

PERMINTAAN PROPOSAL/ REQUEST FOR PROPOSALS (RFP):
INVESTMENT GRADE AUDIT DI SISTEM BOILER UNTUK 2 (DUA) FASILITAS INDUSTRI PROYEK SETI
INDUSTRIAL LAB / INVESTMENT GRADE AUDIT FOR BOILER SYSTEMS AT 2 (TWO) INDUSTRIAL
FACILITIES UNDER THE SETI INDUSTRIAL LAB PROJECT

RINGKASAN PENGADAAN/ SUMMARY OF PROCUREMENT

WRI Indonesia bermaksud memberikan kontrak Harga Tetap (Fixed Price), yang didukung oleh capaian dan faktur, untuk pelaksanaan Investment Grade Audit (IGA) pada sistem boiler di 2 (dua) fasilitas industri yang tergabung dalam program SETI Industrial Lab. Audit akan dilaksanakan secara paralel dan mencakup perencanaan audit, pengukuran diagnostik mengacu pada ISO 50002 Level 3, analisis kinerja energi dan tekno-ekonomi, pengembangan desain engineering, penyusunan rekomendasi efisiensi energi yang siap menjadi dasar keputusan investasi, serta diseminasi hasil dan konsultasi pasca-audit. Penyedia terpilih akan menyerahkan seluruh capaian untuk disetujui dan bekerja sama erat dengan tim WRI Indonesia serta Pemilik Fasilitas. / *WRI Indonesia intends to award a Fixed Price contract, supported by deliverables and invoices, for an Investment Grade Audit (IGA) of boiler systems at 2 (two) industrial facilities participating in the SETI Industrial Lab program. The audits will be conducted in parallel and will cover audit planning, diagnostic measurements referring to ISO 50002 Level 3, energy performance and techno-economic analysis, engineering design development, preparation of investment-ready energy efficiency recommendations, dissemination of results, and post-audit consultation. The selected vendor will submit all deliverables for approval and work closely with WRI Indonesia and the Facility Owners.*

Tentang WRI Indonesia/ About WRI Indonesia

WRI Indonesia adalah organisasi penelitian independen yang berdedikasi untuk berkontribusi pada pembangunan sosial ekonomi Indonesia secara inklusif dan berkelanjutan. Pekerjaan kami difokuskan pada enam bidang utama: hutan, iklim, energi, kota dan transportasi, tata kelola, serta laut. Kami mengaktualisasikan gagasan-gagasan besar menjadi aksi nyata pada titik temu yang menghubungkan lingkungan dengan peluang ekonomi dan kesejahteraan manusia. / *WRI Indonesia is an independent research organization dedicated to contributing to the socioeconomic development of Indonesia in an inclusive and sustainable way. Our work is focused on six main areas: forests, climate, energy, cities and transportation, governance, as well as ocean. We turn big ideas into action at the nexus of environment, economic opportunity, and human well-being.*

Didirikan pada Januari 2014 dengan kantor pusat di Jakarta, WRI Indonesia berafiliasi dengan World Resources Institute, lembaga kajian lingkungan global berbasis di Washington D.C. WRI memiliki jaringan penelitian yang beranggotakan lebih dari 450 tenaga ahli dan staf di lebih dari 50 negara, dengan kantor di Tiongkok, India, Indonesia, Eropa, dan Amerika Serikat. Di Indonesia, kami telah mengerjakan proyek bersama dengan mitra-mitra kami selama lebih dari 20 tahun, dan WRI Indonesia didirikan untuk membangun keberadaan dalam negeri yang kuat, membuat formal kemitraan yang telah terbentuk, serta memperkuat penelitian lapangan kami. / *Established in January 2014 with its headquarter in Jakarta, WRI Indonesia is a non-profit research organization affiliated with the World Resources Institute, a global environmental think tank based in Washington D.C. WRI has a research network of over 450 experts and staff in more than 50 countries with offices in China, India, Indonesia, Europe and the United States. In*

Indonesia, we have run projects with partners for over 20 years, and WRI Indonesia was formally launched to build a robust in-country presence, to formalize existing partnerships, as well as strengthen our research on the ground.

