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North Dakota Lignite Energy Industry

Economic Contribution Analysis

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Preface

This report is the latest biennial assessment of the economic contribution of the North Dakota lignite energy industry.

Data for this study came from industry surveys, state and federal agencies, and other secondary sources,

The definition of the lignite energy industry and methods used to estimate its economic contribution are consistent with studies examining the economic contribution of other industries in the state. As usual, these studies are snapshots in time and economic contributions often vary from year to year with commodity-based industries.

Industry Highlights

The following figures are based on activity during 2021 and projections of industry output in 2022. All values include direct and secondary economic effects.

North Dakota Lignite Energy Industry in 2021

- ❖ \$5.64 billion gross business volume
 - ❖ \$0.9 billion from mining
 - ❖ \$3.2 billion from coal conversion and electricity generation
 - ❖ \$1.5 billion from transmission/distribution
- ❖ 12,800 jobs (direct and secondary)
 - ❖ 3,300 jobs supported by mining
 - ❖ 8,400 jobs supported by coal conversion and electricity generation
 - ❖ 1,050 jobs supported by transmission/distribution
- ❖ \$119 million in local and state government revenues

North Dakota Lignite Energy Industry in 2022

- ❖ \$5.75 billion gross business volume
 - ❖ \$0.8 billion from mining
 - ❖ \$3.2 billion from coal conversion and electricity generation
 - ❖ \$1.7 billion from transmission/distribution
- ❖ 12,000 jobs (direct and secondary)
 - ❖ 3,250 jobs supported by mining
 - ❖ 7,725 jobs supported by coal conversion and electricity generation
 - ❖ 1,060 jobs supported by transmission/distribution
- ❖ \$104 million in local and state government revenues

Understanding the Numbers

Economic contribution assessments measure the gross size of an industry or economic sector.

Size is estimated by combining *direct* or first-round effects (i.e., sales, spending, and/or employment) with economic modeling to estimate secondary effects of business-to-business transactions (*indirect*) and household spending for goods and services (*induced*).

Economic measures frequently used in economic contribution assessments:

- ❖ **Labor income** – earnings of workers and sole proprietors
- ❖ **Employment** – wage and salary jobs and sole proprietor/self-employed jobs
- ❖ **Gross business volume** – includes direct sales of products and services of the industry being measured, and sum of all business-to-business and household-to-business transactions associated with indirect and induced economic activity
- ❖ **Value-added** – represents share of gross state product

An overview and additional information on study methods, data sources, and economic definitions are appended to the end of this report.

Composition of Lignite Energy Industry

Coal Mining: this segment involves the process of extracting lignite coal and delivering it to conversion facilities.

Coal Gasification: this segment involves converting lignite coal into chemicals and other products. It is grouped with electricity generation segment of the industry.

Electricity Generation: this segment burns lignite coal to produce electricity.

Transmission and Distribution: this segment includes moving electricity to local (in-state) distributors and exporting electricity to out-of-state markets.

Industry Contribution 2021

Coal mining had 1,131 direct jobs; business activity relating to coal mining operations supported another 1,220 jobs. Personal spending on goods and services by employees working in the coal mining sector and employees of businesses affected by coal mining supported an additional 960 jobs. The combined effects on statewide employment from coal mining was estimated at 3,300 jobs. Other economic effects from coal mining included \$300 million in labor income and \$915 million in gross business volume.

Coal conversion and electricity generation from lignite was estimated to have nearly 1,700 direct jobs, and business activity relating to those lignite operations supported another 4,680 jobs. Personal spending on goods and services by employees working in the coal conversion and generation activities and employees of businesses affected by those activities supported an additional 2,070 jobs. The combined direct, indirect, and induced effects on statewide employment from coal conversion and electricity generation was estimated at 8,400 jobs. Other economic effects from coal conversion and electricity generation included \$670 million in labor income and nearly \$3.2 billion in gross business volume.

Electricity transmission and generation from lignite-based activities was estimated to have 480 direct jobs; business activity relating to those lignite operations supported another 290 jobs. Personal spending on goods and services by employees working in coal-related electricity transmission and distribution and employees of businesses affected by those activities supported an additional 280 jobs. The combined direct, indirect, and induced effects on statewide employment from coal-related electricity transmission and distribution was estimated at 1,060 jobs. Other economic effects from transmission and distribution included \$84 million in labor income and \$1.5 billion in gross business volume.

