INDEPENDENT EX-POST STUDY · 2026

Lignite phase-out, employment and wage income in Western Macedonia

What earlier studies established, what the available evidence shows for 2019–2026, and which data are still needed for a reliable ex-post account.

2019–2026
ex-post period

2006–2026
literature review

10 Aug 2026
evidence cut-off

Author’s note

This study is a personal effort to systematically record and reassess the available figures on employment and income during the post-lignite transition. It reviews earlier estimates against common criteria and, wherever possible, compares them with newer public and administrative evidence. It does not replace the work or authority of competent public bodies, research institutions or other official organisations, nor is it an official ex-post assessment. It is an independent analytical approach that will be updated as new, verifiable evidence becomes available.

Type: Updated ex-post study based on public and verifiable evidence
Geographical scope: Region of Western Macedonia. Megalopolis is included only where the source does not allow geographical separation.
Period covered: Ex-post assessment for 2019–2026 and literature review for 2006–2026
Evidence cut-off date: 10 August 2026
Update status: This is a living study. New verified evidence will be incorporated using stable definitions, an explicit reference date and a transparent record of revisions.

Executive summary

This study examines what happened to employment and wage income in Western Macedonia as lignite activity contracted. It compares earlier studies with the latest available evidence and separates observed developments from estimates, projections and programme targets.

The overall picture is complex: lignite-related employment and high-paid wage income fell substantially, while employment in other sectors, the labour force and the population also changed. No single headline number can therefore describe the region's trajectory on its own.

What changed with the strongest evidence

In the most comparable corporate series, PPC staff in Western Macedonia, together with the separately reported staff of the company operating the Meliti power plant, fell from 4,147 at the end of 2018 to 2,418 at the end of 2021. This is a reduction of 1,729 people, or 41.7%. It documents a substantial contraction, but not the region's entire labour market.

What the wider labour market shows

Total employment across all sectors rose from 87.0 thousand to 93.3 thousand between 2019 and 2025. At the same time, the labour force contracted by 5.1 thousand and the population fell by 14.3 thousand between 2021 and 2025. These changes require separate interpretation.

What cannot yet be measured precisely

There is no unified public record of contractor jobs that ended, new jobs that became active and remained in place, retirements, transfers and wage replacement. A reliable overall net balance of jobs and income cannot yet be calculated.

What is needed next

An annual, public and comparable record is needed for every project and municipality: active full-time-equivalent jobs, duration, workplace, payroll and job retention. This is the basis for linking investment and funding to measurable outcomes for residents.

Most robust ex-post findings

Finding	Documented value	What is documented	What is not established
PPC staff geographically allocated to Western Macedonia, together with the separately reported staff of the company operating the Meliti power plant, 31 Dec 2018	4,147	Official corporate stock: 3,922 + 225, PPC 2018, published 2019	That every employee worked exclusively in lignite activities
Same comparable scope, 31 Dec 2019	3,488	3,294 + 194, PPC 2019, published 2020	That the entire difference from 2018 resulted from the 2019 phase-out announcement
Same comparable scope, 31 Dec 2020	2,768	2,579 + 189, PPC Sustainability Report 2020, posted February 2022	That the figure represents FTEs or only mine and power-station jobs
Same comparable scope, 31 Dec 2021	2,418	2,223 + 195, PPC 2021, published 2022	That it constitutes a complete series through 2026
Change in comparable corporate stock, 2018–2021	−1,729	Observed corporate contraction in broadly the same scope	Net regional loss or the full 2019–2026 impact
Targeted voluntary-exit scheme, 2020	545 participants	Actual departures from units scheduled for retirement, PPC 2020	545 newly unemployed people; some were already eligible for retirement
Contractor exposure, reference year 2019	Published total 11,065; residual 5,420 after excluding Ptolemaida V	Survey estimate based on 260 of 1,225 firms, World Bank JWP 54, October 2020	A census of all contractor jobs or an actual loss of 11,065/5,420
Publicly identified contractor-job events, 2025–2026	At least 275	120 at Meliti and at least 155 at Agios Dimitrios, as partial local records	A complete or statistically valid lower bound for total losses

Finding	Documented value	What is documented	What is not established
Official RCR01 result indicator at 31 Dec 2024	0 annual FTEs	No recorded achievement for this specific indicator at that date, Managing Authority, final evaluation 31 Mar 2025	That no job was created anywhere in the regional economy
Total employment in Western Macedonia, 2019–2025	87.0k → 93.3k	Net all-sector change of +6.3k, Eurostat, updated 30 Jun 2026	That the phase-out created 6.3k jobs or carried no cost
Labour force in Western Macedonia, 2019–2025	115.3k → 110.2k	Net contraction of 5.1k in the same LFS/Eurostat series	Exact causal allocation among retirement, migration and discouragement
Population, 1 Jan 2021–1 Jan 2025	257,875 → 243,575	−14,300: natural change of −8,904 and −5,396 from net migration together with statistical adjustment, Eurostat/ELSTAT, updated 21 Jul 2026	That all 14,300 "left because of the phase-out"

Central institutional assessment

1. A severe sectoral contraction and a loss of high-paid employment are **confirmed**.
2. **A complete ex-post measurement is not yet available** across PPC, contractors, new jobs, departures and their wage-income effects under consistent definitions.
3. A central ex-post estimate **cannot be derived from non-comparable quantities**, because this would add unlike stocks, flows, construction job-years and modelled induced jobs.
4. A net balance **cannot be calculated** without a unified register of active new jobs, their duration and payroll. Programme totals and investment announcements are not a substitute for active payroll.
5. The loss of net local income is not yet directly observable. It can only be shown as a parametric sensitivity analysis, not as the principal result.

Research question, protocol and limitations

Questions

The study addresses five distinct questions:

1. How many jobs were previously estimated to be dependent, exposed or at risk before and during the acceleration of the lignite phase-out?
2. Which earlier forecasts can genuinely be compared with a later observed outcome?
3. What do public sources show about PPC staff, the contractor chain and new jobs in 2019–2026?
4. How does the sectoral loss relate to changes in total employment, unemployment, the labour force and population?
5. Which policies can convert funding and investment into sustained local employment and income?

Search and selection protocol

The search covered 1 January 2006 to 10 August 2026 in Greek and English. It included the Technical Chamber of Greece/Western Macedonia Section, regional and municipal authorities, chambers of commerce, IME GSEVEE, INE GSEE, IOBE, IENE, GEOTEE, university repositories, PPC, the Just Development Transition Managing Authority, DYPA, ELSTAT/ERGANI, Eurostat, the European Commission/JRC, the World Bank, OECD, the European Court of Auditors, WWF, the Wuppertal Institute, REKK, TRACER, CINTRAN, TIPPING+ and Cowork4YOUTH. Searches used titles and terms, backward and forward citation tracking, and checks of primary PDFs where publicly available.

The review is **extensive but not demonstrably exhaustive**. Unpublished commissions, subscription material, withdrawn links and internal company records may not have been identified. Inclusion in the catalogue does not imply that a source contains an independent numerical jobs estimate. Each source is assessed by base year, geography, unit of measurement, method and suitability for ex-post comparison.

Definitions that must not be conflated

Term	Operational definition in this study
Direct job	Employment at PPC or a separately identified lignite company, in mines and lignite-fired power stations, where the scope is documented
Indirect/contractor job	Employment by a supplier, contractor or subcontractor. Mine/power-station operations are separated from construction of Ptolemaida V and other projects
Induced job	Employment estimated through changes in household consumption. It is not an individually recorded loss
Dependent or at risk	A stock economically linked to lignite or exposed to change. It is not equivalent to a loss
Observed	A public administrative or corporate measurement with a defined date and scope
Estimated	A result of a survey, input–output model or parametric scenario
Announcement or plan	A target or expectation without evidence of active payroll
Gross loss	Termination of old jobs before deducting new jobs and redeployments
Net loss	Gross loss minus additional active and sustained jobs within the same geographical and temporal scope
Full-time equivalent (FTE)	One unit of full-time work for one year. Numerically comparable to one full-time job-year, but not to a headcount, hires, a construction-site peak or the sum of multi-year jobs

Strength of evidence

- **High:** a primary administrative or corporate source with a clear date, geography, unit and reproducible calculation.

- **Medium:** a primary study or survey with a published method, but based on sampling, an old base year or unavailable microdata.
- **Low:** a secondary reference, unclear scope, non-reproducible assumption, or journalistic/union account without administrative verification.

The grade concerns suitability for the specific question “what actually happened by 2026”, not the general scientific value of the source.

Chronological mapping of studies

The mapping is shown in two related tables. The first records scope and numerical findings; the second records method and suitability for ex-post assessment.

