmentally friendly inventions
Korea	October 2009	Technologies funded or accredited by the Korean government, or mentioned in relevant government environmental laws
Japan	November 2009	Energy-saving & CO_2 reduction
US	December 2009*	Environmental quality, energy conservation, development of renewable energy resources, or greenhouse gas emission reduction
Israel	December 2009	All environmentally friendly inventions
Canada	March 2011	All environmentally friendly inventions
Brazil	April 2012	Alternative energy, transportation, energy conservation, waste management and agriculture
China	August 2012	Energy-saving technologies, environmental protection, new energy, new energy vehicles

** Note: the USPTO programme was temporary and closed after the 3,500th application was received for this scheme.*

5.3 New and Emerging Approaches – Commons, Open-Source, Philanthropy

Other innovations include attempts at trialling open access and open innovation structures instead of the traditional commercialisation approach.

In the patent sphere, this notion has found root in an expansive approach to the notion of patent pools, into a related but broader concept, the patent commons. The key difference between a patent commons and a patent pool is the lack of any royalty or license schema; the patents in a commons are genuinely open-access.

The Eco-Patent Commons

One of the leading examples is the establishment of the Eco-Patent Commons initiative, involving patents from companies such as Bosch, Dow, DuPont, Fuji-Xerox, IBM, Nokia, Sony and Sony, and administered in conjunction with the World Business Council for Sustainable Development. This commons has over 100 green patents, which are available to any user seeking to develop new clean technology innovations. The scheme has won praise not only for being a mechanism for incentivising innovation in sectors where inventors may be otherwise dissuaded by the volume of extant patents, but as an avenue by which multi-national companies and innovators can be brought together,

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[106] Cleantech Group, World Wildlife Fund, (2014) *The Global Cleantech Innovation Index 2014: Nurturing tomorrow's transformative entrepreneurs - 2nd Ed,* available at < http://www.cleantech.com/wp-content/uploads/2014/08/Global_Cleantech_Innov_Index_2014.pdf>

[107] Dechezlepretre, Antoine (2013) *Fast-tracking Green Patent Applications: An Empirical Analysis* ICTSD Programme on Innovation, Technology and Intellectual Property: Issue Paper No. 37: International Centre for Trade and Sustainable Development, Geneva, Switzerland, at 5.

enriching the networks of all participants and fostering the kind of linkages that help facilitate eventual commercialisation of new technology[108].

The establishment of the Eco-Patent Commons has been lauded[109] as an example of Industry addressing the tension between "it's contribution to the harm of the environment and its role in reducing the use of resources and pollution"[110]. However, a commons might not be a whole-answer, as providing patented innovations for free fails to recognise the cost of innovation, and accordingly the only industry actors who are likely to be able to contribute to a patent commons are those with sufficient scale that they can absorb the potential revenue thrown away by contributing their IP[111].

While a promising approach, it may be that a patent commons such as the Eco-Patent Commons is a complimentary component, rather than a universal solution, to the challenges of rapid innovation and dissemination of clean technology.

Open-Access Automotive: Tesla vs Toyota vs Ford

While some companies have opted to contribute to patent commons, other companies have approached the notion of open-source approaches to patent portfolios more directly. The automotive industry has seen a spectacular explosion in the quality and popularity of low-emission vehicles, such as hybrid or electric cars.

The current vanguard of this movement is Tesla Motors, the venture launched by the enigmatic Elon Musk. In June 2014, Tesla Motors made the stunning move of declaring all of its patents to be open source[112]. In justifying the move, Musk made the persuasive case that Earth's carbon crisis simply couldn't wait for innovation to advance in the traditional, incremental manner, stating that:

> "[A]nnual new vehicle production is approaching 100 million per year and the global fleet is approximately 2 billion cars, it is impossible for Tesla to build electric cars fast enough to address the carbon crisis…Our true competition is not the small trickle of non-Tesla electric cars being produced, but rather the enormous flood of gasoline cars pouring out of the world's factories every day".[113]

Not to be left behind, Tesla's competitors have followed suit. Toyota announced that it would allow royalty-free use of all 5,680 fuel cell patents it held[114]. Taking the gloss of the announcement somewhat were the significant terms and conditions attached to the offer, and the fine-print that the patents relating to fuel-cell vehicles would only be royalty-free until 2020.

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[108] See discussion in Anna Davies 'Partnership and sharing: beyond mainstream mechanisms' in Abbe F.L. Brown (ed), *Environmental Technologies, Intellectual Property and Climate Change – Accessing, Obtaining and Protecting* (2013, Edward Elgar Publishing) 108, at 110-118

[109] Andrew Boynton, *Eco-Patent Commons: A donation Approach Encouraging Innovation within the Patent System* (2010-2011) 35 WM. & Mary Envtl. L. & Pol'y Rev. 659.