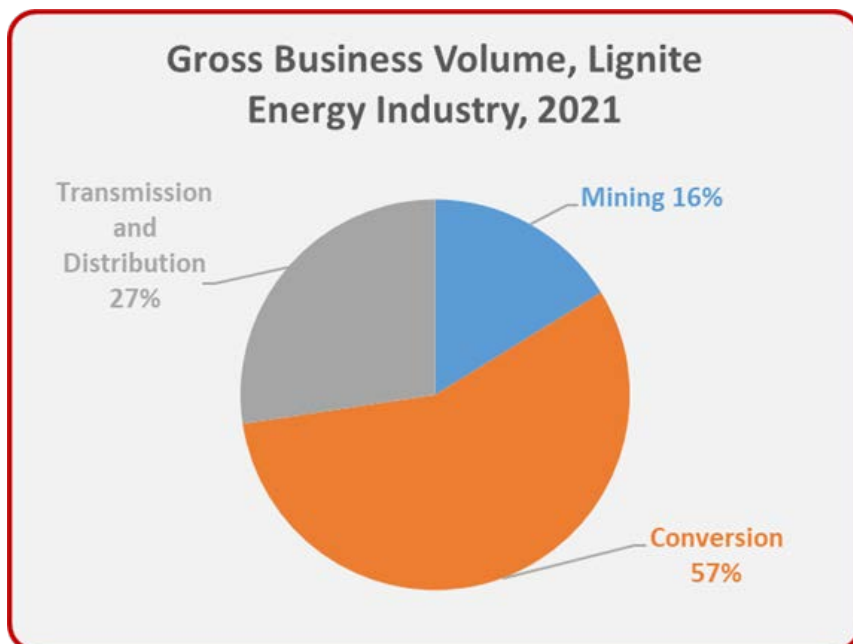
The combination of coal mining, coal conversion, coal-fired electricity generation, and electricity transmission and distribution was estimated to have 3,300 direct jobs in North Dakota in 2021. These lignite coal activities supported about 6,190 jobs through business purchases of goods and services in the state. The combined personal spending of employees in the Lignite Industry, and employees of businesses involved with supplying goods and services to the industry supported another 3,310 jobs. Collectively, the industry was estimated to support 12,800 jobs in the state.

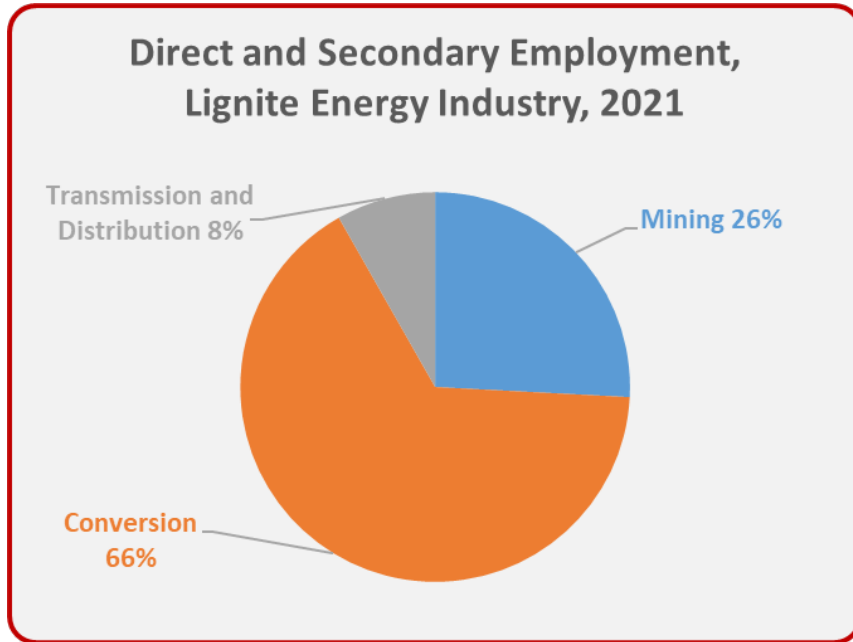
The lignite industry also generated over \$1 billion in labor income, which represents wages, salaries, benefits, and sole proprietor's income. The industry also contributed \$2 billion to the state's gross domestic product, and the industry's gross business volume was estimated at \$5.6 billion.

Direct, Indirect, and Induced Economic Effects, Key Economic Metrics, North Dakota Lignite Industry, 2021

Industry Segment/Type of Economic Effect	Employment ¹	Labor Income	Value-added	Output
----- millions 2021 \$ -----				
Coal Mining				
Direct effects	1,131	165	227	560
Indirect effects	1,220	84	152	270
Induced effects	960	51	84	85
Total economic effects	3,311	300	463	915
Electricity Generation and Coal Conversion				
Direct effects	1,694	228	240	1,728
Indirect effects	4,680	332	568	1,120
Induced effects	2,070	110	182	331
Total economic effects	8,444	671	990	3,178
Electricity Transmission and Distribution				
Direct effects	483	50	453	1,386
Indirect effects	290	19	69	111
Induced effects	285	15	25	45
Total economic effects	1,058	84	547	1,543

¹ Employment represents total jobs, and does not represent employment in FTE.