Time and geography — numerical findings

Year	Study and public link	Base year / geography	Measurement and principal finding
2006	Kordas, *Lignite and regional development in Greece*	Mainly before 2005, Western Macedonia	Historical sectoral dependence; no forecast of net job losses
2008/2010	Chatzitheodoridis et al., *Lignite Mining and Lignite-Fired Power Generation in Western Macedonia*	Regional input–output table 2000, output around 2005	Total employment multipliers of about 1.24–1.34 per direct job, by sector
2010	NTUA, green investment and employment	National	Job-creation potential of green investment; not a specific Western Macedonia assessment
2011	Bank of Greece, climate-change impacts, chapter II	National data through 2010	Macroeconomic and energy context
Jul 2012	TEE/TDM, *Estimate of the cost of Western Macedonia’s transition to low lignite production*	Employment 2009, Western Macedonia	6,882 direct and 22,573 dependent jobs
2013	IENE, *Energy and Employment in Greece*	Around 2010–2012, Greece with references to Western Macedonia	Energy-sector employment
2016	WWF–Panteion University, *Roadmap for the Transition of Western Macedonia to a Post-Lignite Era*	PPC 2014, IO table 2010	4,625 direct; 6,128 direct+indirect with newer coefficients; 13,089 only with old TEE coefficients
2018	TEE/TDM, *Update of the transition-cost estimate*	IO table 2013, output 2017	About 9.7k dependent jobs in 2017 from a chart; modelled decline of more than 10k since 2004
2018	JRC112593, *EU coal regions*	Around 2015–2016	4,283 mining + 1,398 power generation = 5,681 direct, plus 1,640 intra-regional indirect; Western Macedonia total 7,321

Year	Study and public link	Base year / geography	Measurement and principal finding
2018	Wuppertal Institute, *Phasing out coal in the EU*	Around 2015–2017, European regions	Comparative transition typology; no new Western Macedonia census
2019/2020	GEOTEE/Region of Western Macedonia, socioeconomic transition	National IO table 2010, regionalised	4.920 jobs per €1m final demand in mining and 3.552 in electricity
2020	World Bank, *Road Map*	Mixed 2018–June 2020	About 5,200 “directly affected”, with an internal discrepancy in the component total
2020	World Bank, *Labor Market Diagnostic / Jobs Working Paper 54*	PPC 2018, contractors 2019	3,899 full-time + 751 eight-month employees = 4,650 direct persons; 7,268 contractor + 3,795 subcontractor employees = 11,063 arithmetically, 11,065 published; 5,420 after excluding the upper Ptolemaida V scenario
2020	Region of Western Macedonia / Sotiropoulos, Karlopoulos et al., 2022 update	Base 2013, horizon 2028	−21k jobs, −26% GVA, −€1.2bn annually and −€9bn cumulatively
2020	IOBE, impact of the lignite phase-out and Industry Bulletin 2/2021	2019→2029, Kozani, Florina, Arcadia	Western Macedonia base: 3,262 permanent + 800 temporary + 1,850 contractor workers; by 2029, 5,662 “direct” and 10,428 total local losses
2020	Just Development Transition Plan (SDAM/Master Plan), 11 Dec 2020	Project pipeline 2020, horizon 2028, Western Macedonia + Megalopolis	For Western Macedonia, up to about 2,700 at peak construction and about 2,400 in operation in 2028, plus about 6,400 indirect/induced jobs
2020	IME GSEVEE, lignite phase-out in Western Macedonia	LFS Q3 2019	14,275 direct + 8,546 indirect = 22,821 jobs at risk
2020	Green Tank/diaNEOsis, attitudes towards the transition	Survey, October 2020, Kozani/Florina/Arcadia	44.1% subjective income dependence; reproduces figures from other sources
2020	WWF/LDK, *Just Transition and Employment*	2019, Western Macedonia + Arcadia	Western Macedonia: 3,146 permanent, 468 seasonal, 1,365 contractor; 10,318 from 3,146×3.28
2020	REKK/CSD, *Accelerated lignite exit*	Around 2018–2019, Kozani/Florina/Arcadia	5,601 direct in a table + 7,010 indirect = 12,611; discrepancy with 5,765 in the text
2020	IENE M58, transition of lignite regions	May 2020, Western Macedonia + Megalopolis	4,363 permanent/temporary PPC staff; about 5k PPC + contractors through 2024
2021	Ziouzios et al., *Climate* 9(7):115	September 2020	About 3,200 PPC + 2,000 satellite jobs; reproduces −21,000
2021	JRC123508, *Recent trends in coal regions*	2018	1,395 power generation + 3,254 mining = 4,649 direct; 4,574 indirect; total 9,223
2020–2022	TRACER, public deliverables	Various years, Western Macedonia/European coal regions	Social challenges, energy scenarios, retraining and road map

Year	Study and public link	Base year / geography	Measurement and principal finding
2022	European Court of Auditors, Special Report 22/2022	EU programming periods, coal regions	Insufficient linkage between spending and employment outcomes
2023	IENE, *Energy and Employment 2023*	Data to around 2022, Greece	Updated sectoral employment
2024	INE GSEE, employment prospects in Western Macedonia	Indicators through 2023	Employment index 2022 = 96.7 (2010 = 100); unemployment 2023 = 16.7%; industrial GVA 2010–2021 −52%
2024	CINTRAN, policy brief on post-lignite Western Macedonia	Just Transition spending/projects	About 19,087 units of additional employment
2025	JRC139404	FIGARO 2017	3,086 direct + 1,051 indirect = 4,137 embodied jobs, 4.3% of regional employment
2026	GEOTEE/Region of Western Macedonia, transition memorandum	Indicators 2015–2025	Population −10.3% in 2016–2025; labour force −8.4% in 2016–2022; unemployment 15.3% in 2025; GVA −21.8% in 2015–2023

Method and suitability for ex-post assessment

Study	Method / multiplier	Suitability for an assessment in 2026
Kordas 2006	Descriptive/regional analysis	Low; historical context
Chatzitheodoridis et al. 2008/2010	Regional input–output model	Low recency; medium methodological value
NTUA 2010	Sector coefficients	Complementary
Bank of Greece 2011	General-economy scenarios	Complementary
TEE/TDM 2012	Regional Leontief/location quotients; 1.30 power stations, 4.19 mines, 3.28 total	Pioneering transition study with high historical and methodological value; limited current relevance for a 2026 ex-post assessment
IENE 2013	Statistical and scenario synthesis	Low/complementary
WWF–Panteion 2016	Regional IO model and alternative investment scenarios	Medium for planning; low for the 2026 outcome
TEE/TDM 2018	Leontief/LQ; sectoral Type-II coefficient 9.6, not jobs per PPC worker	Low recency; medium transparency
JRC 2018	Plant data and multi-regional IO; local total/direct ratio 1.289	Medium; 3,603 interregional jobs are not Western Macedonia jobs
Wuppertal Institute 2018	Comparative cases	Complementary
GEOTEE/Region 2019/2020	GRIT/Leontief, 46 sectors	Medium method; low direct comparability
World Bank Road Map 2020	Strategic synthesis	Medium/low for precise measurement
World Bank Jobs Working Paper 54	HR data and survey of 260/1,225 firms	High for baseline composition; medium for total stock; not a loss measure

Study	Method / multiplier	Suitability for an assessment in 2026
Region of Western Macedonia 2020/2022	IO model with “no response”; 185 sectoral/725 total jobs per Mt	Low as an ex-post measure; extreme counterfactual scenario
IOBE 2020	63-sector multi-regional IO model	High analytical value; medium transparency of micro-parameters; a scenario, not an observation
SDAM 2020	Project estimates and multipliers of 1.8–5.0	Low as an actual outcome; construction and operation cannot be added as a permanent simultaneous stock
IME GSEVEE 2020	Broad NACE sectoral exposure	Medium for vulnerability; low for actual losses
Green Tank/diaNEOsis 2020	Survey n=802, ±3.46%	High for perceptions; not for job counts
WWF/LDK 2020	Source synthesis and old TEE coefficient	Medium for direct stock; low for 10,318
REKK/CSD 2020	Full-loss and reskilling-cost scenario	Medium/low owing to mixed geography and internal inconsistency
IENE M58 2020	Institutional and scenario synthesis	Medium, with mixed geography
Ziouzios et al. 2021	SWOT/secondary synthesis	Low as an independent quantitative estimate
JRC 2021	Plant data and multi-regional IO	High methodology; medium recency; exposure, not loss
TRACER 2020–2022	Comparative studies and scenarios	Useful for policy; not one ex-post total
European Court of Auditors 2022	Performance audit	High institutional relevance
IENE 2023	Statistical synthesis	Complementary for national context
INE GSEE 2024	Descriptive processing of Eurostat/ELSTAT	High for the regional context; not causal measurement
CINTRAN 2024	Type-I IO model, 1.16–59.03 per €1m	Low as active employment: unclear FTE/job-years, timing and displacement
JRC 2025	CARMEN/MRIO; total/direct ratio 1.34	High methodology; medium recency because of 2017 base; hypothetical exposure
GEOTEE/Region 2026	Descriptive synthesis	High recency; no causal job count

No standalone, reproducible quantitative loss study was identified from the Kozani or Florina Chambers of Commerce, the Thessaloniki Chamber of Crafts or the Athens Chamber of Small and Medium-Sized Industries. Proposals, minutes and reproductions of third-party figures were identified. The Kozani Chamber proposal of 2018 repeats “more than 22,500 dependent” and a reduction of 12,000 by 2030 without a new published calculation. Minutes of the 2021 Forum refer mainly to IME GSEVEE. An institutional position or proposal does not become an independent study merely because it cites a number.

