Towards COP 21 and Climate Agreement Negotiations:
Integrating Scientific Uncertainty and Risk in the Decision-making Framework

By Dr Ted Christie, Environmental Lawyer & Mediator – 16 April 2015

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"A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because the opponents eventually die, and a new generation grows up that is familiar with it." (trans. Frank Gaynor, 1950)
***Nobel Laureate-Quantum Physics*, Max Planck (1858–1947)**

Environmental decision-making under scientific uncertainty or risk becomes problematic when the facts in dispute are both complex and numerous and the issues controversial. The science of climate change and its global consequences is such a case – even though widespread scientific consensus exists to support a "cause and effect" linkage.

A watershed has now been reached for the published scientific information on global climate change reviewed at COP (1) meetings of UNFCCC over time: *to finalize the terms of the new Climate Agreement to be negotiated at Paris in December 2015.*

The new Agreement will be legally binding on the 192 UN Member States that are currently Parties to the UNFCCC and the Kyoto Protocol.

Decision-Making on Climate Change under Scientific Uncertainty & Risk

UN General Assembly Resolution 43/53 (6 December 1988) – "*Protection of Global Climate for Present and Future Generations of Mankind*") endorsed the establishment of the IPCC *"to provide internationally co-ordinated scientific assessments of the magnitude, timing and potential environmental and socio-economic impact of climate change and realistic response strategies (*(at Para. 5)*."*

Given the complexity of the scientific data and technological information on which climate change is based, it should not be surprising that decision-making on the potential consequences of climate change will have to be made under some degree of scientific uncertainty and/or risk.

For example, the agreement reached at COP 16, Cancun, Mexico in 2010 for an international climate change limit: a commitment to limit temperature rise to a maximum of 2°C above pre-industrial levels by 2100.

But, there is now some scientific uncertainty whether 2°C will be a safe upper limit: whether it will give a reasonable chance to avoid the worst impacts of climate change?

There is also another dimension to scientific uncertainty and risk in decision-making for climate change: the national contributions and commitments made by UN Parties at COP 21 that are needed to mitigate the impacts of climate change.

***The source of uncertainty is the extent and rate of adoption of scientific innovations to tackle climate change e.g. the* IPCC's 5th Assessment Report (2014) '*Mitigation of Climate Change; and the "Deep Decarbonization Pathways Project (2014)* (2)."**

There should be no dispute that the diffusion (or "spread") of scientific evidence and assessments on global climate change, by the UNFCCC, has been effective in making this information available to all UN Parties.

The IPCC and science have demonstrated their capability to provide UN Parties with scientific evidence and measures and pathways to mitigate climate change.

But, this alone will not guarantee its adoption!

The principles and concepts for the diffusion and adoption of scientific innovations have their foundations in the social sciences and are recognized as being an accepted body of scientific knowledge (3).

Applying these principles to mitigation measures and other pathways would enable UN Parties to objectively evaluate their potential for adoption to tackle climate change.

Two principles serve to illustrate this point:

(i) "Relative advantage" is considered to be an essential condition absolutely necessary for the adoption of scientific innovations. A mitigation measure or pathway would need to have a clear advantage over competing measures or other pathways to tackle climate change.

If there were scientific uncertainty or a risk whether a mitigation measure or pathway would be climate change- or cost-effective compared to other measures or pathways, the likelihood of it being adopted would be limited.

(ii) If there were a perception of risk (4) or scientific uncertainty whether an upper limit of 2°C for global temperature rise by 2100 would prevent significant adverse environmental impacts, then negotiations over mitigation measures or pathways to tackle climate change would be confounded.

Environmental Decision-Making: The Legal Model *~v~* The Scientific Model

An issue that needs to be recognized in climate change negotiations is the significant difference between law and science for fact finding and decision-making under scientific uncertainty and risk.

The scientific model - in marked contrast to law - will defer a decision if inadequate information exists.

In essence, there is a total absence of finality in the scientific model as it operates under no deadlines.

Law - like the situation for science and global climate change - is frequently confronted with a situation where courts have to make decisions under scientific uncertainty and risk; most commonly, in environmental and planning litigation. Divergent scientific opinion over potential adverse impacts on the environment for a proposed action or development will be the primary source of dispute.

Compared to science, how does the legal model address this situation?

The legal model will resolve a factual dispute in circumstances where scientific uncertainty exists. In deciding cases involving both actual and potential environmental impacts, law produces a final determination of facts. Finding of facts by the court on disputed scientific evidence is a crucial part of the legal process.

An effective integration between the legal and scientific decision-making models is required to facilitate decision-making at COP 21.

In preparing for COP 21, a prudent course to take would be to recognize that the fact-finding process that will drive the negotiation of outcomes for the new climate agreement at Paris in December 2015 is not the exclusive domain of science; nor is it the sole province of law.