Tentang Proyek / About the Project

Sustainable Energy Transition in Indonesia (SETI) merupakan proyek yang bertujuan mengakselerasi pencapaian target net-zero dan transisi energi Indonesia melalui peningkatan efisiensi energi dan penerapan teknologi energi terbarukan pada sektor industri dan lingkungan terbangun. Proyek kolaboratif pemerintah Jerman dan Indonesia ini dipimpin oleh Direktorat Jenderal Energi Baru, Terbarukan, dan Konservasi Energi (DJEBTKE) KESDM dan Pusat Industri Hijau Kementerian Perindustrian, serta dilaksanakan oleh konsorsium GIZ, WRI Indonesia, IESR, Yayasan Cerah, LPEM FEB UI, dan Fraunhofer. WRI Indonesia merupakan mitra implementasi utama untuk Industrial Energy Lab. Pada 2026, Industrial Lab merencanakan IGA pada sistem boiler di 2 (dua) fasilitas industri untuk mengidentifikasi solusi peningkatan efisiensi, pemanfaatan panas buang, dan pengurangan emisi yang layak secara teknis dan finansial. / *Sustainable Energy Transition in Indonesia (SETI) aims to accelerate Indonesia's net-zero and energy transition targets by improving energy efficiency and deploying renewable energy technologies in the industrial and built-environment sectors. This German-Indonesian collaborative project is led by DJEBTKE of the Ministry of Energy and Mineral Resources and the Green Industry Center of the Ministry of Industry, and implemented by a consortium consisting of GIZ, WRI Indonesia, IESR, Yayasan Cerah, LPEM FEB UI, and Fraunhofer. WRI Indonesia is the lead implementation partner for the Industrial Energy Lab. In 2026, the Industrial Lab plans to conduct IGAs of boiler systems at 2 (two) industrial facilities to identify technically and financially viable solutions for efficiency improvement, waste heat utilization, and emission reduction.*

LINGKUP PEKERJAAN / SCOPE OF WORK

Penyedia jasa wajib melaksanakan seluruh tahapan IGA secara menyeluruh dan terintegrasi pada sistem boiler di 2 (dua) fasilitas industri secara paralel. Ruang lingkup mencakup keseluruhan siklus audit dari perencanaan, pengumpulan data dan pengukuran lapangan, analisis teknis dan tekno-ekonomi, pengembangan desain engineering, hingga diseminasi hasil dan konsultasi pasca-audit. / *The vendor shall conduct all IGA stages comprehensively and in an integrated manner for boiler systems at 2 (two) industrial facilities in parallel. The scope covers the full audit cycle, from planning, data collection and field measurements, technical and techno-economic analysis, engineering design development, to dissemination and post-audit consultation.*

a. Perencanaan Audit dan Evaluasi Baseline / Audit Planning and Baseline Evaluation

- Sebelum pelaksanaan pengukuran lapangan, penyedia jasa wajib melaksanakan tahap perencanaan yang matang dan terstruktur. Tahap ini dibuka dengan kick-off meeting bersama Pemilik Fasilitas dan WRI Indonesia untuk menyepakati ruang lingkup detail, daftar dokumen/data/drawing yang dibutuhkan, titik-titik yang akan diukur, jadwal akses fasilitas, protokol K3 (keselamatan kerja), dan jalur komunikasi selama pelaksanaan audit; / *Prior to conducting field measurements, the Vendor shall undertake a thorough and structured planning stage. This stage shall commence with a kick-off meeting with the Facility Owner and WRI Indonesia to agree on the detailed scope of work, the list of required documents/data/drawings, measurement points, facility access schedule, Occupational Health and Safety (OHS) protocols, and communication channels throughout the audit;*

