

# LMI-CliCKE: The Climate Change Knowledge Engine

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## ABSTRACT

LMI is a not-for-profit research organization committed to helping government leaders and managers reach decisions that make a difference on issues of national importance.

Climate change will be one of the defining issues of this century. It has moved from the province of specialists in environmental issues to one of concern for all government leaders. The International Panel on Climate Change (IPCC), the U.S. Global Change Research Program, and individual U.S. agencies have produced important studies of climate change. However, the IPCC Fourth Assessment Report (AR4) alone is over 2660 pages. Within these pages, LMI identified 2693 findings that include specific defined levels of uncertainty.

The findings from the IPCC have been so thoroughly demonstrated by the scientific method that it would be a failure of responsibility to ignore them. They form the basis for the LMI Climate Change Knowledge Engine (LMI-CliCKE™) and *A Federal Leader's Guide to Climate Change* – a LMI published book written to assist leaders of federal agencies in addressing the challenges associated with climate change.

Thorough analysis of the 2693 findings led LMI to develop a semantically driven, wiki-based web site that allows users to explore, analyze, evaluate, and compare scientific findings related to climate change. The LMI Climate Change Knowledge Engine (LMI-CliCKE™) gives full text and categorical details of the findings and relationships among them. As an initial prototype the LMI climate team has selected and categorized all findings from the AR4.

## Keywords

Semantic MediaWiki, MediaWiki, Semantic Drill Down, Google Charts API, SPARQL, Climate Change, Wiki, Scientific Findings, RDF, LMI-CliCKE, LMI, *A Federal Leaders Guide to Climate Change*, IPCC findings

## 1. INTRODUCTION

Developed through LMI's internal research & development, LMI-CliCKE™ allows users to identify key findings about climate change according to their interests in a familiar and intuitive wiki interface. By focusing on a given climate change topic, a LMI-CliCKE™ user can identify the findings related to that topic and query the knowledge engine to drill down on the topic or meta information within the findings.

The following navigation paths are offered as a means of entry points to the IPCC findings and the relationship between them:

**Topic:** Browse findings by climate change topic (Temperature, GHG emissions, etc.)

**Scientific Uncertainty:** What are the most likely findings and where is the most confidence?

**Source:** Research by the finding source (IPCC document, etc.)

**Regions:** Research by a specific geographic region

**Advanced Search:** Drill down based on filters of all properties and values. Powerful option allows users to build queries based on specific interests.

## 2. DEVELOPMENT OF A CLIMATE CHANGE FINDING TAXONOMY

As part of the initial organization of the 2693 IPCC AR4 findings, LMI began categorizing the findings by properties that were identified through extensive analysis of the AR4.

One example of LMI-CliCKE™ finding categorization uses the AR4 levels of scientific understanding to compare and categorize climate change findings. The IPCC assessment process assigns a well-defined level of scientific understanding to each finding, using a uniform and carefully vetted process. The findings may be qualitative in nature, with the understanding expressed in qualitative terms reflecting the degree of agreement of the evidence and the amount of evidence, as below:

Subset list of Degrees of scientific understanding (qualitative)

**High Agreement, Much Evidence**

High Agreement, Low Evidence

Medium Agreement, Much Evidence

Low Agreement, Low Evidence

When there is **High Agreement and Much Evidence** and when the information allows estimates of the probability of events (by quantitative analysis or expert judgment), the IPCC makes a probabilistic assessment using terms referring to the likelihood of the event.

Subset of Certainty property (% probability of occurrence)

~100 - Unequivocal

>90 - Very likely

>66 - Likely

### 3. DEVELOPING LMI-CLICKE USING SEMANTIC MEDIAWIKI

#### 3.1 Platform Selection

Existing wiki platforms were evaluated for feasibility MediaWiki is the platform behind the widely used Wikipedia® web site. In MediaWiki sites, authorized users can create pages or articles on any subject.

Semantic MediaWiki is a plugin that enables semantic relationships to be developed within and between Wiki articles. Semantic MediaWiki also offers extensions that allows for importing formatted text to create semantic wiki articles.

#### 3.2 Semantic MediaWiki Extensions

Using existing extensions, a Semantic MediaWiki site can add key functionality to existing wikis. Two enhancements that were used in LMI-ClicKE™ were Semantic Drill Down and Google Chart integration.

##### 3.2.1 Semantic Drill Down

Since all findings were imported with properties and values already organized as semantic attributes, adding the Drill Down filters allows for users to generate queries based on their specific needs.