Direct, Indirect, and Induced Economic Effects, Key Economic Metrics, North Dakota Lignite Industry, 2021				
Type of Economic Effect	Employment ¹	Labor Income	Value-added	Output
ND Lignite Industry			----- millions 2021 \$ -----	
Direct	3,308	443	919	3,674
Indirect	6,190	436	789	1,501
Induced	3,310	177	291	461
Total	12,808	1,056	1,999	5,636

¹ Employment represents total jobs, and does not represent employment in FTE.

Industry Contribution 2022 (projected)

The following figures and values were based on an industry survey soliciting estimates of calendar year 2022 business activities, although the survey was administered prior to yearend. Firms were asked to estimate what their 2022 revenues and expenditures would be based on data available at the time of the survey and augment that information with expected activities for the remaining months in 2022. Data provided by the industry for 2022 is treated as a projection. However, the projection is considered a reasonable estimate of 2022 since, in many cases, the estimates included actual revenues and expenditures for 10 to 11 months of 2022.

Coal mining had 1,170 direct jobs; business activity relating to coal mining operations supported another 1,090 jobs. Personal spending on goods and services by employees working in the coal mining sector and employees of businesses affected by coal mining supported an additional 990 jobs. The combined effects on statewide employment from coal mining was estimated at 3,250 jobs. Other economic effects from coal mining included \$300 million in labor income and \$830 million in gross business volume.

Coal conversion and electricity generation from lignite was estimated to have 1,630 direct jobs, and business activity relating to those lignite operations supported another 4,240 jobs. Personal spending on goods and services by employees working in the coal conversion and generation activities and employees of businesses affected by those activities supported an additional 1,850 jobs. The combined direct, indirect, and induced effects on statewide employment from coal conversion and electricity generation was estimated at 7,720 jobs. Other economic effects from coal conversion and electricity generation included \$620 million in labor income and over \$3.2 billion in gross business volume.

Electricity transmission and generation from lignite-based activities was estimated at 470 direct jobs; business activity relating to those lignite operations supported another 300 jobs. Personal spending on goods and services by employees working in coal-related electricity transmission and distribution and employees of businesses affected by those activities supported an additional 280 jobs. The combined direct, indirect, and induced effects on statewide employment from coal-related electricity transmission and distribution was estimated at 1,050 jobs. Other economic effects from transmission and distribution included \$86 million in labor income and \$1.7 billion in gross business volume.

The combination of coal mining, coal conversion, lignite coal-fired electricity generation, and electricity transmission and distribution was estimated to have 3,270 direct jobs in North Dakota in 2022. These lignite coal activities supported about 5,630 jobs through business purchases of goods and services in the state. The combined personal spending of employees in the Lignite Industry, and employees of businesses involved with supplying goods and services to the industry supported another 3,120 jobs. Collectively, the industry was estimated to support 12,020 jobs in the state.

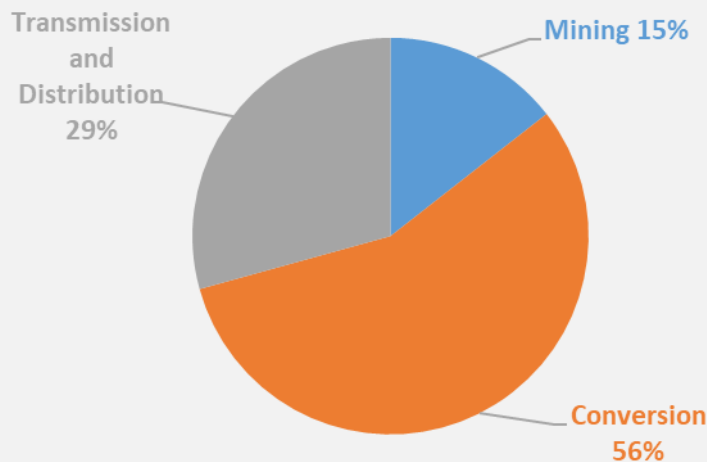
The lignite industry also generated over \$1 billion in labor income, which represents wages, salaries, benefits, and sole proprietor's income. The industry also contributed nearly \$2.2 billion to the state's gross domestic product, and the industry's gross business volume was estimated at \$5.8 billion.