The legal decision-making model should be seen as an essential complement to the scientific model. Their integration should be directed at a common goal: *achieving the desired outcomes sought by UN Parties in the new Climate Agreement at COP 21 - recognizing that scientific uncertainty and risk is part of the fact-finding framework.*

The Legal Model: Decision-Making under Scientific Uncertainty &Risk

There are a number of decision-making approaches applied in the legal model that justify consideration for achieving this common goal.

(i) Divergent Expert Opinion

Divergent expert opinion is a feature of scientific research.

As one counter to this, the central test employed by science to determine the validity of a finding, reasoning or theory, in any given context, is acceptance through widespread consensus within the scientific community, following peer review and publication.

A landmark decision of the United States Supreme Court in 1993 (5) extended the "consensus test" of science so that judges could become "gatekeepers" to ensure that scientific evidence before the court was "*both relevant and reliable*".

The United States Supreme Court concluded that the legislative question of law, "*whether the underlying reasoning or methodology is scientifically valid and properly can be applied to the facts at issue*", depended on many considerations, including:

"[1] whether the theory or technique in question can be (and has been) tested;
[2] Whether it has been subjected to peer review and publication;
[3] Its known or potential error rate; and
[4] The existence and maintenance of standards controlling its operation and whether it has attracted widespread acceptance within a relevant scientific community.

The inquiry is a flexible one and its focus must be solely on principles and methodology, not on the conclusions that they generate."

(ii) Environmental Risk Assessment and Risk Analysis

For many years, two unifying scientific concepts that are central to decision-making for environmental management and protection - "*Environmental Impact Assessment*" *("EIA")* and "*Risk Analysis*" - have been prescribed in contemporary global environmental legislation.

By linking legal principles to these scientific concepts, the legislation facilitates legal decision-making under scientific uncertainty and risk.

*An **EIA** is descriptive in predicting the potential environmental impacts of a proposed action that are reasonably likely to occur.*

***Risk analysis**, in contrast, is concerned with risks that may possibly occur; the probability and consequences of risk events, that have the potential to occur, are assessed.*

(iii) Environmental Impact Assessment & Scientific Uncertainty

The origin of EIA is the United States statute, the *National Environmental Policy Act of 1969*. It is regarded as being "*the most successful legal export in history*" as it has been a model for EIA in over 100 countries.

The EIA process commences with a carefully researched environmental report which identifies the likely, or possible, environmental consequences of a proposed development or activity. Its role is to alert the government, developer and the public – as fully as possible - to the potential environmental impacts of the proposed action.

The process of reviewing this report is termed EIA. This involves the *systematic evaluation of the positive and negative ecological, economic, social and cultural impacts* that are possible, or likely to arise, from a development proposal or activity.

Scientific information is recognized as a cornerstone for the EIA process. However, there may be may limits on the capability of science to precisely predict the severity of potential adverse environmental impacts because of scientific uncertainty in the information available.

One pathway for a decision-maker to address scientific uncertainty, in these circumstances, is found in the EIA legislative framework for the United States.

The aim of this Federal United States Regulation **(6)**, as part of the EIA process, is to address a situation where "*information relevant to evaluating reasonably foreseeable significant adverse impacts*" cannot be obtained e.g. "*The means to obtain it are not known*".

The United States Regulation requires the decision-making government agency to include:

- *A statement that such information is incomplete or unavailable;*
- *The relevance of this information for evaluating reasonably foreseeable significant adverse impacts;*
- *A summary of relevant existing credible scientific evidence on such impacts; and*
- *The agency's evaluation of such impacts based upon generally accepted scientific theories and research methods.*

(iv) Risk Analysis & Environmental Decision-Making

Risk analysis is commonly found incorporated in legislation related to "*Genetically Modified Organisms*" and "*Workplace and Occupational Health and Safety*".

Risk Analysis recognises that all human activity involves some level of risk - but that it is rarely possible to reduce risk to a zero level. It is a broad concept that incorporates the processes of "*Risk Assessment*", "*Risk Management*" and "*Risk Communication*".

A risk assessment identifies hazards that may be sources of potential harm to the environment or people. A *"hazard"* does not become a "*risk*" unless there is exposure to it at a level that may do harm.

A risk assessment refers to both the potential consequences that a hazard may cause to the environment or people and the probability (or likelihood) of this arising from human activities and/or natural events. Probability is the mathematical measure of risk.

A *"risk assessment"* for climate change would commence with identifying potential hazards *e.g. burning of fossil fuels*; and then estimate the probability of the risk occurring and its consequences (*e.g. sea level rise, food insecurity, livelihood of people living in poverty…*), based on the severity of the predicted global temperature rise.

"Risk management" identifies the risks requiring management and the mitigation measures that could be used to manage the risks to an *"acceptable level of risk"* in such a way to protect people and the environment from harm.

Risk communication is the process of information exchange about the nature, consequences, and probability of the risk - as well as mitigation measures for managing it to an acceptable level of risk.