Methodological assessment

The 3.28 multiplier

The TEE/TDM study was completed in July 2012, well before the accelerated phase-out, and was a pioneering technical account of developments that followed. It used primary PPC data on staff, payroll, contracts and services; a 2009 employment reference year; national technical coefficients published in 2007 using 2005 data; and regional employment and value-added figures for 2001 and 2005. It publishes its regionalisation procedure using location quotients, the Leontief inverse, technical coefficients and detailed appendices. Given the data and tools then available, its documentation is substantive and reproducible to a significant degree.

The study applies an overall ratio of 3.28, with 1.30 for power stations and 4.19 for mines. In the merged mining sector, the diagonal technical coefficient of 0.599 implies an intra-sector feedback of 1/(1−0.599)=2.49 before other pathways. This calculation is a useful diagnostic check, **not proof that the model is wrong**. It shows that the result is highly sensitive to sector aggregation, regionalisation and the treatment of households. This limits use of 3.28 as a fixed coefficient over time without diminishing the study's pioneering role and historical value.

Later studies produce very different ratios: about 1.29 for direct plus intra-regional indirect jobs in JRC 2018 and 1.34 in JRC 2025; the conditional World Bank 2020 baseline gives 10,070/4,650≈2.16 when the direct headcount for 2018 is combined with the residual contractor stock for 2019. These quantities are not fully comparable. There is no single time-invariant "correct" multiplier. Every use must state the year, sectors, geography, Type I or II model, unit and whether it measures jobs, persons, FTEs or job-years.

Assessment of the main quantitative sources

Scores from 1 to 10 refer only to suitability for answering "what actually happened by 2026". They are not a general appraisal of the scientific or institutional work of the organisations concerned. Each study is assessed against the evidence and methods available when it was produced; recency considers the base year, not merely the publication year.

Study	Data quality	Methodology	Transparency	Recency for 2026
TEE/TDM 2012	7/10	6/10	8/10	3/10
WWF–Panteion 2016	6/10	8/10	8/10	3/10
TEE/TDM 2018	5/10	4/10	5/10	3/10
JRC 2018	8/10	9/10	9/10	4/10
Region of Western Macedonia 2020/2022	5/10	4/10	5/10	5/10
World Bank Road Map 2020	6/10	6/10	6/10	5/10
World Bank Jobs Working Paper 54	8/10	8/10	9/10	6/10
IOBE 2020	8/10	8/10	6/10	6/10

Study	Data quality	Methodology	Transparency	Recency for 2026
SDAM 2020	5/10	5/10	6/10	4/10
IME GSEVEE 2020	6/10	5/10	8/10	5/10
European Commission SWD(2020)507	6/10	5/10	6/10	5/10
WWF/LDK 2020	6/10	5/10	6/10	5/10
Green Tank/diaNEOsis 2020	7/10	7/10	8/10	4/10
Ziouzios et al. 2021	5/10	4/10	7/10	5/10
JRC 2021	9/10	9/10	9/10	6/10
CINTRAN 2024	6/10	6/10	5/10	8/10
INE GSEE 2024	8/10	6/10	8/10	8/10
JRC 2025	9/10	9/10	9/10	6/10
GEOTEE/Region 2026	8/10	6/10	8/10	9/10

JRC and World Bank receive the strongest method and transparency scores. The World Bank is the strongest source for the composition of direct and contractor exposure near the start of the accelerated exit. No source combines high recency with a complete 2019–2026 ex-post series. That is the central evidence gap.

Can the forecasts be tested retrospectively?

Source/claim	Is there a like-for-like observed quantity?	Assessment
TEE 2012: 22,573 dependent jobs	No; this was not a time-specific forecast of losses	Cannot be graded as “right/wrong”. It measured supported employment and has not been verified as an actual loss
TEE 2018: about 9.7k dependent jobs in 2017	Only partly; the World Bank gives 10,070 direct plus conditional contractor exposure using mixed years and a different construction adjustment	Similar order of magnitude, not a valid forecast-error test
World Bank: 3,899 full-time and 751 eight-month employees in 2018	Partly; PPC’s 2018 corporate geographical stock was 4,147	Compatible scale, different definitions. The World Bank is the closest external baseline check
Region: −21k and total employment around 70k by 2028 under no response	Not yet for the horizon; actual 2025 employment was 93.3k	The path through 2025 does not follow the extreme no-response scenario, but this is not a full causal rejection of the still-open 2028 horizon
IOBE: 9,349 local jobs and €242.2m labour income in 2026 before offsets	No public ex-post account of gross sectoral terminations with the same scope	Not yet testable. The 13,689 figure includes the rest of Greece and must not be presented as local Western Macedonia
SDAM: up to 2,700 construction jobs, 2,400 operating jobs in 2028 and 6,400 indirect/induced jobs in Western Macedonia	No project-level publication of active FTEs, residence and retention	Cannot be certified. Construction and operation are different phases and cannot be added as a simultaneous permanent stock

The scientifically honest answer to “which studies got it right?” is limited. World Bank and JRC performed better in establishing the **scale of the exposure baseline**, not because they predicted the exact ex-post outcome. The high TEE/IME/Commission figures were not verified as actual losses because they were not necessarily loss forecasts. The Region and IOBE produced counterfactual scenarios that cannot be scored without like-for-like final evidence and, for the former, before the 2028 horizon closes.

Ex-post account, 2019–2026

Timeline of changes in the production system

Date	Event	Public evidence	Implication for employment measurement
July 2019	Retirement of Kardia I–II	PPC Sustainability Report 2020, posted February 2022	The assessment period began while closures were already under way
September 2020	Retirement of Amyntaio I–II and the Amyntaio mine	PPC Financial Report 2020, 2021	Both direct work and operational contractor activity changed
May/December 2021	Retirement of Kardia III–IV and derecognition in December	PPC Financial Report 2021, 2022	End of the Kardia cycle; the public regional staff series ceases to be comparable after 2021
9 October 2023	Start of commercial operation of Ptolemaida V	PPC Financial Report 2023, published 2024	Construction and operation must be recorded in separate accounts
September 2024	Retirement of Agios Dimitrios I–II	PPC Financial Report 2024, 2025	Further contraction of operational activity
31 December 2024 / 31 March 2025	Exit of Meliti and temporary reserve status	PPC Financial Report 2024, 2025	The closure is linked to a public report of 120 contractor notices, not to a complete census
15 May 2026	End of normal operation of Agios Dimitrios III–V; units retained in cold reserve until 31 March 2027	ERT, 15 May 2026, referring to PPC planning and an IPTO request	Critical for staff, contractors and district heating. Cold reserve is not normal generation and has no public employment register
By end-2026	Planned complete cessation of lignite activity; Ptolemaida V remained the last active lignite unit at the cut-off date	ERT, 15 May 2026, citing a public PPC management statement	A future plan as at 10 August 2026; it is not entered as an already realised job loss

A plant closure date does not by itself produce a job count. It is not necessarily the date on which each worker leaves, transfers, retires or starts a new job.

Direct PPC employment

Date/reference year	Staff	Exact scope	Source/date	Evidence grade
31 Dec 2018	4,147	3,922 PPC S.A. in Western Macedonia + 225 in the company operating the Meliti power plant	PPC 2018, 2019	High

Date/reference year	Staff	Exact scope	Source/date	Evidence grade
2018	4,650	3,899 full-time + 751 eight-month employees; annual persons, not FTEs	World Bank JWP 54, Oct 2020	High for HR data, with a different unit
31 Dec 2019	3,488	3,294 PPC S.A. in Western Macedonia + 194 in the company operating the Meliti power plant	PPC 2019, 2020	High
31 Dec 2020	2,768	2,579 + 189, broadly the same corporate/geographical scope	PPC 2020, posted Feb 2022	High
31 Dec 2021	2,418	2,223 + 195, broadly the same scope	PPC 2021, 2022	High
2022–2025	Not published	No public series with the same coverage was identified	Review of corporate reports through 10 Aug 2026	Explicit gap
Mar–Jun 2026	1,027–1,100	Narrower union record for the Western Macedonia Lignite Centre/Ptolemaida V	kozan.gr, 16 Mar 2026 and June 2026	Low; non-comparable scope

Within the comparable corporate scope, staff declined by 1,729, or 41.7%, between 31 December 2018 and 31 December 2021. Between 31 December 2019 and 31 December 2021, the reduction was 1,070, or 30.7%. These calculations follow the corporate series above. They do not show that every departure was caused solely by the 2019 decision, nor do they cover the whole period to 2026.