Direct, Indirect, and Induced Economic Effects, Key Economic Metrics, North Dakota Lignite Industry, Projected 2022

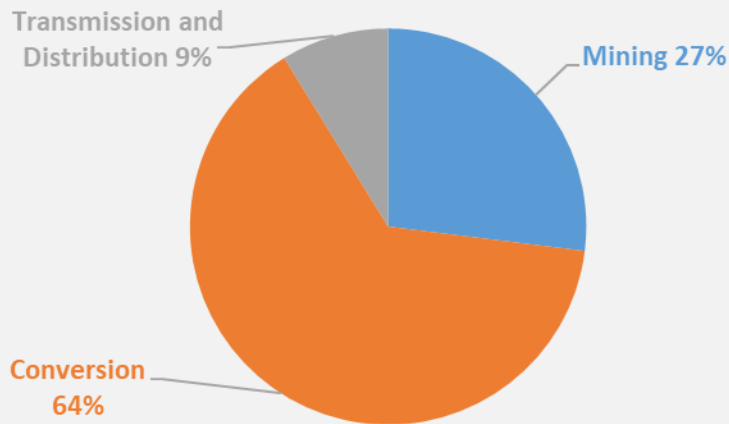
Industry Segment/Type of Economic Effect	Employment ¹	Labor Income	Value-added	Output
----- millions 2022 \$ -----				
Coal Mining				
Direct effects	1,168	177	219	537
Indirect effects	1,090	76	123	207
Induced effects	990	53	87	88
Total economic effects	3,248	306	430	832
Electricity Generation and Coal Conversion				
Direct effects	1,633	225	510	2,008
Indirect effects	4,240	295	534	935
Induced effects	1,850	99	163	297
Total economic effects	7,723	619	1,208	3,239
Electricity Transmission and Distribution				
Direct effects	473	51	473	1,525
Indirect effects	300	20	47	116
Induced effects	280	15	25	45
Total economic effects	1,053	86	545	1,687

¹ Employment represents total jobs, and does not represent employment in FTE.

Gross Business Volume, Lignite Energy Industry, 2022



Direct and Secondary Employment, Lignite Energy Industry, 2022



Direct, Indirect, and Induced Economic Effects, Key Economic Metrics, North Dakota Lignite Industry, 2022 (projected)

Type of Economic Effect	Employment ¹	Labor Income	Value-added	Output
ND Lignite Industry				
			----- millions 2022 \$ -----	
Direct	3,274	453	1,202	4,070
Indirect	5,630	391	704	1,258
Induced	3,120	167	275	430
Total	12,024	1,011	2,182	5,758

¹ Employment represents total jobs, and does not represent employment in FTE.

Government Revenues 2021

Government revenues are often used as a measure of how effectively an industry supports public services. In North Dakota, the most common sources of in-state public revenues are severance taxes, sales and use taxes, property taxes, and income taxes. A host of other taxes and revenue sources are often tracked in economic contribution and impact assessments, but those sources have varying levels of contribution to government revenue.

The lignite industry was estimated to contribute \$64.5 million in government revenues directly from the firms in the industry. Tax revenues arising from secondary business activity were estimated to generate an additional \$54.5 million in state and local government revenues. A total of \$119 million in state and local tax revenues were generated by the Lignite Industry in North Dakota in 2021.

Coal conversion and coal severance taxes were estimated at \$26.5 million. Other substantial contributions to state and local government revenues from secondary economic effects were from sales taxes (\$25 million) and property taxes (\$19.5 million).

State and Local Government Revenues, Lignite Industry, North Dakota, 2021			
Government Revenue	Paid Directly by the Industry	Collected from Indirect and Induced Activity	Total Collections
	----- 000s 2021 \$ -----		
Coal Severance Tax	10,518	---	10,518
Coal Conversion Tax	15,991	---	15,991
Sales, Property, and Corporate Income Taxes (reported in survey data)	25,861	---	25,861
Social Insurance Tax	1,952	1,247	3,200
Personal Income Tax	3,039	2,377	5,416
Sales Tax	see above	25,336	25,336
Property Tax	see above	19,531	19,531
Corporate Income Tax	see above	1,362	1,362
Other Taxes	2,666	1,438	4,104
Non Taxes	4,568	3,222	7,789
Totals	64,595	54,512	119,107

Government Revenues 2022 (projected)

The lignite industry was projected to contribute \$53 million in government revenues directly from the firms in the industry. Tax revenues arising from secondary business activity, based on projections of industry activity, were estimated to generate an additional \$50.6 million in government revenues. A projected total of \$103.5 million in state and local tax revenues were created by the Lignite Industry in North Dakota in 2022.

Coal conversion and coal severance taxes were estimated at \$15.8 million. Other substantial contributions to state and local government revenues from secondary economic effects were from sales taxes (\$23.5 million) and property taxes (\$18 million).

