Latin America and Caribbean (LAC) awareness creation workshop to maximize the

positive and minimize the negative impacts of implementation of Climate Change response measures

ECONOMIC IMPACT EVALUATION OF BIOENERGY IN THE PROVINCE OF SANTA FE, ARGENTINA

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Objectives

- Main objective:

i) estimate the economic characteristics of bioenergy: Province of Santa Fe

ii) analyze the impact of the policies at the level of provincial production & employment

iii) increase in production given the current capacity, investments in new plants and substitution of conventional energy by biomass energy

- Pre-condition: data quality and availability issues:
  - inconsistent information
  - outdated information
  - information referring to productive or geographic locations, different from the area under analysis

Method

❑**Need of detailed information on:**

i) supply & demand in bioenergy

ii) input-output relationships in provincial economy

iii) detailed information on household employment & expenditure by branch of activity

❑**Data treatment:**

i) Estimate the size of bioenergy and its costs & sales structures:

specific surveys of production companies

i) Input-output matrix (IOM) representing inter-industry relationships in the province:

estimated: surveys and applying statistical methods

i) Employment information based on surveys and information:

data from provincial bodies, expenditure structure estimated based on the national household expenditure survey

Production, costs & employment figures

WHAT: Quantifying employment directly related to the bioenergy sector

HOW: 1) inquiry to firms; 2) secondary sources

MORE: Inquiry also provides relevant information on bioenergy, which is necessary to build Input-Output models

PRELIMINARY ACTIVITIES		SURVEY DONE		RESULT ANALYSIS / REPORT
• Elaborate a directory with all firms at the local level • Organize firm data based on established taxonomy • Select cases		• Plan a chronogram • Plan surveys • Surveys done • Build the database: regional and imported raw materials, employment, revenue: regional and exports		• Build provincial IO model (o/c) with employment module • Prepare statistical data meeting key objectives of the research • Elaborate the report

Estimation of the Input-Output Matrix for Santa Fe

❑Hybrid method for the estimation of IO tables:

Mix between direct methods for bioenergy sectors (using specific surveys) & location quotients for the rest of the sectors (using FLQ – Flegg Location Quotient)

❑Data used:

- ✓2004 economic census
- ✓2004 supply & use charts
- ✓Geographical gross product (sectorally disaggregated)
- ✓Level of occupation by sector of activity (2010 Santa Fe Census)
- ✓Annual Survey of Urban Households for the jobs by sector of activity
- ✓Argentina's 1997 input-output matrix, up-dated figures
- ✓Crops data per province from the (ex-) Ministry of Agroindustry
- ✓Argentina's 2015 social accounting matrix, jointly prepared by Ministries of Production and Energy

Economic and labour structure: Bioenergy in Santa Fe

Santa Fe, 2015. Participation of local and imported inputs, production structure and employment by sector of activity