The difference between 3,488 in 2019 and 1,027–1,100 in 2026 **must not be treated as a loss of 2,388–2,461**, because the first number is a broader corporate geographical stock and the second a narrower union count. Similarly, 4,650→1,100 is not valid because it combines 2018 annual persons, eight-month employees and a different operational scope in 2026.

PPC records 545 participants in its targeted 2020 voluntary-exit programme for units scheduled for retirement. This is a real departure flow, but not a flow of 545 unemployed people: part of the workforce was aged 55 or over and eligible for retirement. A transfer outside the region, retirement within the region and unemployment have different effects on employment, unemployment and local income.

Contractor and subcontractor chain

For 2019, the World Bank estimated 7,268 contractor and 3,795 subcontractor employees. The components sum to 11,063, while the published total is 11,065. The estimate is based on 260 responses from 1,225 firms and an extrapolation, not a universal administrative census. About 51% was associated with construction. After excluding the upper Ptolemaida V construction-employment scenario, the remaining 5,420 is a **conditional estimate of residual contractor exposure**, not a “structural census” and not a job-loss figure. Source: World Bank JWP 54, October 2020.

More recent public records are fragmentary:

- 120 contractor employees at Meliti were reportedly notified of dismissal on 31 March 2025, according to a parliamentary question published by Nea Florina in April 2025.

- By 31 May 2026, at least 155 of around 300 Agios Dimitrios contractor workers were reported unemployed by the Agios Dimitrios–Ryaki Unemployed Association.
- Ptolemaida V employed more than 1,500 people in March 2020 and the World Bank used a scenario exceeding 2,500 annually. No final named census was published for the end of construction or the share subsequently re-employed.

The total 120+155=275 is the sum of **two specific public events**, not a statistical lower bound for the entire contractor chain. The end of Ptolemaida V construction must be reported separately from the contraction of operational mine and power-station contracts. Otherwise, the normal completion of a project is incorrectly turned into a permanent operational loss.

Induced and wider local effects

There is no public causal model of consumption and payroll for 2019–2026 that converts lost lignite income into jobs actually abolished in retail and services. The following indicators show pressure or adjustment, not the number of jobs caused by the phase-out:

Indicator	Change	Source/date	Permissible interpretation
Deposits of Western Macedonia residents/businesses	€2.746bn Dec 2019 → €3.277bn Dec 2025; +19.4% nominal	Bank of Greece 2019 and 2025	Nominal growth says nothing conclusive about real purchasing power without a reproducible deflator; it proves neither prosperity nor a specific loss
Retail turnover	−2.8% in Western Macedonia in 2025 versus +2.0% nationally	ELSTAT, 17 Feb 2026	Evidence of recent underperformance, not causal attribution
District heating	Priority operation of Agios Dimitrios, 15 Oct 2024–15 May 2025	RAAEY decision, 2025	A real transition cost and infrastructure dependency requiring separate economic assessment
Municipal revenue	No single audited 2019–2026 table identified	Review through 10 Aug 2026	A gap that cannot be filled with assumptions
Population	−14,300, or −5.55%, from 1 Jan 2021 to 1 Jan 2025	Eurostat/ELSTAT, updated 21 Jul 2026	Strong demographic deterioration: natural decline −8,904 and −5,396 from migration together with statistical adjustment

Countervailing flows: what has and has not been verified

Programme/project	Public figure	Status at the cited date	Treatment in this study
DYPA to March 2022	796 mainly seven-month placements	Work-experience/subsidised-employment flows; 301 of 1,014 placements in the two lignite regions involved wage subsidies, Kathimerini, 18 Mar 2022	Not permanent new jobs; not added to later programmes
PPC Renewables, 31 Dec 2023	21 workers at Western Macedonia construction sites	Corporate stock at one date, PPC Sustainability Report 2023, 2024	Observed but very narrow; not a hiring flow or a 2026 stock

Programme/project	Public figure	Status at the cited date	Treatment in this study
DYPA to 7 Jul 2025	419 twelve-month hires	All eligible lignite regions, DYPA, 7 Jul 2025	Unknown Western Macedonia share; not treated as sustained beyond the 12-month subsidy
DYPA 2025	Capacity for 700 additional jobs in Western Macedonia	Applications closed 29 Jul 2025, DYPA	Budget/applications, not 700 verified and sustained jobs
DYPA, 14 Apr 2026	Administrative claim of 1,700 jobs	Interregional programme, DYPA	Not added: geography, payroll start, duration and retention are missing
Just Development Transition Programme, RCR01 at 31 Dec 2024	Achievement 0; target for selected operations 700; programme target for 2029 5,225; proposed revision 4,429	Annual FTEs in supported entities, Managing Authority report, 31 Mar 2025	Strongest official indicator, but a historical snapshot; zero is not zero employment in the economy
PPC plan, 3 Apr 2025	€5.75bn investment; up to 20,000 construction and 2,000 operating jobs at full development	Corporate plan, PPC, 3 Apr 2025	Announced potential, not active employees or guaranteed local payroll
PPC photovoltaic projects, 6 Apr 2026	Completion of 2.13 GW in northern Greece	Physical completion, PPC, 6 Apr 2026	Evidence of a project, not worker numbers, duration or residence
Development Law, 28 Jul 2026	Government reference to “more than 500 jobs” in Western Macedonia	No employer list, payroll start or retention evidence, Vice-President of the Government, 28 Jul 2026	Announced result not credited until a register is published

What can be said about gross and net balances

Category	Minimum observed evidence	Central ex-post value
Direct PPC, 2019–2026	Not identifiable. Only −1,070 in a comparable corporate stock, 2019–2021	Not identifiable
Operational contractors	275 in two specific public accounts, not a statistical lower bound	Not identifiable
Ptolemaida V construction	Not identifiable	Not identifiable
Induced jobs	Not observed	Not identifiable
New active/sustained jobs	RCR01 was zero at 31 Dec 2024, but only for that programme/date	Not identifiable
Net balance	Not identifiable	**No central number can be derived**

Category	Maximum exposed base	Institutional requirement
Direct PPC, 2019–2026	Not identifiable	No official same-coverage series through 2026
Operational contractors	Not identifiable; 5,420 is an exposure base, not a loss	Contractor/subcontractor and payroll register required
Ptolemaida V construction	Not identifiable; >1,500 or >2,500 are site stocks/scenarios	Separate job-year and redeployment account
Induced jobs	Not identifiable	A model using a new regional matrix and actual payroll spending changes

Category	Maximum exposed base	Institutional requirement
New active/sustained jobs	Not identifiable	Subsidised flows and announcements cannot be added without identification
Net balance	Not identifiable	Public evidence does not support an institutionally valid point estimate or range

These columns are not probabilistic scenarios and must not be summed. They distinguish observed evidence, an identifiable central value and an exposure base, which is not a loss. The absence of a central figure results from non-comparability, not evasion. A range such as 3,200–8,200 or a "central" 5,900 would combine unlike units and evidence quality and create false precision. The direction and a significant part of direct corporate contraction are documented; the complete gross or net outcome is not.

Relationship with official regional series

Employment, unemployment and the labour force

Year	Employed, thousand	Unemployed, thousand	Labour force, thousand	Unemployment rate
2019	87.0	28.3	115.3	24.6%
2020	87.1	21.3	108.4	19.7%
2021	89.5	22.1	111.6	19.8%*
2022	88.9	19.1	108.0	17.7%
2023	93.9	18.9	112.8	16.7%
2024	98.5	14.1	112.6	12.5%
2025	93.3	16.9	110.2	15.3%

Sources: Eurostat APIs for employment, unemployment and unemployment rate, release 30 June 2026. *Break in series in 2021. Values are Labour Force Survey estimates rounded to 0.1 thousand.

From 2019 to 2025, total employment rose by 6.3k, unemployment fell by 11.4k and the labour force fell by 5.1k. The accounting identity shows that about 55% of the decline in unemployment coincided with employment growth and about 45% with exit from the labour force. This is an **arithmetic decomposition, not causal proof** of retirement, migration or discouragement.

The Eurostat sectoral series, updated 30 June 2026, shows approximately −4.8k in agriculture, −1.9k in sectors B–E, +2.8k in construction, roughly zero change in G–I, +4.9k in M–N, +4.3k in O–Q and +1.1k in R–U for 2019–2025 (table `lfst_r_lfe2en2`). Growth in construction, professional/administrative activities and public services can coexist with lignite-related losses, without showing that the same workers were redeployed or their wages replaced.

ERGANI records 33,422 private-law employees in 2019, 34,821 in 2024 and 35,565 in 2025: a stock increase of 2,143 or 6.41%. Sources: ERGANI Special Issue 2019, Annual Report 2024 and Special Issue 2025, February 2026. This is not a register of "transition jobs" and does not uniformly include workers under public or special company employment regimes.