[110] Michael A. Gollin, *Using Intellectual Property to Improve Environmental Protection* (1991) 4 Harv. J.L. & Tech. 193, 193.

[111] Andrew Boynton, above n 109, at 672.

[112] Elon Musk, *All our Patent Are Belong to You*. (12 June 2014) Tesla Motors, http://www.teslamotors.com/blog/all-our-patent-are-belong-you

[113] Ibid.

[114] See footage of Toyota announcement at CES here: http://www.cnet.com/au/news/toyota-kickstarting-fuel-cell-future-with-patent-release/

Joining Tesla and Toyota is now Ford, although the company's embrace of open-source philosophies has been somewhat more tentative. Ford is offering over 650 electric vehicle patents for an undisclosed fee via an intermediary[115].

The competing approaches in the automotive industry are instructive in that they demonstrate the willingness of even established companies to depart from business-as-usual practices to remain ahead of the pack in the continuing innovation and development of clean technologies.

Philanthropic ventures – the Bill and Melinda Gates Foundation

Philanthropic organisations and corporate philanthropy are increasingly playing a role in the global response to climate change. Google.org, the philanthropic arm of Google (now Alphabet Inc.), has spent the best part of the decade engaged in various initiatives to combat climate change, including the RE<C initiative, which sought to encourage renewable technology innovation with the end-goal of producing one gigawatt of renewable energy more cost-effectively than one gigawatt of coal[116]. The project was retired in 2013 when it published its findings and technical papers, citing that other firms were better positioned to take the vision forward.

One of the largest philanthropic foundations in the United States, the William and Flora Hewlett foundation, with net assets totalling over $9 billion, has made considered and significant contributions over the past decade as well, including a five-year, $100 million a year funding arrangement to the ClimateWorks Foundation[117] from 2008-2013[118]. The Foundation continues to provide grants to clean technology innovation in the power generation and transport sectors, as well as funding advocacy groups[119].

One of most significant global philanthropy organisations, the Bill and Melinda Gates Foundation, has become a target for climate-action advocates seeking a greater role from the humanitarian organisation in combatting climate change[120]. The fossil-fuel divestment movement, which advocates for organisations and institutions to 'divest' themselves from carbon-intensive industries, has shed light on the reputed $1.4bn dollars which the Bill and Melinda Gates Foundation had invested in fossil fuel companies as of its 2013 tax filings[121]. Despite some limited philanthropic input into the fight against climate change[122], the pressure remains on the world's most visible philanthropists to do more, and it remains to be seen if (or when) that pressure will eventually tell.

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[115] the Ford patents are available to license via the website http://www.AutoHarvest.org

[116] Google.org, 'RE<C initiative' (2015) Google https://www.google.org/rec.html

[117] ClimateWorks is a clearinghouse for the coordination and support of regional climate foundations around the world.

[118] Hewlett Foundation, 'philanthropy's role in fighting climate change', Hewlett.org http://www.hewlett.org/philanthropys-role-fighting-climate-change

[119] See: http://www.hewlett.org/programs/environment/energy-and-climate

[120] GatesDivest.Org, 'Help Us Convince the World's Largest Charitable Foundation To Divest From Fossil Fuels' (September 2015) Indiogogo, https://www.indiegogo.com/projects/urge-bill-gates-to-lead-on-climate-change#/story

[121] GatesDivest.Org, 'The Letter', (2015) GatesDivest http://www.gatesdivest.org/theletter/

[122] Bill and Melinda Gates Foundation, 'New Funding to Help Poor Rice Farmers Succeed Amid Climate Change and Other Challenges' (2008) <http://www.gatesfoundation.org/Media-Center/Press-Releases/2008/01/Funding-to-Help-Poor-Rice-Farmers-Succeed>

5.4 Approach of multi-lateral institutions and developing United Nations frameworks

The most significant global movement in response to climate change however, is undoubtedly within the United Nations Framework Convention on Climate Change, or UNFCCC[123]. The Conference of the Parties, or COP, is the supreme body of the framework. It's annual meetings have taken on a meta-significance in the eyes of the world, as attempts to hammer out an enduring and universal agreement between member states repeatedly comes into reach before receding again. From an Australian point of view, the most significant of these meetings was undoubtedly Copenhagen (or COP15), the failure of which some credit with heralding the fall of the then Prime Minister, Kevin Rudd[124].

Within the machinations of the UNFCCC and COP meetings, there has however been some progress at bedding down the various mechanisms by which the framework seeks to combat climate change. In the realm of Intellectual Property, a technology transfer mechanism has been mooted, as discussed earlier in this manual[125].