- Evaluasi Performa Baseline Energi: mengevaluasi dan menyusun baseline konsumsi energi total fasilitas, menetapkan Indikator Kinerja Energi (EnPI) dan Specific Energy Consumption (SEC) heating system sebagai referensi awal (GJ/ton-steam untuk boiler); / *Energy Baseline Performance Evaluation: evaluate and establish the baseline of the facility's total energy consumption and establish the Energy Performance Indicators (EnPI) and Specific Energy Consumption (SEC) of the heating system as the initial reference (GJ/ton-steam for the boiler);*
- Untuk sistem Boiler, melakukan pengumpulan data nameplate dan spesifikasi teknis seluruh unit: merek, model, tipe boiler, kapasitas desain (ton uap/jam), tekanan desain (bar), suhu steam (°C), efisiensi termal desain (%), jenis dan spesifikasi bahan bakar, termasuk tahun pemasangan, riwayat overhaul, kondisi fisik, dan lain-lain; / *For the Boiler system, collect nameplate data and technical specifications for all units, including brand, model, boiler type, design capacity (tons of steam/hour), design pressure (bar), steam temperature (°C), design thermal efficiency (%), fuel type and specifications, year of installation, overhaul history, physical condition, and other relevant information;*
- Untuk sistem Boiler, menyusun data komponen sistem dan distribusi steam: economizer (eksisting/tidak ada), air preheater, deaerator, sistem blowdown (continuous/intermittent), kondisi steam trap, pipa distribusi steam, sistem condensate return, titik penggunaan, dan lain-lain; / *For the Boiler system, compile data on system components and steam distribution, including the economizer (existing/not installed), air preheater, deaerator, blowdown system (continuous/intermittent), steam trap condition, steam distribution piping, condensate return system, points of use, and other relevant components;*
- Melakukan wawancara untuk memahami gambaran umum operasi fasilitas: jadwal produksi bulanan, proyeksi dan target produksi, jam operasi heating system, siklus charging dan cycle time, pola shutdown/idle, serta data relevan lainnya yang diperlukan untuk analisis dan proyeksi di masa depan. / *Conduct interviews to understand the overall facility operations, including monthly production schedules, production projections and targets, heating system operating hours, charging cycles and cycle time, shutdown/idle patterns, and other relevant data required for analysis and future projections.*

b. Pengukuran Diagnostik Sistem Boiler / Boiler System Diagnostic Measurements

Melakukan pengukuran dan inspeksi visual pada sistem boiler berdasarkan metodologi pengumpulan data yang telah disiapkan pada fase perencanaan. Checklist kesiapan audit mencakup: verifikasi kalibrasi semua alat ukur, izin akses area boiler (Work Permit), persiapan single-line diagram kelistrikan dan layout sistem pemipaan, serta izin kerja yang telah disetujui Pemilik Fasilitas. / *Conduct measurements and visual inspections of the boiler system based on the data collection methodology prepared during the planning phase. The audit readiness checklist shall include verification of the calibration of all measurement instruments, access permits for the boiler area (Work Permit), preparation of the electrical single-line diagram and piping system layout, as well as work permits approved by the Facility Owner.*

- **Pengukuran Sistem Boiler / Boiler System Measurements**
- ✓ Pengukuran kontinu konsumsi bahan bakar (*flow meter*): laju aliran massa, tekanan, dan suhu bahan bakar; / *Continuous measurement of fuel consumption using a flow meter, including fuel mass flow rate, pressure, and temperature;*
- ✓ Pengukuran dan analisis komposisi gas buang secara kontinu pada berbagai kondisi beban menggunakan *combustion/flue gas analyzer* terkalibrasi, termasuk *sampling* pengukuran O₂, CO₂, CO, NO_x, SO_x, dan suhu gas buang pada berbagai titik; / *Continuous measurement and analysis of flue gas composition under various load conditions using a calibrated combustion/flue gas*

analyzer, including sampling measurements of O₂, CO₂, CO, NO_x, SO_x, and flue gas temperature at various points;