State and Local Government Revenues, Lignite Industry, North Dakota, 2022 (projected)			
Government Revenue	Paid Directly by the Industry	Collected from Indirect and Induced Activity	Total Collections
	----- 000s 2022 \$ -----		
Coal Severance Tax	10,450	---	10,450
Coal Conversion Tax	5,360	---	5,360
Sales, Property, and Corporate Income Taxes (reported in survey data)	25,667	---	25,667
Social Insurance Tax	1,996	1,183	3,179
Personal Income Tax	3,107	2,264	5,371
Sales Tax	see above	23,457	23,457
Property Tax	see above	18,082	18,082
Corporate Income Tax	see above	1,310	1,310
Other Taxes	2,349	1,331	3,680
Non Taxes	4,024	3,003	7,027
Totals	52,953	50,630	103,583

Share of State Economy

A key means of placing an industry contribution study into context is showing its share of a broader economy. The lignite energy industry represents an important share of the North Dakota's economy. The lignite energy industry represented 2.6 percent of the state's gross state product and 4 percent of the state's gross business volume. The industry represented about 2.8 percent of the state's total labor income. The industry represents about 1.2 percent of all state and local government revenues.

The lignite energy industry share of employment was 2.3 percent of statewide employment. Those shares are based on a state total for both wage and salary jobs and sole proprietors/self employed jobs. The industry's share of the state economy was not estimated for 2022 as state-level data was unavailable prior to completing the study.

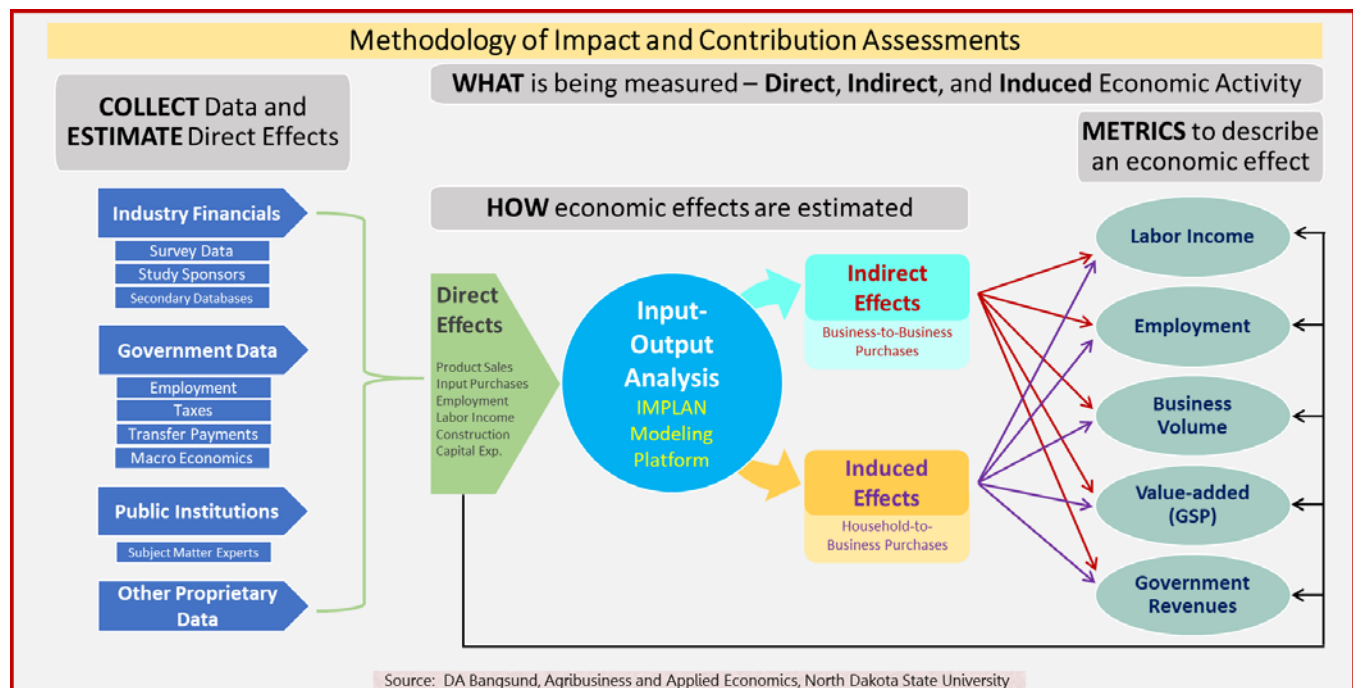
ANNUAL SHARE OF STATE TOTALS, North Dakota Lignite Energy Industry				
Industry Segment	Labor Income	Value-added (GSP)	Total Output	State and Local Government Revenues
State-level Values for 2021	\$37.3 billion	\$77.0 billion	\$142.7 billion	\$9.954 billion
Mining	0.81%	0.60%	0.64%	---
Conversion	1.80%	1.29%	2.23%	---
Transmission and Distribution	0.23%	0.71%	1.08%	---
All Segments	2.83%	2.60%	3.95%	1.20%