The 2025 reversal and the first quarter of 2026

Estimated employment fell from 98.5k in 2024 to 93.3k in 2025 (−5.2k), while unemployment rose from 12.5% to 15.3%. This is compatible with slowing or completed projects and renewed sectoral pressure, but the Labour Force Survey cannot isolate the impact of the lignite phase-out.

In the first quarter of 2026, ELSTAT estimated 92.0k employed, 12.5k unemployed and 126.5k outside the labour force, compared with 91.8k, 16.6k and 122.7k respectively in the first quarter of 2025. Employment rose by only 0.2k, while unemployment fell by 4.1k and those outside the labour force increased by 3.8k. The fall in the unemployment rate from 15.3% to 11.9% therefore arose mainly, in arithmetic terms, from labour-force contraction. Sources: ELSTAT Q1 2026, 5 Jun 2026 and Q1 2025, 6 Jun 2025.

Why there is no contradiction

Improvement in total employment through 2024 and the loss of lignite-related employment can both be true because:

- retirement or voluntary exit removes a worker from lignite payroll without necessarily registering that person as unemployed;
- migration and natural decrease reduce both population and the labour force;
- temporary construction sites raise employment in particular years without creating an equivalent permanent operating job;
- other sectors and public services can create jobs independently of the transition;
- the Labour Force Survey is sample-based and has a series break in 2021.

These mechanisms are plausible and compatible with the data, but their exact quantitative contributions **cannot be identified** from the published aggregate series.

Lost wage flows and net local income

Four different income measures

1. Gross earnings no longer paid.
2. Net labour income after employee tax and social contributions.
3. Net change in disposable income after pension, benefits, new work and other income.
4. The share of disposable income that would have been spent or saved within Western Macedonia.

No public dataset observes all four. Voluntary-exit compensation is a one-off inflow; a pension may remain in the local economy; and a transfer outside Western Macedonia removes local demand without eliminating a national job.

What wage sources establish

Using 2019 HR data, the World Bank reported annual earnings of about €40,000 for older mine technicians and €38,000 for older power-station technicians, while technical engineers received about €55,000. These are **benchmarks for specific occupational and age groups**, not the average wage of all PPC staff in Western Macedonia. Source: World Bank JWP 54, October 2020.

WWF/LDK used about €16,000 as "average annual net revenue" for contractor/seasonal workers. This is not an administratively verified net wage. Source: WWF/LDK 2020.

For Greece in 2019, the OECD gives a net-to-gross ratio of 73.9% under the specific tax model of a single worker earning 100% of the average wage. It cannot be generalised to all households, incomes and PPC employment regimes. Source: OECD, *Taxing Wages 2020*.

Transparent scale per 1,000 verified FTEs

Until actual wage distributions and comparable FTEs are published, only a sensitivity calculator can be used. For every 1,000 annual FTEs demonstrably abolished:

`local gross wage flow = 1,000 × average annual gross earnings × share of Western Macedonia residents`.

Hypothetical annual gross earnings	Average gross flow per worker per calendar month	Annual local gross flow, 80%–90% resident share	Indicative net flow using 73.9% ratio
€20,000	€1,667	€16.0–€18.0m	€11.8–€13.3m
€30,000	€2,500	€24.0–€27.0m	€17.7–€20.0m
€40,000	€3,333	€32.0–€36.0m	€23.6–€26.6m

Dividing annual earnings by twelve describes the average monthly economic flow, not whether pay is made in twelve or fourteen instalments. The World Bank's €38,000–€40,000 benchmarks correspond arithmetically to about €3,167–€3,333 gross per calendar month for those specific groups of older technicians. They are not the average wage of all PPC staff.

The table is not an estimate of the actual total loss. It selects no number of lost FTEs and excludes pensions, benefits, new wages, residence changes and one-off compensation. It becomes an ex-post tool only when populated with a verified FTE count, actual wage distribution and the labour-market pathway of each pseudonymised individual.

Comparison with IOBE and regional accounts

IOBE forecast for 2026 a loss of “income from labour” of €84.5m in Florina and €157.7m in Kozani, for a total of **€242.2m**, before offsets. The composition was €167.8m direct, €42.6m indirect and €31.8m induced. In the same year, the scenario’s local jobs were 2,935 in Florina and 6,414 in Kozani, for a total of **9,349**; 13,689 includes effects elsewhere in Greece. Source: IOBE 2020, tables 10.6 and 10.9. This is a multi-regional model result, not an observed net flow.

Eurostat regional accounts show nominal compensation of employees received by households rising from €1.541bn in 2019 to €1.739bn in 2023, and net disposable income from €2.855bn to €3.413bn. Sources: Eurostat, compensation of employees D1, received, €m and Eurostat, net disposable income B6N, balance, €m, dataset updated 20 May 2026. There is therefore no observed nominal decline in total regional income. This does not negate the specific loss of the lignite wage core: higher prices, pensions, transfers and wages in other sectors may conceal it in the regional total.

The institutionally defensible conclusion is that **high-paid lignite payroll was lost, but the net amount removed from Western Macedonia cannot be identified from public data**. IOBE’s €242.2m is a comparable scenario benchmark, not an ex-post observation. The parametric table per 1,000 FTEs provides a transparent update mechanism once the actual number and wage distribution are published.

Regional Transition Wage-Income Account

Lost wage income should be monitored as an outcome equal in importance to jobs. A lower-paid or shorter-duration new job does not economically replace a stable lignite job. Conversely, retirement abolishes a job but may retain a substantial part of disposable income in the local economy.

An annual Regional Transition Wage-Income Account should be established within the National Just Development Transition Observatory, without creating a new organisation. It should record:

1. active monthly and annual FTEs in lignite operations, contracting, construction and new operations;
2. gross payroll of Western Macedonia residents, and mean and median wages;
3. new wage, pension, benefits and other recurring income of those who left, in aggregate form;
4. one-off exit compensation in a separate account;
5. replacement rate of the former wage and retention of the new job at 12 and 24 months;
6. construction job-year payroll separately from operating jobs;
7. local spending on first- and second-tier suppliers without double counting.

The cumulative 2019–2026 loss cannot be obtained by multiplying a one-year estimate by seven. It requires summing actual monthly FTEs and the corresponding income gap in current and constant 2019 prices. The exact value remains unknown until wage, residence, pension, benefit and new-employment records can be linked.

What the Master Plan forecast and what the evidence shows

Institutions and instruments are not synonyms

Term	Institutional function	Must not be confused with
SDAM/Master Plan 2020	Strategic plan and initial project pipeline	An ex-post payroll register
Territorial Just Transition Plan for Western Macedonia	Territorial plan under Article 11 of Regulation 2021/1056, setting out needs, affected territories and intervention sectors	A payment programme or a list of completed projects
Just Development Transition Programme 2021–2027	ESIF co-financed operational programme with priorities, calls and indicators	The whole Just Development Transition policy
Special Just Development Transition Development Programme	Separate national financing instrument under the National Development Programme	Part of the Just Transition Fund
Just Development Transition	The overall field of strategy, finance, spatial planning, labour, land restoration and governance	Funds absorption

Regulation (EU) 2021/1056 requires territorial plans to assess expected job losses, depopulation risks and social, economic and environmental impacts. Regulation (EU) 2021/1060 provides for partnership and multi-level governance. The Just Development Transition Programme 2021–2027 is the principal co-financed component, not the transition in its entirety.

Master Plan forecast and administrative results

Field	SDAM, 11 Dec 2020	Public ex-post evidence	Assessment at 10 Aug 2026
Construction in Western Macedonia	Up to about 2,700 jobs at peak	No project-level active FTE/job-year, residence or duration figures	Not verifiable; a peak is not a permanent stock
Operation in Western Macedonia	About 2,400 jobs in 2028	Horizon remains open; no unified active-payroll register	Not verifiable at the cut-off
Indirect/induced	About 6,400	No published regional matrix applied to actual expenditure with double counting removed	Cannot be certified
RCR01	Not the original Master Plan account	Zero annual FTE achievement at 31 Dec 2024; target for selected operations 700; 2029 target 5,225; proposed revision 4,429	Underperformance of this indicator at that date, not proof of zero overall job creation
Financial progress	Strategic investment plan	March 2025 evaluation reported public expenditure of about €1.63bn and 2.5% absorption at 31 Dec 2024	Historical snapshot showing the gap between available resources and realised outcomes

Sources: Updated SDAM, 11 Dec 2020, Managing Authority final risk evaluation, 31 Mar 2025, and the 2026 Territorial Just Transition Plan for Western Macedonia.

The correct judgement is neither “SDAM succeeded because investments were approved” nor “it failed completely because RCR01 was zero at the end of 2024”. Public evidence shows delays in converting approvals into measurable outcomes and a serious gap in more recent reporting. A final evaluation requires, for every project, the date operations began, active FTEs, contract type, place of work and residence, gross pay, and retention at 12 and 24 months.