- ✓ *Pengukuran laju aliran gas buang (volume atau massa) serta tekanan statik pada ducting/stack; / Measurement of flue gas flow rate (volumetric or mass flow) and static pressure in the ducting/stack;*
- ✓ *Pengukuran daya listrik peralatan bantu: pompa, blower, forced draft (FD) fan, induced draft (ID) fan, dan peralatan pendukung lainnya menggunakan Power Quality Analyzer (PQA), meliputi daya aktif (kW), faktor daya, arus, dan tegangan tiga fase; / Measurement of electrical power for auxiliary equipment, including pumps, blowers, forced draft (FD) fans, induced draft (ID) fans, and other supporting equipment using a Power Quality Analyzer (PQA), including active power (kW), power factor, current, and three-phase voltage;*
- ✓ *Inspeksi termal (thermal imaging) pada kondisi insulasi boiler, pipa steam, dan permukaan peralatan untuk mengidentifikasi heat loss area; / Conduct thermal imaging inspections of boiler insulation, steam piping, and equipment surfaces to identify potential heat loss areas;*
- ✓ *Penyediaan profil beban termal dan profil kebutuhan panas harian berdasarkan continuous data logging (mencakup variasi shift, siklus operasi, dan perubahan beban produksi); / Develop thermal load and daily heat demand profiles based on continuous data logging, covering shift variations, operating cycles, and changes in production loads;*
- ✓ *Evaluasi neraca energi dan massa boiler (heat and mass balance): heat input (bahan bakar), heat output (steam), dan breakdown losses (flue gas loss, radiation loss, blowdown loss, dan unaccounted loss); / Evaluate the boiler heat and mass balance, including heat input (fuel), heat output (steam), and breakdown of losses (flue gas loss, radiation loss, blowdown loss, and unaccounted loss);*
- ✓ *Pengukuran laju aliran air umpan (feedwater flow): flow rate (m³/jam atau ton/jam) menggunakan non-invasive ultrasonic flow meter atau flow meter terpasang; / Measure the feedwater flow rate (m³/hour or ton/hour) using a non-invasive ultrasonic flow meter or an installed flow meter;*
- ✓ *Pengukuran laju produksi steam: steam flow meter, tekanan steam outlet header, dan suhu steam (jenuh atau superheated); / Measure the steam production rate, including steam flow, steam outlet header pressure, and steam temperature (saturated or superheated);*
- ✓ *Pengukuran kualitas air: TDS (ppm) air umpan, air boiler, dan kondensat; pH; konduktivitas; dan kesadahan menggunakan portable TDS meter, pH meter, dan water analysis kit. / Measure water quality parameters, including TDS (ppm) of feedwater, boiler water, and condensate; pH; conductivity; and hardness using a portable TDS meter, pH meter, and water analysis kit.*
- **Pengukuran Khusus (tergantung potensi intervensi EE Measures pada masing-masing fasilitas) / Specific Measurements (depending on the potential EE Measures interventions at each facility):**
 - **Waste Heat Recovery / Pemanfaatan Panas Buang / Waste Heat Recovery**
 - ✓ *Pengukuran suhu dan laju aliran gas buang secara kontinu (continuous data logging) pada titik keluaran sistem dan setelah peralatan pemanfaatan panas eksisting, untuk memperoleh profil representatif yang mencakup variasi beban harian, shift, dan siklus produksi; / Continuous measurement of flue gas temperature and flow rate (continuous data logging) at the system outlet and downstream of existing heat recovery equipment to obtain a representative profile covering daily load variations, shifts, and production cycles;*
 - ✓ *Kalkulasi daya termal panas buang yang tersedia (kW-th dan GJ/tahun), termasuk penetapan batas suhu gas buang minimum; / Calculate the available waste heat thermal*

capacity (kW-th and GJ/year), including determination of the minimum allowable flue gas temperature;

- ✓ Karakterisasi kualitas gas buang yang berpotensi menimbulkan *fouling*, abrasi, atau korosi pada permukaan penukar panas; / *Characterize flue gas properties that may potentially cause fouling, abrasion, or corrosion on heat exchanger surfaces;*
- ✓ *Assessment* kinerja *recuperator/regenerator/air preheater* eksisting (apabila terpasang): efektivitas aktual vs desain, suhu udara *preheat* yang dicapai, indikasi kebocoran, dan penurunan tekanan (*pressure drop*); / *Assess the performance of existing recuperators/regenerators/air preheaters (if installed), including actual versus design effectiveness, achieved preheated air temperature, indications of leakage, and pressure drop;*
- ✓ *Assessment* potensi pemanasan awal udara pembakaran (*recuperator/regenerative burner*): target suhu *preheat* dan potensi kenaikan efisiensi termal; / *Assess the potential for combustion air preheating (recuperator/regenerative burner), including target preheat temperature and potential improvement in thermal efficiency;*
- ✓ *Assessment* potensi *Waste Heat Recovery Boiler/steam generator*: kapasitas *steam* yang dapat dibangkitkan (ton/jam), tekanan dan suhu *steam*, serta skema integrasi dengan *steam header* dan kebutuhan *steam* eksisting fasilitas; / *Assess the potential for a Waste Heat Recovery Boiler/steam generator, including potential steam generation capacity (ton/hour), steam pressure and temperature, and integration scheme with the existing steam header and facility steam demand;*
- ✓ Survei dan *assessment* lokasi fisik, ruang bebas, rute *ducting*, serta kapasitas struktur untuk penempatan unit WHR. / *Survey and assess the physical location, available clearance, ducting routes, and structural capacity for installation of the WHR unit.*