ANNUAL SHARE OF STATE EMPLOYMENT, North Dakota Lignite Energy Industry			
Industry Segment	Total Employment	Wage and Salary	Self-employed
State-level Values for 2021	557,702	434,811	122,691
Mining	0.59	0.51	0.42
Conversion	1.51	0.99	0.86
Transmission and Distribution	0.19	0.17	0.08
All Segments	2.30%	1.67%	1.36%

Supplemental Materials

Economic Contribution Analysis

An economic contribution assessment measures the gross size of some aspect or component of an economy, and is usually measured in conjunction with the overall size of a given economy over a specified period. Size is estimated by combining direct or first-round effects (e.g., industry expenditures, business sales, new employment) with economic modeling to estimate how those first round effects generate business-to-business transactions and household spending on consumer goods and services. Both of those conduits for economic output can be framed using labor income, employment, value-added, gross business volume and government revenues.



Key Terms and Concepts

Direct Effects: First-round of payments for services, labor, and materials and/or sales of an industry's products.

Indirect Effects: Economic activity created through purchases of goods and services by businesses.

Induced Effects: Economic activity created through purchases of goods and services by households.

Industry Output and Gross Business Volume: Industry output is the value of all goods and services produced and supported by an industry. In most industries, output is largely synonymous with sales; however, for some sectors output also includes changes in product inventory. For lignite energy industry, direct output includes both sales and inventory adjustments.

When output from business-to-business transactions (*indirect*) and households-to-businesses (*induced*) are measured, they also are described as the *sum of gross receipts* as annual adjustments to inventories are largely unquantified and not distinguished from sales. *Gross business volume* (GBV) therefore includes direct output/sales and includes secondary sales from indirect and induced economic activity.

Value-added: Value-added is synonymous with measures of gross domestic product (GDP) and gross state product (GSP), are some of the most commonly used economic measures to indicate the economic size and change in economic output. However, official government estimates of GDP and GSP do not include secondary economic effects generated by any industry. For lignite energy industry, official government estimates are primarily limited to coal mining, coal conversion, and transmission/distribution. Economic contribution assessments include secondary economic effects, and include GSP from those effects, thereby providing a more realistic and representative portrait of an industry.

Key components of value-added include labor income, consumption of fixed capital, profits, business current transfer payments (net), and income derived from dividends, royalties, and interest. In nontechnical terms, value-added is equal to product value minus production inputs. For example, value-added from coal mining would be the value of coal sold less the value of the inputs consumed in mining the coal. Depreciation charged to durable assets (e.g., buildings, pipelines, processing equipment) are not included in value-added measures.

Employment Compensation: Wages, salaries, and benefits earned by an employee.

Proprietor Income: Payments received by self-employed individuals and unincorporated business owner/operators.

Labor Income: Wages, salaries, and benefits for employees and compensation for self-employed individuals.

Input-output Analysis (I-O): Mathematical application of the interdependence among producing and consuming sectors in an economy.

I-O Matrix: Depiction of an economy using a grid of rows and columns that represents consumption and production for each economic sector in an economy.

Intermediate Inputs: Goods and services consumed in one year to produce another good or service. Intermediate inputs do not include expenditures for capital inputs used for multiple production seasons (e.g., machinery, buildings).

Capital Inputs: Represent the use of inputs to produce another good or service that are not consumed in one production season and are subject to depreciation. *Capital expenditures* represent the purchase of those depreciable assets.

Industry Balance Sheet: Dividing an industry or economic sector into various components for use in estimating the economic effects using input-output analysis. Components of the balance sheet include measures of output, wage and salary employment, self-employment, payroll and proprietor income, other property type income, taxes on production and imports, and intermediate inputs.