Sec.	Description	Part. CI Santa Fe	Part. CI rest of the country	Part. CI Import.	VA c.f. (MM$)	Struc. VA c.f.	Jobs (quantity)	Stru jol
s1	Agriculture, forestry and fishing	24.1%	19.1%	2.3%	43,677	12.2%	28,767	2.5
s2	Corn	21.6%	21.5%	2.3%	1,934	0.5%	1,274	0.1
s3	Soy	19.7%	23.4%	2.3%	8,698	2.4%	5,728	0.5
s4	Mining and quarrying and non-metal minerals.	73.4%	2.2%	0.7%	359	0.1%	1,863	0.2
s5	Food, beverages and tobacco	57.8%	6.2%	1.7%	28,939	8.1%	36,944	3.1
s6	Vegetable oils	61.8%	2.2%	1.7%	4,647	1.3%	5,935	0.5
s7	Textiles and Leather	43.9%	6.5%	4.1%	3,944	1.1%	15,015	1.3
s8	Paper Wood and editions	37.5%	11.2%	6.2%	3,664	1.0%	22,245	1.9
s9	Biodiesel	63.5%	8.6%	0.0%	407	0.1%	671	0.1
s10	Bioethanol	44.3%	12.0%	0.0%	134	0.0%	76	0.0
s11	Biomass	11.2%	1.4%	0.0%	194	0.1%	82	0.0
s12	Oil refineries	2.3%	34.5%	8.0%	8,560	2.4%	536	0.0
s13	Rubber, Chemicals and Petrochemicals	82.5%	4.6%	1.0%	1,378	0.4%	20,623	1.8
s14	Basic metals and Metallic products	27.6%	25.8%	6.8%	13,559	3.8%	45,627	3.9
s15	Machinery, equipment and precision materials	25.1%	23.6%	10.0%	11,346	3.2%	10,285	0.9
s16	Automotive and transportation equipment	41.0%	14.3%	14.3%	4,969	1.4%	8,334	0.7
s17	Other manufacturing industries	2.1%	0.4%	0.8%	4,491	1.3%	13,699	1.2
s18	Replacement, Maintenance and installation of machinery and equipment	19.5%	12.8%	7.6%	731	0.2%	5,816	0.5
s19	Generation and distribution Electricity	12.1%	6.9%	58.4%	2,618	0.7%	7,920	0.7
s20	Gas distribution	13.0%	79.8%	40.9%	101	0.0%	709	0.1
s21	Production and distribution of water	25.2%	16.3%	2.7%	844	0.2%	659	0.1
s22	Building	21.9%	21.8%	7.8%	20,137	5.6%	123,820	10.(
s23	Commerce, Restaurants and hotels	40.3%	3.1%	1.9%	32,784	9.2%	309,381	26.4
s24	Transport	35.0%	15.5%	5.0%	12,197	3.4%	69,925	6.0
s25	Communications	37.6%	8.7%	4.5%	6,645	1.9%	13,972	1.2
s26	Financial and business activities	21.6%	4.6%	1.9%	54,443	15.2%	120,558	10.1
s27	Public Administration and education	16.1%	7.9%	0.0%	56,443	15.8%	182,599	15.(
s28	Health and Social Services	28.8%	8.0%	0.0%	30,250	8.4%	119,934	10.1
	TOTAL	35.0%	11.5%	3.5%	358,089	100.0%	1,172,997	100.

Part. CI: Participation of intermediate purchases in Santa Fe, Rest of the country, and imported purchases, as a % of VBP; Struc. indicates a % of the relevant variable versus the total; c.f.; cost of factors; employment is measured by the quantity of working persons

Santa Fe, 2015. Forward linkages (FL) and backward linkages (BL) by sector of activity.

Sec.	Description	Open Model		Closed model	
		BL1	FL1	BL2	FL2
s1	Agriculture, forestry and fishing	1.361	2.982	1.928	5.142
s2	Corn	1.333	1.436	1.887	1.454
s3	Soy	1.300	1.823	1.837	1.913
s4	Mining and quarrying and non-metal minerals.	2.279	1.251	2.911	1.288
s5	Food, beverages and tobacco	1.917	2.031	2.393	6.607
s6	Vegetable oils	1.873	2.086	2.401	2.300
s7	Textiles and Leather	1.741	1.311	2.543	1.798
s8	Paper Wood and editions	1.655	1.400	2.279	1.544
s9	Biodiesel	2.193	1.060	2.552	1.090
s10	Bioethanol	1.606	1.018	1.976	1.026
s11	Biomass	1.153	1.136	1.412	1.141
s12	Oil refineries	1.033	1.528	1.225	1.739
s13	Rubber, Chemicals and Petrochemicals	2.582	2.317	3.208	2.858
s14	Basic metals and Metallic products	1.403	1.828	1.869	1.968
s15	Machinery, equipment and precision materials	1.387	1.141	1.796	1.355
s16	Automotive and transportation equipment	1.652	1.361	2.138	1.580
s17	Other manufacturing industries	1.035	1.063	3.150	1.204
s18	Replacement, Maintenance and installation of machinery and equipment	1.296	1.038	1.693	1.051
s19	Generation and distribution Electricity	1.152	1.243	1.757	1.309
s20	Gas distribution	1.165	1.032	1.619	1.038
s21	Production and distribution of water	1.386	1.018	2.062	1.039
s22	Building	1.365	1.119	2.353	1.167
s23	Commerce, Restaurants and hotels	1.678	2.403	2.680	3.437
s24	Transport	1.503	1.893	2.628	3.125
s25	Communications	1.554	1.340	2.024	1.954
s26	Financial and business activities	1.316	2.522	2.009	3.746
s27	Public Administration and education	1.242	1.012	3.581	1.309
s28	Health and Social Services	1.468	1.235	2.942	2.301