The other development that has garnered significant attention is the development of the green climate fund. Reflecting calls in the literature for the establishment of a fund to assist in the purchase and diffusion of IP,[126] the Green Climate Fund (**GCF**) was established at COP16. The GCF is administered by a trustee (initially the World Bank), and had secured a modest $10.2 billion by December 2014 (as reported at COP20).

The ultimate disposition and function of the fund however, remains unclear. Commentators have variously argued for the fund to be used to establish a series of large-scale clean technology prizes[127], which it argued have the benefit of 'internalising' the negative externalities of the patent system, by directly incentivising innovation without the need for states' to cede a monopoly period to an inventor.[128] Other suggestions are consistent with the commentary referred to earlier, namely the establishment of a large-scale patent pool or patent commons, with the GCF purchasing essential clean technology patents to add to the pool, to be licensed on either nominal terms or on an open-source basis to the developed world (for rapid dissemination and adoption) and to innovators around the world (for further experimental development and improvement). How the GCF evolves will be one of the more interesting elements to watch at future meetings of the COP.

Of course, the hope of the UNFCCC is the establishment of a truly global carbon pricing mechanism. While this has not yet been fully realised, there are several such markets now established around the world. Several states now in the US who are setting up their own emissions trading markets. The EU has now had a carbon price established for some time, despite some recent turbulence. 2014 saw the trialling of a provincial carbon market in China.

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[123] See http://unfccc.int/2860.php

[124] Phillip Chubb, *The day the Rudd government lost its way on climate change* (9 May 2014), The Age http://www.theage.com.au/insight/the-day-the-rudd-government-lost-its-way-on-climate-change-20140509-zr7fm.html

[125] The framework was set up following COP7, and expanded at COP 13: see http://unfccc.int/ttclear/templates/render_cms_page?TTF_home

[126] Including by establishing a patent pool or commons, see Anne Davies, above n 108.

[127] Rimmer, M. above n 58, at 375.

[128] Gregory N. Mandel. *Promoting Environmental Innovation with Intellectual Property Innovation: A New Basis for Patent Rewards* (2005) 24 Temp. J. Sci. Tech & Envtl. L. 51, at 64-69.

Despite the relative lack of progress in Australian carbon pricing (and the significant domestic subsidies to fossil-fuel energy production and the resources sector), international markets offer better prospects for a genuinely level playing field for new and emerging clean technologies to complete. The business case for clean-tech start-ups will continue to improve over time as the distortionary effects of carbon externalities are gradually priced around the world, bringing cleaner power generation up to parity.

CONCLUSION

> The world's energy system is at a crossroads. Current global trends in energy supply and consumption are patently unsustainable — environmentally, economically, socially. But that can — and must — be altered; there's still time to change the road we're on. It is not an exaggeration to claim that the future of human prosperity depends on how successfully we tackle the two central energy challenges facing us today: securing the supply of reliable and affordable energy; and effecting a rapid transformation to a low-carbon, efficient and environmentally benign system of energy supply.[129]

This manual has emphasised some of the more practical challenges facing Australian innovators, and may assist scientists, engineers, and policy thinkers in this space to chart a brief course for an entrepreneur or start-up in commercialising a new clean technology. This manual has attempted to illustrate some of the challenges facing entrepreneurs in this space, but as well as that, some of the reasons to be hopeful, with the clear-eyed view of the obstacles to be overcome in driving growth in the sector.

When discussing innovation policy, politicians of all stripes love a great story, a key narrative, and it isn't uncommon for a Minister or local MP to be quoted as talking about how a given policy is geared to finding the next Australian Steve Jobs, or founding the new Cochlear.

The reality is quite different. Sustained innovation and the development of an organic entrepreneurial culture isn't about the big disruptive success or the remarkable business careers of any handful of individuals. It's about the sum innovative potential of the thousands of grassroots entrepreneurs, researchers, engineers and scientists developing ideas. It is this workforce which needs the help of both government and private sector actors to realise their ideas in the marketplace, competing for international sources of capital.

Australian innovation has a role to play in equipping the world with the necessary technological and innovative processes required to decrease the carbon intensity of human endeavour. Rapid and innovative technological change is essential if the 'global village' is to ensure that the economic and social advances of the future can continue to bring enhanced prosperity to the many without compromising the stability and integrity of the biosphere on which each and every one of us depends.

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[129] International Energy Agency, World Energy Outlook 2008, November 12, 2008 (See: http://www.worldenergyoutlook.org/media/weowebsite/2008-1994/WEO2008.pdf)

Key Texts

For further reading on the topics discussed in this manual, the following texts constitute the key references on the topic of Intellectual Property and Climate Change.

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