Atau / Or

- ***Blowdown Heat Recovery***

- ✓ Pengukuran laju *blowdown* aktual: *continuous blowdown* dan *intermittent blowdown*; pengukuran suhu dan tekanan *blowdown* di titik keluaran *boiler* sebelum *blowdown valve*; / *Measure the actual blowdown rate for both continuous blowdown and intermittent blowdown, including blowdown temperature and pressure at the boiler outlet upstream of the blowdown valve;*
- ✓ Monitoring TDS air *boiler* dan membandingkan TDS aktual dengan nilai batas operasi; / *Monitor boiler water TDS and compare the actual TDS with the operating limit;*
- ✓ Kalkulasi *blowdown heat*; / *Calculate blowdown heat;*
- ✓ Kalkulasi potensi *flash steam recovery*; / *Calculate the potential for flash steam recovery;*
- ✓ Pengukuran suhu dan laju aliran *make-up water*; / *Measure make-up water temperature and flow rate;*
- ✓ Penyusunan neraca massa dan energi *blowdown*; / *Develop the blowdown mass and energy balance;*
- ✓ *Assessment* kondisi dan operasi sistem *blowdown* eksisting. / *Assess the condition and operation of the existing blowdown system.*

Atau / Or

- ***Optimasi Air–Fuel Ratio / Air–Fuel Ratio Optimization***

- ✓ Pengukuran dan analisis komposisi gas buang secara kontinu pada berbagai kondisi beban menggunakan *combustion analyzer (flue gas analyzer)* terkalibrasi: O₂, CO₂, CO, NO_x, dan suhu *flue gas* di berbagai titik; / *Continuously measure and analyze flue gas composition under various load conditions using a calibrated combustion analyzer (flue gas analyzer), including O₂, CO₂, CO, NO_x, and flue gas temperature at various points;*
- ✓ Kalkulasi *excess air (%)* aktual; / *Calculate the actual excess air (%);*
- ✓ Kalkulasi efisiensi pembakaran aktual menggunakan metode tidak langsung; / *Calculate the actual combustion efficiency using the indirect method;*
- ✓ Pengukuran rasio aliran udara pembakaran; / *Measure the combustion air flow ratio;*
- ✓ Evaluasi kinerja *burner*; / *Evaluate burner performance;*
- ✓ *Assessment* potensi *upgrade* sistem kontrol: pemasangan O₂ *trim control (real-time feedback adjustment)* dan *Variable Speed Drive (VSD)* pada *FD fan* untuk regulasi aliran udara; / *Assess the potential for control system upgrades, including installation of O₂ trim control (real-time feedback adjustment) and a Variable Speed Drive (VSD) on the FD fan for airflow regulation;*
- ✓ Simulasi dan kuantifikasi potensi penghematan bahan bakar dari penurunan *excess air* berdasarkan kurva efisiensi pembakaran; estimasi penghematan (%) dan nilai ekonomi (Rp/tahun). / *Simulate and quantify potential fuel savings resulting from reduced excess air based on the combustion efficiency curve, including estimated savings (%) and economic benefits (IDR/year).*

Atau / Or

- **Economizer**
- ✓ Pengukuran suhu gas buang secara kontinu di titik *stack* sebelum dan sesudah titik potensial pemasangan *economizer*; / *Continuously measure flue gas temperature at the stack upstream and downstream of the potential economizer installation point;*
- ✓ Pengukuran dan analisis komposisi gas buang pada berbagai kondisi beban *boiler* (beban rendah, sedang, dan penuh); / *Measure and analyze flue gas composition under various boiler load conditions (low, medium, and full load);*
- ✓ Pengukuran laju aliran gas buang; / *Measure the flue gas flow rate;*
- ✓ Kalkulasi potensi *economizer heat duty*; / *Calculate the potential economizer heat duty;*
- ✓ Pengukuran suhu dan laju aliran air umpan (*feedwater*) sebelum masuk *boiler drum*; / *Measure feedwater temperature and flow rate before entering the boiler drum;*
- ✓ *Assessment* kondisi fisik dan dimensi ruang yang tersedia di jalur *flue duct/chimney* untuk pemasangan *economizer*; / *Assess the physical condition and dimensions of the available space along the flue duct/chimney for economizer installation;*
- ✓ Penilaian kondisi *existing economizer* (jika sudah terpasang), efisiensi aktual vs desain. / *Assess the condition of the existing economizer (if installed), including actual versus design efficiency.*

c. **Analisis Kinerja Energi pada Fasilitas / Facility Energy Performance Analysis**