Santa Fe, 2015. Direct, indirect and induced job multipliers, per sector of activity

Sec.	Description	Direc Req.	Total Req		Job Multiplier	
			type 1	type 2	type 1	type 2
s1	Agriculture, forestry and fishing	0.312	0.607	1.014	1.946	3.247
s2	Corn	0.312	0.650	1.047	2.081	3.353
s3	Soy	0.312	0.583	0.968	1.866	3.100
s4	Mining and quarrying and non-metal minerals.	1.200	3.591	4.045	2.992	3.369
s5	Food, beverages and tobacco	0.193	0.733	1.074	3.797	5.566
s6	Vegetable oils	0.193	0.831	1.211	4.309	6.274
s7	Textiles and Leather	1.140	2.047	2.622	1.795	2.299
s8	Paper Wood and editions	2.332	3.632	4.080	1.558	1.750
s9	Biodiesel	0.108	0.668	0.926	6.192	8.578
s10	Bioethanol	0.226	0.574	0.840	2.537	3.710
s11	Biomass	0.370	0.445	0.632	1.204	1.707
s12	Oil refineries	0.018	0.049	0.187	2.718	10.349
s13	Rubber, Chemicals and Petrochemicals	1.604	4.121	4.570	2.570	2.850
s14	Basic metals and Metallic products	1.202	1.837	2.172	1.529	1.807
s15	Machinery, equipment and precision materials	0.288	0.912	1.206	3.170	4.191
s16	Automotive and transportation equipment	0.237	1.018	1.366	4.287	5.753
s17	Other manufacturing industries	2.504	2.569	4.086	1.026	1.632
s18	Replacement, Maintenance and installation of machinery and equipment	4.438	4.974	5.258	1.121	1.185
s19	Generation and distribution Electricity	2.153	2.344	2.779	1.089	1.291
s20	Gas distribution	2.153	2.284	2.610	1.061	1.212
s21	Production and distribution of water	0.367	1.100	1.585	3.002	4.324
s22	Building	2.886	3.498	4.207	1.212	1.458
s23	Commerce, Restaurants and hotels	4.551	5.234	5.953	1.150	1.308
s24	Transport	2.205	2.920	3.727	1.324	1.690
s25	Communications	0.823	1.753	2.090	2.131	2.541
s26	Financial and business activities	1.263	1.825	2.322	1.444	1.838
s27	Public Administration and education	2.454	2.877	4.556	1.172	1.856
s28	Health and Social Services	2.226	3.081	4.139	1.384	1.860

Simulation scenarios

Simulation: Increases in final demand resulting from increases in final bioenergy consumption/ investment to expand production capacity (incl. direct, indirect and induced employment)

1. **Production increase scenarios (PROD)**:
   PROD-1: any idle capacity is eliminated from the existing production capacity. Increases are: 40% in Biodiesel, 10% in Bioethanol and 50% in Biomass
   PROD-2: Production increase resulting from new plants, as shown in the survey. Increases are: 12% in Biodiesel, 34% in Bioethanol and 296% in Biomass

2. **Investment increase scenario (INVE)**:
   INVE-1: This assesses the cost of building new plants, modelling the impact of demand on goods and services needed for such construction.
   INVE-2: This assumes that capital goods (machinery and equipment sector) are not produced in the province.

3. **Impact of the potential of biomass-based energy (WISD) scenario**. Potential production expansion according to WISDOM methodology (FAO, 2018)

Quantifying Indirect/Induced Effects and Simulations

- I-O REGIONAL Matrix
- Closed and Open Models (Indirect and Induced Employment)
- Employment/Production Multipliers

*Santa Fe, 2015. Rise in **production** resulted from the exploitation of **unused installed capacity (Prod 1)**:*
Direct, Indirect, Induced production and employment