A *"risk management"* for climate change would focus on the mitigation measures and pathways that could be put into place in national contribution commitments made at COP 21, in order to achieve the goal of limiting global temperature rise to less than 2°C pre-industrial by 2100.

The categories of any risk, such as the risk associated with climate change, has two dimensions.

"Scientific" (or "factual") risk, based on objective science, consists of outcomes that can be measured e.g. the potential consequences of hazards that have been identified as a risk.

There is also a socio-cultural dimension that reflects how a particular risk is viewed in terms of values and emotions. *"Risk perception"* is subjective as it involves people's feelings, beliefs, attitudes and judgements.

Decisions as to what is an acceptable level of risk by science *e.g. climatologists* and *ecologists,* based on their expert knowledge, may be quite different from public opinion and subjective perceptions of risk.

These differences between "scientific risk" and "risk perception" often lead to conflict over what constitutes an "acceptable level of risk"!

The pathway for managing risk advocated by the International Risk Governance Council (7), based in Lausanne, Switzerland overcomes such conflict by providing "*equal room for both scientific evidence and community value-based perceptions of risk*".

Conclusions

(i) **Decision-making under scientific uncertainty and risk is a real issue confronting climate agreement negotiations at COP 21.**

(ii) **From a risk management perspective, the agreement to limit temperature rise to a maximum of 2°C above pre-industrial levels by 2100 represents the existing *"acceptable level of risk"* for managing the consequences of climate change.**

(iii) **Adhering to 2°C as the safe upper temperature limit will be crucial for UN Parties at COP 21 in deciding the measures and pathways needed to mitigate the impacts of climate change in their national contributions.**

(iv) **Any scientific uncertainty - created by divergent scientific opinion - over 2°C as the safe upper limit must be resolved. The legal model offers an alternative approach to science for resolution.**

(v) **Endorsing the accepted body of knowledge from the social sciences for the adoption of scientific innovations would enable UN Parties to objectively evaluate mitigation measures and pathways in their decision-making on national contributions.**

(vi) ***The 'IPCC Fifth Assessment Report: Climate Change (2014) 'Impacts, Adaptation and Vulnerability'*, is equivalent to an Environmental Impact Assessment: *The role of an EIA is to facilitate decision-making; in the case of the IPCC Report, through the information published and made available on the consequences of climate change.***

(vii) **To offset one criticism of the EIA process – *inaccuracy of impact predictions because of scientific uncertainty* – potential environmental impacts in the IPCC Report that have not been fully evaluated, because of lack of information, need to be identified.**

In these circumstances, options for resolution include: more science is required or applying the United States Federal Regulation for "*Incomplete or unavailable information"* in the EIA process.

(viii) ***The 'IPCC Fifth Assessment Report: Climate Change (2014) 'Mitigation of Climate Change' is* equivalent to a Qualitative Risk Analysis: *Its role is to facilitate decision-making on mitigation measures and pathways to manage the wide range of global risks to an acceptable level of risk.***

A Qualitative Risk Analysis *assesses* the probability of a risk by ranking the level of risk into a number of descriptive categories such as "High", "Medium" and "Low"

(ix) Public trust and confidence in any Qualitative Risk Analysis is essential for achieving its role. Uncertainty issues to avoid in this regard include: limited objective scientific data for the risk assessment; and where achieving consensus on '*scientific*' (or '*factual*') *risk* and the '*public perception of risk*' as to what constitutes an '*acceptable level of risk*' becomes problematic.

(x) Courts in the United States, UK and Australia recognize that an EIA is not a decision-making end in itself. Its purpose is to assist the decision-maker. This approach should also be adopted for Qualitative Risk Analysis: to be a decision-making aid and not the decision end-point.

About Dr Ted Christie and Environmental Dispute Resolution:

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End Notes

(1) Conferences of the Parties ("COP") serve as the formal meeting of the UNFCCC Parties to review progress in dealing with climate change and the implementation of the Convention and any other legal instruments that the COP adopts. All States that are Parties to the UNFCCC are represented at the COP. The first COP meeting was held in Berlin, Germany in March, 1995. The COP is the supreme decision-making body of the UNFCCC.

(2) The "Deep Decarbonization Pathways Project" is convened under the auspices of the *'Sustainable Development Solutions Network'* and the Paris based *'Institute for Sustainable Development and International Relations'*.

(3) Rogers, Everett M (2003), 'Diffusion of Innovations' (5th Edition), New York: Free Press.

(4) Re "*risk perception*": see page 8 of this article.

(5) *Daubert v Merrell Dow Pharmaceuticals Inc.* 509 U.S. 579 (1993).

(6) "Incomplete or Unavailable Information*": Code of Federal Regulations. Title 40 Protection of Environment,* Section 1502.22.

(7) The International Risk Governance Council is an independent think-tank with multidisciplinary expertise to help bridge the gaps between science, technological development, policymakers and the public. It aims to help improve the understanding and management of risks and opportunities by providing insight into systemic risks that have impacts on human health and safety, on the environment, on the economy and on society at large.