Comparing earlier estimates with the available evidence

Earlier estimate	What the review shows	Interpretation
“3.28 is an artefact; a realistic total is 2.0–2.5”	**Corrected**	3.28 is highly sensitive to aggregation and regionalisation. The 1/(1−0.599)=2.49 calculation is diagnostic, not proof of invalidity. A 2.0–2.5 range may be used only as sensitivity for a specified scenario, not as a universal “correct” multiplier
“Dependent base in 2019: 12,500–14,000”	**Not verified as one observed stock**	The World Bank gives 4,650 direct annual persons and 11,065 estimated contractor/subcontractor workers, with a large construction component. After the conditional Ptolemaida V exclusion the sum is 10,070. The 12.5–14k range mixes a different contractor and induced assumption and is not an official census
“2019–2026: direct −3,550, contractor −3,900, induced −1,800, gross −9,250, new permanent 700–1,700, net about −7,500”	**Not verified as an institutional ex-post account**	4,650→1,100 changes unit and scope; −3,900 combines operational contracting with completed construction; induced losses are not observed; 700/1,700 are programme/administrative flows without unified payroll retention. They cannot be added
“All-sector employment 2019–2025 increased about 6.2k because of retirements, population outflow of about 8,100 and temporary projects; 2025 −5.2k and unemployment 12.5%→15.3%”	**Partly confirmed, with arithmetic and causal correction**	Updated Eurostat gives +6.3k and confirms the 2025 reversal. The mechanisms are compatible, not quantified causes. Population fell by 14,300 in 2021–2025: natural change −8,904 and −5,396 from net migration together with statistical adjustment. The entire total is not “outflow”
“Lost local income about €151m gross and €54m net after replacement”	**Not documented as an ex-post result**	There is no comparable lost-FTE count, actual average pay, residence or observed replacement income. Only the transparent calculation per 1,000 verified FTEs and IOBE’s €242.2m external scenario are permissible

Overall picture from the comparison

The comparison shows that earlier studies used different methods to describe the regional economy’s exposure to lignite. Their estimates cannot be transferred mechanically to 2026 or added together as observed losses. The current assessment confirms the severe contraction of the lignite value chain, but comparable administrative records are still required to measure precisely which jobs ended, how long new jobs lasted and how much wage income was lost or replaced.

The required new ex-post methodology

Unit of observation and administrative linkage

A definitive assessment cannot be produced by applying a new multiplier. It requires an anonymised monthly file in the form:

`person identifier × employer identifier × place of work × month`.

Each record should include hours or FTE, gross earnings, contract type, residence, sector, project/plant and reason for exit. The linkage must cover:

- PPC and related lignite companies;
- contractors and subcontractors by contract and facility;
- ERGANI and e-EFKA for active employment and payroll;
- DYPA for benefits, subsidised hiring and retention after subsidy;
- e-EFKA/HELIOS for retirement;
- the Just Development Transition Managing Authority and support bodies for beneficiary firms and result indicators;
- AADE/ELSTAT, in a secure environment, for business survival, turnover and regional income.

Publication must be aggregate and comply with personal-data protection rules. Access to pseudonymised microdata should be limited to authorised evaluators working in a secure research environment.

Four separate accounts

Account	Content	Unit	Prohibited conflation
A. Lignite operations	PPC, mines, power stations, operational contractors	Active monthly FTE and annual payroll	With construction of new projects
B. Construction	Ptolemaida V, renewables, storage, grids, land restoration	Person-months/person-years and peak	With permanent operating jobs
C. New operations	New firms and facilities that have begun payroll	Additional FTE, pay and 12/24-month retention	With an approved investment plan or announcement
D. Household/area	Wage, pension, benefits, new income, residence	Net disposable income and locally retained flow	With gross payroll cost or regional GDP

Determining each worker’s outcome

For every person in the 2019 baseline, status should be recorded at 6, 12 and 24 months after exit:

- remains in the same position;
- transferred within Western Macedonia;
- transferred outside Western Macedonia;

- hired by a new employer within Western Macedonia;
- employed on a temporary/construction project;
- retired;
- registered unemployed;
- outside the labour force;
- cannot be identified.

The income loss for the same person is the difference between counterfactual net earnings and the sum of the new net wage, pension and benefits. Exit compensation must be recorded separately as a one-off amount.

Counterfactual pay should be operationally defined from regular and variable gross earnings in the twelve months before exit, by occupation, shift regime and seniority. Its path without the lignite phase-out should be estimated using a stated wage index and, where microdata permit, a matched control group of unaffected workers. The account should be compiled monthly until redeployment, retirement or the end of 2026, in current prices and constant 2019 prices. Any present-value calculation must state the discount rate and publish sensitivity tests at 0% and 3%.

Causal regional evaluation

A simple 2019–2026 difference contains the pandemic, inflation, national recovery, demographic ageing, migration, public-sector hiring and investment cycles. Estimating the additional impact of the phase-out requires:

1. pre-specification of outcome variables and the pre-intervention period;
2. a synthetic control or difference-in-differences design with comparable regions;
3. tests of parallel trends and placebo dates;
4. separate analysis of Kozani, Florina, Grevena and Kastoria;
5. uncertainty intervals and sensitivity tests;
6. publication of code, a data dictionary and all cleaning decisions.

Model results should be shown alongside, not merged into, the administrative account of actual flows.

Minimum public project table

Field	Mandatory publication
Identity	Project, beneficiary, facility, municipality, sector
Timing	Approval, contract, start of construction, start of operation, reference date
Construction	Average and maximum monthly employment, person-years, share of Western Macedonia residents

Field	Mandatory publication
Operation	Active additional FTEs, contract type, median gross wage, share of Western Macedonia residents
Retention	Active FTEs at 12 and 24 months after start or end of subsidy
Transition workers	Former PPC/contractor workers placed and their wage change
Local supply chain	First- and second-tier supplier spending, without double counting
Public support	Grant, loan/guarantee, tax expenditure, public land/infrastructure

Policies for measurable employment, income and productive transition

From investment announcements to verified outcomes

Western Macedonia has funding programmes, territorial planning, delivery bodies and substantial investment interest. The gap lies in connecting these instruments to four verifiable outcomes: active jobs, residents' wage income, productive participation by local firms and retention of the working-age population.

Regulation (EU) 2021/1056 requires Territorial Plans to assess potentially affected and lost jobs, depopulation risks and social, economic and environmental impacts. Regulation (EU) 2021/1060 establishes partnership and multi-level governance. Active participation by the Region of Western Macedonia is therefore an integral element of the European transition architecture.

Success is not measured only by approved budgets, installed MW, selected operations or forecast jobs. Every intervention should follow an auditable sequence: design, contract, actual start, active payroll and job retention at 12 and 24 months.

Coordinating role of the Region of Western Macedonia

The Region has begun building territorial coordination through the Western Macedonia Strategic Hub. Regional Council Decision 62/2025 approved an ecosystem linking entrepreneurship, innovation and employment, with income-related objectives and an explicit place for the social economy. Decision 4/2026 approved a draft law on the Innovation Zone and Strategic Hub and forwarded it for legislative processing. This documents a regional institutional initiative, not yet completed national legislation.

According to the Region's official presentation of 27 January 2026, the Hub does not create a new legal entity. Coordination is assigned to the Regional Development Fund of Western Macedonia, with a proposed Coordinating Council and dedicated organisational function. The Fund can therefore operate as the Hub's delivery coordinator: harmonising indicators, organising data collection and processing, supporting the Council, tracking the strategic and operational plan and publishing comparable reports. Full implementation requires completion of the relevant legislation and administrative arrangements, explicit authority to access data and secured financing.

The Region does not replace the Managing Authority, competent ministries, METAVASI S.A., municipalities or PPC. Its role is to connect individual decisions with the real needs of the labour market and production system through five functions:

1. **Integrated regional programming**, with mature projects, start dates, required occupations, land and infrastructure needs and accountable delivery bodies.
2. **Connecting investment with the workforce**, so training begins from verified employer demand and specific vacancies.
3. **Organising the local supply chain**, with advance procurement information, certification and support for collaborative schemes.
4. **Land and property readiness**, with clear ownership, restoration, planning, permitting, network access and actual availability.
5. **Public accountability**, through an annual Regional Council presentation of active jobs, wage flows, retention, supplier participation and labour-force trends.

The Region cannot unilaterally establish tax measures or state-aid rules. It can coordinate local needs, include conditions in instruments within its remit, advocate implementation of the Just Transition Horizontal Clause and publish the performance of every intervention.

Operational use of the Just Transition Horizontal Clause

Article 134 of Law 5317/2026, Government Gazette A 108/10 Jul 2026 allows special eligibility criteria, additional scoring, distinct actions and calls, dedicated financial instruments, tax relief, higher aid intensities and other tools in territories covered by approved Territorial Just Transition Plans, subject to state-aid rules. It creates an enabling power, not an automatic entitlement to funding.