The findings that match each of the properties that are part of the query appear in a list below the Drill Down screen as depicted in Figure 1 below.

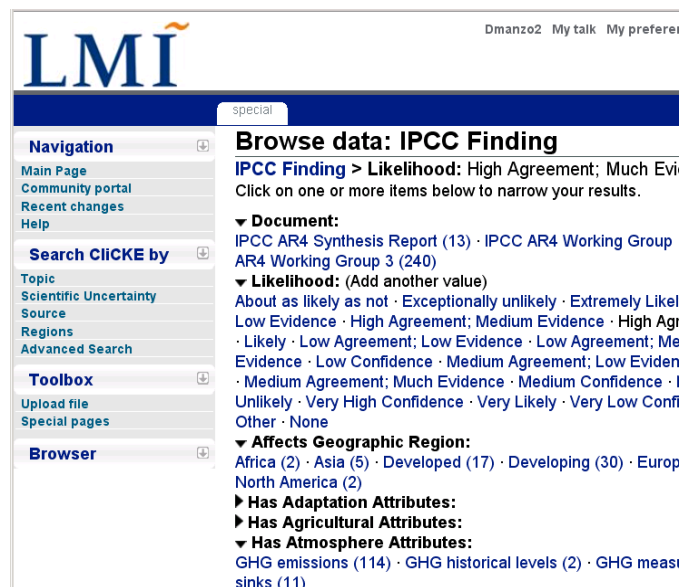


Figure 1- Semantic Drill Down

##### 3.2.2 Google Charts integration

LMI-ClicKE™ users also benefit from visual tools that show finding distribution. Depicted in Figure 2, the IPCC AR4 finding distribution by geographic region enables for a intuitive display of which regions are addressed.

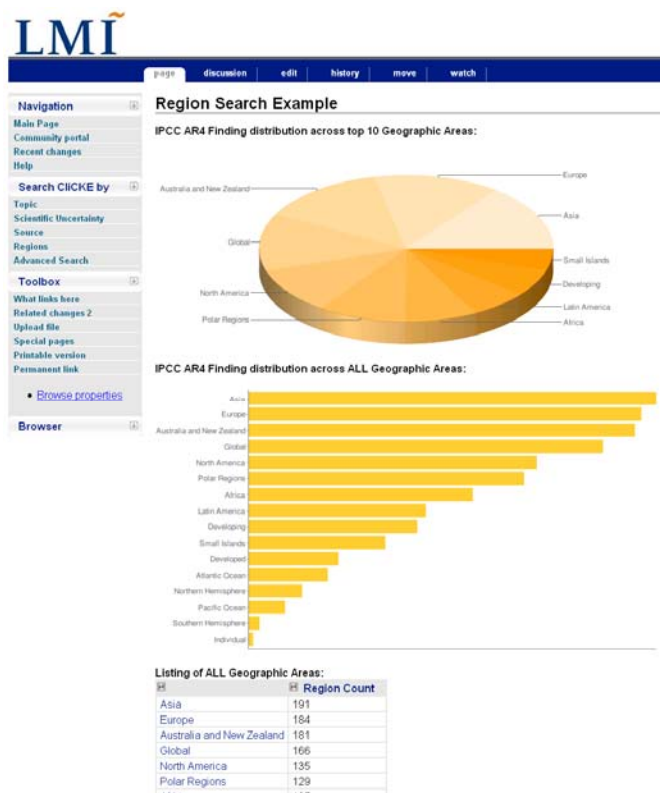


Figure 2 - Graphical Distribution of IPCC Findings

Existing support and documentation of these and other MediaWiki extensions are proof that the Semantic MediaWiki platform is a viable, robust, and cost effective solution.

### 4. ROADMAP

Future enhancements to LMI-ClicKE™ include adding additional IPCC reports, selecting additional sources of climate change scientific findings, adding Really Simple Syndication (RSS) feeds based on areas of interest, and developing a SPARQL-based interface to enable queries from clients and partners to LMI-ClicKE™.

### 5. ACKNOWLEDGMENTS

IPCC Findings are property of the IPCC.

Rachael G. Jonassen, PhD, is the lead author of *A Federal Leaders Guide to Climate Change*.

Semantic MediaWiki, is an open-source project to which many people and organizations have contributed. The SMW project is lead by its founders – Markus Krötzsch and Denny Vrandečić.