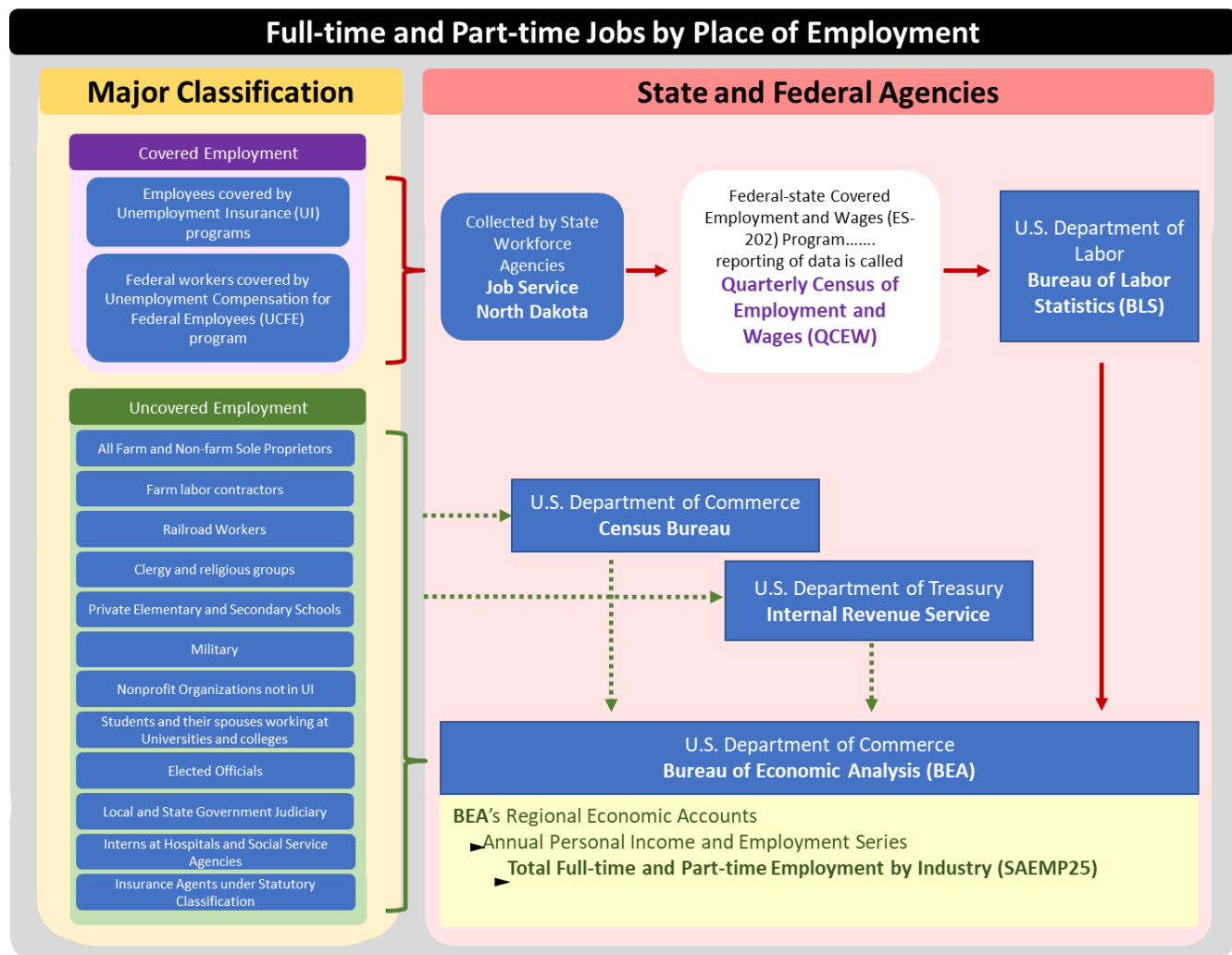
Institutions: Represent governments and other non-private entities consuming goods and services in an economy.

Households: Represent one or more individuals in a specific living arrangement for which income from all sources is used to purchase goods and services.

North American Industry Classification System (NAICS): Government classification system for all goods and services produced in the economy.