Implementation requires a circular establishing a common administrative procedure, an annual Clause Activation Plan for Western Macedonia and an Application Sheet for each relevant law, programme, call or major public investment. The sheet should state the problem, legal basis, implementation instrument, budget, expected employment, wage flow, delivery timetable, method for preventing double counting and responsible verifier.

Western Macedonia Local Observatory and its link to the National Observatory

Article 10(6) of Law 4872/2021, Government Gazette A 247/10 Dec 2021 provides for local branches of the Autonomous Observatory Unit in areas covered by Territorial Just Transition Plans. The National Just Development Transition Observatory became operational on 5 June 2026 and envisages cooperation with local branches and Regional Territorial Committees. The task is therefore not to establish a parallel mechanism, but to make the legally foreseen Western Macedonia Local Observatory fully operational and publicly accountable as the regional arm supplying the National Observatory with detailed, verifiable evidence.

The University of Western Macedonia has relevant institutional and research capacity and could provide scientific support under a clear programme agreement. Its official announcement of 11 November 2025 records the Managing Authority's invitation for the University to take an active role in the Local

Observatory with measurable indicators and development impact. This establishes a direction of cooperation, not a completed administrative assignment. Particularly relevant is the established Energy Transition and Development Transformation Laboratory (ENTRA Lab), with expertise in just-transition impacts, monitoring and evidence-based policy. This reference identifies available scientific capacity; it does not replace the specific administrative or programme act required to assign responsibilities.

The University's research project Just Transition Observatory (JT-OBSERVATORY) is a separate academic initiative and is not the statutory local branch of the National Observatory. Its expertise and outputs can be used if incorporated into a shared protocol for indicators, quality assurance and open publication.

Roles should be complementary: the Local Observatory should carry institutional responsibility for the regional ex-post account; the University and the relevant laboratory should provide independent scientific support; and the Regional Development Fund, as proposed coordinator of the Strategic Hub, should organise interoperability and operational data flows. Published indicators should be compatible with the National Observatory and cover, at a minimum, active employment, payroll, job retention, residence, skills, demography, local enterprise and the social economy.

Local Value and Employment Pact

PPC has three distinct roles: it was the principal operator of lignite activity and payroll; it is party to land-restoration and transfer arrangements; and it is the largest planned investor in the new energy and technology period.

Law 4956/2022 ratified the programme agreement for post-lignite land. PPC states that approximately 54.8 km² had been transferred by the end of 2024 and around 42 km² remained to be transferred by the end of 2026. Progress should be linked to the agreement's deliverables and the actual investment readiness of each site.

PPC's €5.75bn investment plan of 3 April 2025 refers to up to 20,000 construction jobs and up to 2,000 operating jobs at full development. These are corporate planning figures, not recorded workers or active local payroll. The investment potential is significant, but its outcome must not be assumed in advance.

A "Local Value and Employment Pact 2027–2031" is proposed among the Region, the Managing Authority, PPC, METAVASI S.A., energy municipalities and their regional association, chambers, the University of Western Macedonia, CERTH, DYPA and representative employee and employer organisations. It should have annual project annexes recording maturity, final investment decision, contracted value, timetable, construction job-years, operating FTEs, occupations, duration, pay, redeployments, suppliers, training needs, land, infrastructure and verification method.

Work, enterprise, innovation and property

Equivalence between one lost and one new job is not purely numerical. The Pact should assess residents' total payroll, median wage, duration, contract type, retention at 12 and 24 months and pay changes experienced by former lignite-chain workers.

Local firms need access to real demand, working capital, technical certification, collaboration and diversified customers. Measures should include a lignite-supplier register, a rolling 18–24-month procurement programme from PPC and major investors, certification and export support, working-capital guarantees, and assessment of survival and non-lignite activity at 24 and 36 months.

The University of Western Macedonia, CERTH, DYPA, chambers and firms could establish a Skills and Applied Innovation Pact. Actions should be linked to real investments, specified occupations, expected pay, recruitment dates and retention. Priorities may include energy storage, the circular economy, automation, land restoration, district heating and digital infrastructure.

The Region, METAVASI S.A., PPC, municipalities and relevant bodies should maintain a quarterly readiness table for post-lignite land and productive property. Classification must distinguish transfer of title, environmental restoration, planning maturity, networks, permitting, investor contract and actual production.

Legality of local value measures

Local value creation should not rely on exclusive quotas based on registered office or residence. Directives 2014/24/EU and 2014/25/EU allow social, environmental and innovation criteria and contract-performance clauses where linked to the subject matter, proportionate and applied without discrimination.

Lawful tools include early publication of procurement pipelines, justified division of contracts into lots, supplier certification, open market engagement, proportionate apprenticeship and unemployed-person inclusion clauses, subcontracting oversight and measurement of place of performance, payroll and value produced. Every clause requires prior legal review.

Governance, indicators and timetable

A joint Steering Committee coordinated by the Region is proposed, without establishing a new legal entity and with an operational link to the National Observatory. Public accountability should cover:

1. investment value by stage: announced, approved, contracted and spent;
2. temporary construction FTEs and job-years, separately from active operating jobs;
3. residents' gross payroll and median gross wage;
4. job retention at 12 and 24 months;
5. redeployment of former PPC and contractor workers and wage change;
6. first- and second-tier supplier spending without double counting;
7. firms with new non-lignite turnover and sustained employment;
8. land area by readiness stage and time to productive use;
9. public-support cost per additional job retained for 24 months;
10. trends in population, labour force and age structure.

Within 100 days, the Regional Council decision on the Pact, the standard Clause Application Sheet, classification of PPC projects, the supplier register and the indicator protocol could be completed. Within six months, the first ex-post database, rolling procurement programme, land/property table and first annual project annex could be published. From 2027, an annual independent verification and public hearing before the Regional Council are required.

The International Labour Organization Guidelines place social dialogue, labour rights, social protection and decent work at the heart of the transition.

Policy conclusion

Major investments by PPC and other actors can provide the momentum Western Macedonia needs. They will not automatically replace lignite-related employment and income. Their value will depend on how quickly they are converted into active and sustained payroll, adequately paid operating jobs, productive contracts, applied innovation and investment-ready land.

The Region should help shape and connect the instruments for employment, enterprise, innovation and productive use of post-lignite land and property. PPC should cooperate through transparency, contractual annexes and measurable local value. The Managing Authority and central administration should turn the Horizontal Clause from a legal possibility into stable administrative practice.

Final conclusion

What is confirmed

- Lignite activity and PPC employment in Western Macedonia contracted sharply. The comparable geographical corporate staff series for PPC in Western Macedonia, together with the separately reported staff of the company operating the Meliti power plant, fell from 4,147 on 31 December 2018 to 2,418 on 31 December 2021: a decrease of 1,729 or 41.7%.
- The contractor chain was large, but the strongest baseline, World Bank 2020, is a sample-based exposure estimate containing a large construction component. There is no public annual census of its contraction.
- The region lost high-paid lignite payroll. The precise net income no longer circulating locally cannot be derived without linked data on wages, pensions, benefits, new work and residence.
- Total all-sector employment rose by 6.3k in 2019–2025, but the labour force fell by 5.1k, population fell by 14.3k in 2021–2025, and employment fell by 5.2k in 2025. These trends neither cancel the sectoral loss nor prove that the transition succeeded.
- Programme figures from SDAM, the Just Development Transition Programme, DYPA and PPC are not a net account of new jobs. The most complete official indicator, RCR01, showed zero achievement at 31 December 2024, but no newer unified picture was publicly available at the cut-off.

What is not confirmed

- There is not yet a unified public series linking, under consistent definitions, departures from lignite activity, contractor developments, active new jobs and wage-income replacement.
- The difference from 3,488 or 4,650 to 1,027–1,100 cannot be used as a direct 2019–2026 loss because the scopes are not identical.
- The World Bank's 5,420 is not a census of "structural contractor" jobs; it is the remainder of an estimate after a specific construction-scenario exclusion.
- No universal 2.0–2.5 multiplier is adopted, and 3.28 is not dismissed merely as an "artefact". Multipliers depend on data, aggregation, geography and model type.
- No exact gross or net total for jobs and income can be derived by adding non-comparable stocks, flows, construction sites and model parameters.

What the study shows overall

Western Macedonia has experienced a **large, real and inadequately measured loss of lignite-related work and income**. The most robust observed component is the corporate contraction recorded between 2018 and 2021. For later years, evidence remains fragmented across contractors, retirements, temporary projects, transfers and new jobs that are not recorded under a unified framework. The study therefore does not seek a striking headline total; it organises what is known, explains the gaps and identifies the evidence required for a reliable ex-post account.

This study is the most comprehensive **independent ex-post synthesis that can be produced within the limitations of publicly available data**. It should not be described as a definitive census until PPC, ERGANI, e-EFKA, DYPA and Just Development Transition programme records can be linked and comparable results published. That administrative task is now a matter of institutional accountability, not a technical detail.

