Water Food Energy Nexus in Chile: Future challenges due to global change

Francisco J Meza
Director Centro de Cambio Global UC
PUBLIC POLICY

ENVIRONMENTAL INFORMATION FOR STRATEGIC PLANNING

Centro UC Cambio Global

SCIENCE

UNIVERSITY
Water Availability/ Demand

DGA, 1999
Fast Growing Country/ Fast Growing Demand

### Uso

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Riego</td>
<td>516</td>
<td>611</td>
<td>647</td>
<td>527*</td>
</tr>
<tr>
<td>Agua potable</td>
<td>27</td>
<td>34</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>Industrial</td>
<td>47</td>
<td>68</td>
<td>77</td>
<td>84</td>
</tr>
<tr>
<td>Minería</td>
<td>43</td>
<td>51</td>
<td>53</td>
<td>63</td>
</tr>
<tr>
<td>Energía</td>
<td>1.189</td>
<td>2.914</td>
<td>3.929</td>
<td>3.997</td>
</tr>
<tr>
<td>Total</td>
<td>1.823</td>
<td>3.678</td>
<td>4.743</td>
<td>4.711</td>
</tr>
</tbody>
</table>
Fig. 1. Seasonal rainfall indices for central Chile (30°–41°S): (top) winter (JJA) in region A (30°–35°S), (middle) late spring (ON) in region B (35°–38°S), and (bottom) summer (JFM) in region C (38°–41°S). Spatial distribution of rainfall stations in each region is indicated.
Droughts as recurrent phenomena

En Illapel sufren por sequía y Gobierno decreta emergencia agrícola en toda la IV Región

Una 350 mil personas de zonas rurales de Coquimbo afectadas por suministro de agua

La sequía obliga a trasladar el agua en balde a sus hogares:

Estas personas, que dependen de un suministro de agua, sufren por la falta de agua.
Tendencia de temperatura en Chile Central

Falvey and Garreau, 2009
Projected changes
Annual Precipitation Change

Difference from 1986–2005 mean (%)

mid 21st century

RCP2.6

Solid Color

Very strong agreement

Gray

Divergent changes

RCP8.5

White Dots

Strong agreement

Diagonal Lines

Little or no change
Impactos en Evapotranspiracion
Meza et al., 2012
Demand cover
Meza et al., 2014

Graph showing the relationship between average and minimum coverage change and precipitation change. The graphs illustrate how urban and agricultural areas respond to changes in precipitation.
Case Study Maule
CEPAL, 2009

Grafico del caudal (m³/s) desde 1976 hasta 2099, con predicciones para los próximos años.
Stremflow reductions

Impacts on Agriculture

Poblete et al in Prep

![Graph showing cumulative distribution and agriculture coverage](image-url)
Cas Studies
Antofagasta

WFE-NEXUS SYSTEM

WATER

Groundwater
Surface water

FOOD

Energy

MINING

Processing
Irrigation
Cooling
Pumping, Desalination

Food Products

Renewable
Non-Renewable
Antofagasta
global change
Maipo global change

WFE-NEXUS SYSTEM

WATER
- Surface water
- Groundwater

URBAN
- Industry
- Domestic

FOOD
- Food Products

ENERGY
- Renewable
- Non-Renewable

Irrigation

Reflow

Hydropower

Pumping, Treatment, Distribution

Power
Maule

**WFE-NEXUS SYSTEM**

**WATER**
- Surface water
  - Irrigation
  - Reflow
  - Hydropower

**FOOD**
- Food Products
  - Power

**ENERGY**
- Renewable
- Non-Renewable
  - Pumping, Treatment, Distribution
Maule

Global change

WFE-NEXUS SYSTEM

Food Products

Energy
- Renewable
- Non-Renewable

Water
- Surface water
- Groundwater

Power

Irrigation

Reflow

Hydropower

Pumping, Treatment, Distribution

Groundwater

Surface water
Future Steps

• Towards the development of integrated models/methods to quantify the fluxes

• Addressing W-E-F dynamics under the concept of water-energy-food security
  – Managing Demand
  – Reliability of supply
  – Increase Efficiency
  – Build strong institutional capacities
Muchas Gracias!

Dr. Francisco Meza
fmeza@uc.cl

Centro UC
Cambio Global

http://cambioglobal.uc.cl