		ΔX					ΔL				
		Directo	Total 1	Total 2	mult 1	mult 2	Directo	Total 1	Total 2	mult 1	mult 2
Biodiesel	12,0%	2.486	5.454	6.346	2,19	2,55	268	1.662	2.302	6,19	8,58
Bioetanol	34,2%	34	54	66	1,61	1,98	8	19	28	2,54	3,71
Biomasa	296,0%	111	128	157	1,15	1,41	41	49	70	1,20	1,71
TOTAL		**2.631**	**5.636**	**6.569**	**2,14**	**2,50**	**317**	**1.731**	**2.400**	**5,46**	**7,57**

ΔX: rise in production millions of $ (pesos) of 2015
ΔL: rise in employment (number of jobs)

Quantifying Indirect/Induced Effects and Simulations

*Santa Fe, 2015. Increase of **investments i**n order to install expected capacity*

		ΔX					ΔL				
		Direct	**Total 1**	**Total 2**	**mult 1**	**mult 2**	**Direct**	**Total 1**	**Total 2**	**mult 1**	**mult 2**
Cogeneration	349.3%	1,355	1,803	3,026	1.33	2.23	2,821	3,575	4,452	1.27	1.58
Biogas	10.3%	71	96	161	1.37	2.28	181	224	270	1.24	1.49
Biofuel	12.2%	311	410	736	1.32	2.37	719	882	1,116	1.23	1.55
TOTAL		**1,737**	**2,31**	**3,923**	**1.33**	**2.26**	**3,721**	**4,681**	**5,839**	**1.26**	**1.57**

ΔX: rise in production millions of $ (pesos) of 2015
ΔL: rise in employment (number of jobs)

Quantifying Indirect/Induced Effects and Simulations

Santa Fe, 2015. ***WISD****: Impact of biomass potential. Construction of plants and production*

	ΔX					ΔL				
	Direct	**Total 1**	**Total 2**	**mult 1**	**mult 2**	**Direct**	**Total 1**	**Total 2**	**mult 1**	**mult 2**
Investment	15,138	20,592	30,297	1.36	2.00	17,121	26,084	33,048	1.52	1.93
Production	1,3	1,498	1,835	1.15	1.41	481	579	821	1.20	1.71
TOTAL	**16,437**	**22,09**	**32,132**	**1.34**	**1.95**	**17,602**	**26,663**	**33,869**	**1.51**	**1.92**

ΔX: rise in production millions of $ (pesos) of 2015
ΔL: rise in employment (number of jobs)

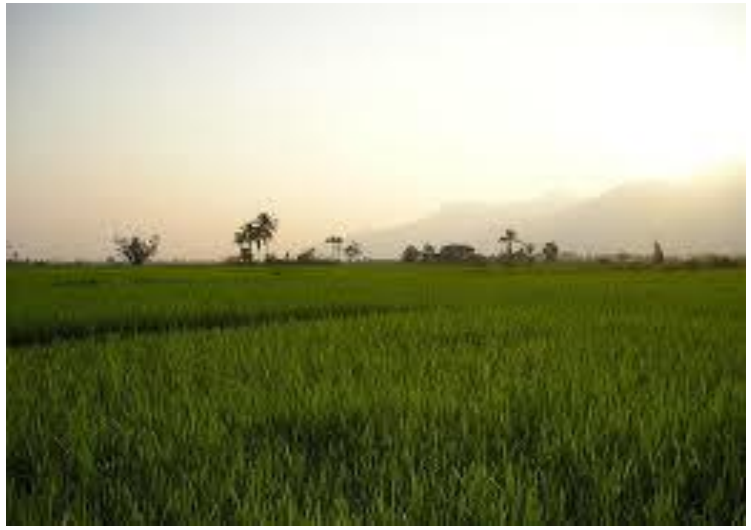
Conclusion

1. Biodiesel and Bioethanol are two “driving” branches with above average BWD linkages, high labour multiplier
2. Effect on indirect or induced employment high in production scenarios, as direct employment coefficient low in biodiesel production: job creation
3. Investment scenario: Strong employment impact, lower when imports considered
4. WISDOM: Strongest impact on employment from the installation of plants
5. Simulations allowed to assess the impact of potentially harnessing the supply of biomass in the province. Potential strong impact on employment
6. Structure of employment: male dominated, workers with secondary completed

Increasing job potential, through the value chain, male-biased, various education levels

!!Handbook on EIA in bioenergy, together with FAO!!

THANK YOU VERY MUCH!



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