The transition will be just when it can show, for every year and municipality, not only how many euros were committed or how many MW installed, but how many active FTEs were created, at what wage, for residents of which area, how many remained after 24 months and how much income they replaced.

Appendix A. Public studies and key sources

The list contains publicly identified studies and deliverables with direct or complementary relevance to employment, income and the transition. The review is extensive, but cannot prove the existence of unpublished commissions or withdrawn files.

A.1 Greek and regional studies

- 2006, Kordas, *Lignite as Contributory Factor to Regional Development of Greece*.
- 2008/2010, Chatzitheodoridis, Kolokontes and Vasiliadis, *Lignite Mining and Lignite-Fired Power Generation in Western Macedonia*.
- 2009, Tourkolias, Mirasgedis and Damigos, *Employment benefits of electricity generation*.

- 2011, Bank of Greece, *The Environmental, Economic and Social Impacts of Climate Change in Greece*, energy chapter.
- 2012, TEE/TDM, *Estimate of the cost of Western Macedonia's transition to low lignite production*.
- 2013, IENE, *Energy and Employment in Greece*, M09.
- 2013, Markaki et al., *The impact of clean energy investments on the Greek economy*.
- 2015, Loizou et al., *Linkages of the energy sector in the Greek economy*.
- 2016, WWF Greece and Panteion University, *Roadmap for the Transition of the Western Macedonia Region to a Post-Lignite Era*.
- 2018, TEE/TDM, *Update of the transition-cost estimate*.
- 2018, EKKE, *Socioeconomic impacts of the installation and operation of conventional and renewable energy sources: a literature review*.
- 2018, Kozani Chamber of Commerce, *Proposal for Western Macedonia's transition to reduced lignite activity*.
- 2019/2020, GEOTEE/Western Macedonia Branch, *Study on the socioeconomic transition of Western Macedonia in the post-lignite period*.
- 2019, Pavloudakis et al., *Economic and Social Impact Assessment of Decarbonisation in Ptolemais*.
- 2020, Region of Western Macedonia, Sotiropoulos, Karlopoulos et al., public update posted in 2022.
- 2020, IOBE, *Impacts of the lignite phase-out in Western Macedonia and Megalopolis* and Industry Bulletin 2/2021.
- 2020, IME GSEVEE, *Lignite phase-out and Western Macedonia*.
- 2020, Green Tank and diaNEOsis, *Just Transition: attitudes and prospects*.
- 2020, WWF/LDK, *Just Transition and Employment in Greece*.
- 2020, IENE, *Current Situation and Prospects for Areas in Energy Transition in Greece*, M58.
- 2021, Ziouzios et al., *A Socioeconomic Study for the Transition to the Post-Lignite Era*.
- 2023, IENE, *Energy and Employment in Greece*.
- 2024, INE GSEE, *Employment prospects in Western Macedonia*.
- 2026, GEOTEE/Region of Western Macedonia, *Memorandum on Western Macedonia's transition*.
- 2026, Farmaki and Tranoulidis, *Towards a Sustainable Just Transition: Participatory Governance and Workers' Evaluations*.

A.2 International and European studies

- 2018, JRC112593, *EU coal regions: opportunities and challenges ahead*.
- 2020, World Bank, *A Road Map for a Managed Transition of Coal-Dependent Regions in Western Macedonia*.
- 2020, World Bank, *Labor Market Diagnostic*, Jobs Working Paper 54.
- 2020, REKK/CSD, *Accelerated Lignite Exit in Bulgaria, Romania and Greece*.

- 2020–2022, TRACER, public deliverables for Western Macedonia and European coal regions.
- 2021, JRC123508, *Recent trends in coal, peat and oil shale regions*.
- 2022, Cowork4YOUTH, *Baseline Study on the Impact of Youth Employment Policies*.
- 2022, European Court of Auditors, Special Report 22/2022 on support to coal regions.
- 2023, OECD, *OECD Economic Surveys: Greece 2023*.
- 2023, POTENTIALS, *Economic, social and territorial impact assessment*.
- 2024, CINTRAN, *Post-Lignite Era in Western Macedonia*.
- 2025, JRC139404, *The employment impact of the coal transition in EU regions*.

A.3 Strategic, administrative and statistical sources

- Updated SDAM, 11 December 2020.
- Just Development Transition Programme 2021–2027.
- Managing Authority, final evaluation using data at 31 December 2024.
- European Commission SWD(2020)507.
- PPC annual/sustainability reports: 2018, 2019, 2020 and 2021.
- Eurostat Labour Force Survey for EL53.
- ERGANI annual reports.
- ELSTAT labour-market statistics.
- DYPA employment programmes for lignite-transition areas.
- National Just Development Transition Observatory.
- Western Macedonia Regional Council Decision 62/2025, official Diavgeia record, ecosystem for enterprise, innovation and employment.
- Western Macedonia Regional Council Decision 4/2026, official Diavgeia record, draft law on the Innovation Zone and Strategic Hub.
- Region of Western Macedonia presentation of the Strategic Hub and the Fund’s coordinating role, 27 January 2026.
- Law 4872/2021, Government Gazette A 247/10 December 2021, Article 10(6) on local branches of the Autonomous Observatory Unit.
- Managing Authority, launch of the National Just Development Transition Observatory, 5 June 2026.
- University of Western Macedonia, established research laboratories and ENTRA Lab.
- University of Western Macedonia, announcement on an active role in the Local Observatory, 11 November 2025.
- University of Western Macedonia, Just Transition Observatory public deliverables.

Appendix B. Glossary of terms and indicators

Term / abbreviation	Full form	Definition in this study	Legal / technical reference	Relevant chapter
Just Development Transition	Overall strategy, funding, employment, land and governance field	The complete field of the transition, beyond any one programme	Law 4872/2021	7, 10
SDAM	Just Development Transition Plan	Strategic plan and initial 2020 project pipeline	SDAM 11 Dec 2020	7
Territorial Just Transition Plan	Territorial plan defining needs, affected areas and sectors of intervention	Statutory territorial plan	Regulation (EU) 2021/1056	7, 10
Just Development Transition Programme	Just Development Transition Programme 2021–2027	Co-financed operational programme with priorities, calls and indicators	ESIF 2021–2027	7, 10
Regional Development Fund of Western Macedonia	Regional development fund	Proposed operational coordinator of the Strategic Hub under the approved regional proposal	Regional Council Decisions 62/2025 and 4/2026	10
Western Macedonia Strategic Hub	Strategic Hub	Regional ecosystem coordinating enterprise, innovation, employment and the social economy; institutional completion in progress	Regional Council Decisions 62/2025 and 4/2026	10
Western Macedonia Local Observatory	Local branch of the National Just Development Transition Observatory	Regional arm collecting, checking and publishing comparable transition indicators	Law 4872/2021, Article 10(6)	10
Full-time equivalent (FTE)	Annual full-time equivalent	One unit of full-time work for one year; comparable to a full-time job-year, not to headcount, hires, a construction peak or multi-year totals	Common EU indicators	1, 4, 6, 9
Direct job	Direct employment	A job at PPC or a clearly defined lignite company and facility	Study definition	1, 4
Contractor job	Contractor or subcontractor employment	Employment with a supplier to lignite operations or construction, classified separately by project	World Bank JWP 54	1, 4
Induced job	Induced employment	A modelled job generated by changes in household consumption, not an individual record	Input–output models	1, 3, 4
Net loss	Net employment balance	Gross terminations minus additional active and sustained jobs of the same scope	Study definition	1, 4
RCR01	Jobs created in supported entities	Common result indicator in annual FTEs, not number of approvals or hires	Just Development Transition Programme 2021–2027	4, 7

Author's declaration

The study was prepared from publicly available and verified evidence up to the cut-off date. The author assumes responsibility for the methodological choices, the assessment of the sources and the conclusions.

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Western Macedonia, 10 August 2026

Data required for future updates

Accuracy will improve materially when PPC provides comparable monthly and annual 2018–2026 data on persons and FTEs by facility and employment relationship; hiring, departure, retirement and transfer flows; residence; and active contractor and subcontractor workers by contract and project, separately for operations, construction, restoration and new investment. An accurate income account also requires pseudonymised data on regular pay, shifts, overtime, allowances, employer contributions and exit compensation, with recurring and one-off amounts held in separate accounts.

Securely linkable records are also required from ERGANI, e-EFKA and IDIKA's HELIOS system, DYPA, the Managing Authority and programme-monitoring systems, ELSTAT, AADE, METAVASI S.A., the Region and municipalities, covering employment, pensions, subsidies, wages, residence, turnover, municipal revenue and redeployment. Linkage should be performed by an authorised body with data minimisation, pseudonymisation, controlled access and publication only of aggregate results. This study is an ex-post reference point with an evidence cut-off of 10 August 2026 and will be updated whenever new verified publications or administrative datasets become available, using stable definitions, a date for every revision and a complete revision record.