Employment Sources and Measures

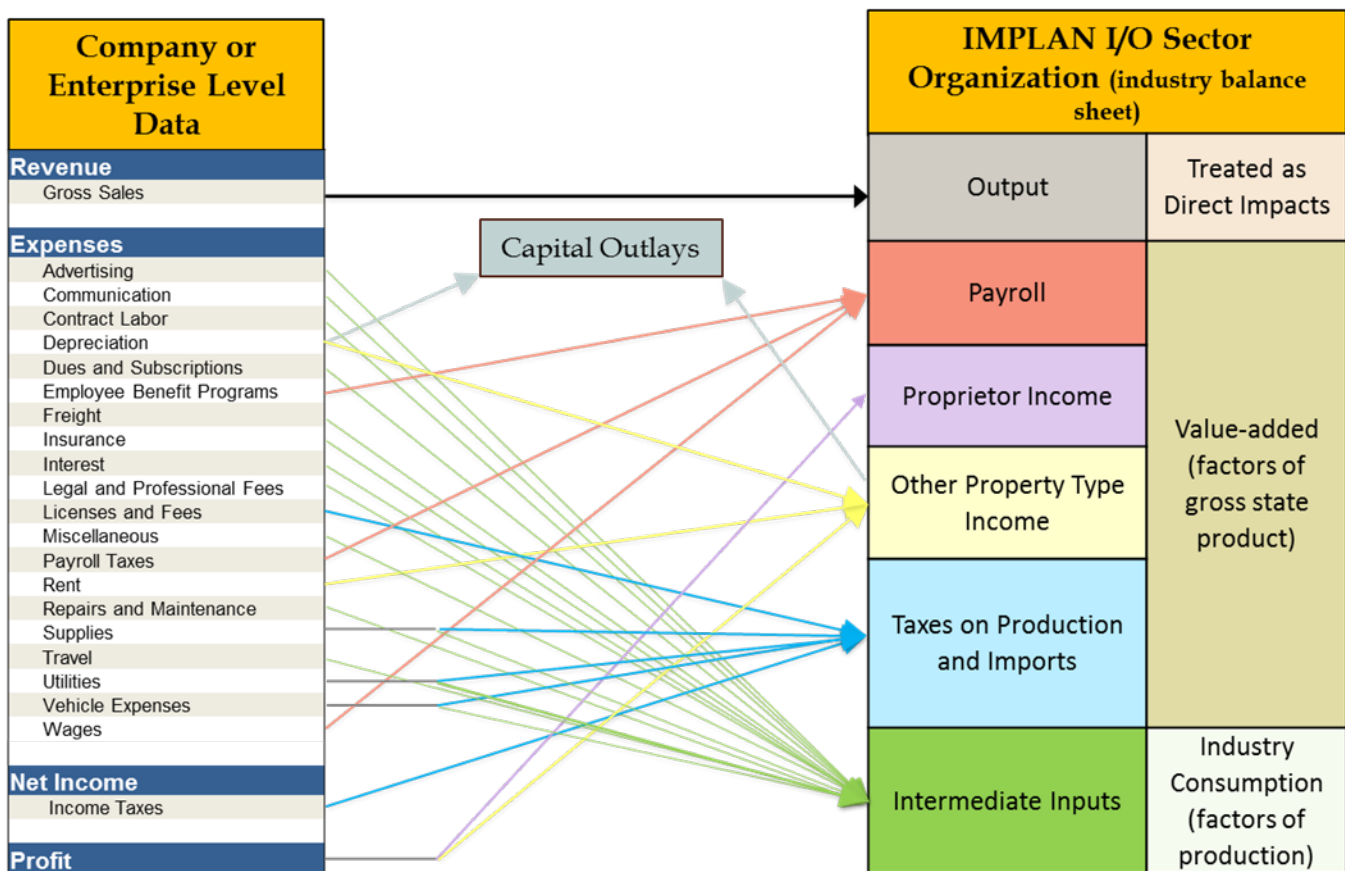
Employment is broadly measured in two distinct categories: covered and uncovered. Covered workers are those that are employed by a business, institution, or government agency, receive a wage or salary, and are subject to unemployment insurance (UI). Jobs that fall under an UI program are called 'covered' employment. Quarterly Census of Employment and Wages (QCEW) employment reported by Job Service North Dakota is 'covered' employment. QCEW data are collected for each state and reported by the U.S. Bureau of Labor Statistics (BLS). Therefore, employment statistics for self-employed individual cannot be derived from QCEW data.



Developing Economic Sector Profiles

An industry balance sheet or economic profile is one of the most important elements in economic contribution studies. Nearly all key economic metrics have their origin within an industry's economic profile/sector. Information and data to create economic sector profiles were collected from surveys of industry firms and data from government agencies.

While the IMPLAN modeling platform provides baseline economic profiles generated from proprietary estimation techniques applied to government data, this study relied on state-sourced data and industry input to create a customized IO matrix. The process of developing study-specific economic profiles and then modifying an IO matrix is time consuming and requires considerable empirical analysis, but the results from those efforts produce a credible and transparent evaluation of an industry's role in an economy.



General Transposition of Financial Information into IMPLAN Economic Sector Profiles

Source: DA Bangsund, Department of Agribusiness and Applied Economics, NDSU

Treatment of Traditional Economic Sectors Supporting Lignite Energy Industry

This summary omits specific details of how the secondary economic effects are distributed among the state's numerous economic sectors and sub-sectors. Several economic sectors support the lignite energy industry by providing inputs and services to various segments of the industry. Examples include manufacturing, financial institutions, legal representation, business services, industrial equipment and machinery, among others. Under some definitions, those activities and sectors are presented as "direct" segments of the industry. However, from the perspective of how this study's input-output analysis was structured, those sectors represent "indirect" economic output of the industry, meaning those sectors are supported and sustained from purchases relating to lignite energy industry mining, conversion, and transportation/distribution.

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