- Analisis kinerja energi sistem *boiler* terhadap keseluruhan fasilitas pabrik: proporsi konsumsi bahan bakar *boiler* terhadap total konsumsi energi fasilitas; / *Analyze the energy performance of the boiler system in relation to the overall plant facility, including the proportion of boiler fuel consumption relative to the facility's total energy consumption;*

- Menyusun neraca energi dan daya pada tingkat fasilitas dalam *Sankey diagram (energy flow diagram)* dari sisi pasokan bahan bakar dan listrik hingga *end-use*; / *Develop facility-level energy and power balances in a Sankey diagram (energy flow diagram), covering fuel and electricity supply through to end-use*;
- Analisis dan evaluasi konsumsi energi serta biaya bahan bakar dan listrik per bulan (24 bulan terakhir); analisis tren untuk proyeksi kebutuhan energi masa depan; / *Analyze and evaluate monthly energy consumption and fuel and electricity costs for the last 24 months, including trend analysis to project future energy requirements*;
- Evaluasi Indikator Kinerja Energi (EnPI) pada tingkat fasilitas dan *Specific Fuel Consumption (SFC)* sistem boiler: GJ/ton-steam. / *Evaluate facility-level Energy Performance Indicators (EnPI) and the Specific Fuel Consumption (SFC) of the boiler system: GJ/ton-steam*.

d. Menyusun Detail Rekomendasi Efisiensi Energi / *Development of Detailed Energy Efficiency Recommendations*

- Menyusun detail rekomendasi efisiensi energi baik dari sisi teknis maupun finansial pada sistem yang diminta; / *Develop detailed energy efficiency recommendations covering both technical and financial aspects of the specified system*;
- Mengembangkan model analisis sensitivitas untuk menilai dampak rekomendasi efisiensi energi, sebagai contoh dampak terhadap biaya, produksi, dan variabel relevan lainnya; / *Develop a sensitivity analysis model to assess the impacts of the energy efficiency recommendations, including, for example, impacts on costs, production, and other relevant variables*;
- Mengembangkan desain dan perencanaan implementasi dari hasil yang direkomendasikan. / *Develop the design and implementation plan for the recommended measures*.

LOKASI PELAKSANAAN PEKERJAAN/ *WORK IMPLEMENTATION LOCATION*

Proyek ini mencakup 2 (dua) fasilitas industri yang berlokasi di Indonesia. Pelaksanaan audit pada kedua fasilitas wajib dilakukan secara PARALEL (bersamaan) oleh tim konsultan yang beroperasi secara simultan pada masing-masing fasilitas. Informasi mengenai lokasi fasilitas, jumlah dan kapasitas unit boiler, estimasi minimum jumlah hari pengukuran, serta kebutuhan tim untuk masing-masing fasilitas tercantum dalam tabel berikut. / *This project covers 2 (two) industrial facilities located in Indonesia. The audits at both facilities shall be conducted IN PARALLEL (simultaneously) by consultant teams operating concurrently at each respective facility. Information regarding the facility locations, number and capacity of boiler units, estimated minimum number of measurement days, and team requirements for each facility is provided in the following table.*

No.	Sektor Bisnis / <i>Business Sector</i>	Lokasi/ <i>Location</i>	Jumlah Unit & Kapasitas Boiler / <i>Number of Boiler Units & Capacity</i>	Estimasi Jumlah Hari Pengukuran / <i>Estimated Number of Measurement Days</i>
1	Automotive	Cikarang - GIC	2 Unit Boiler x 5 TPH	14 hari/ 14 days

2	Chemicals (Petrochemicals)	Kalimantan Timur - Bontang	1 Boiler Gas x 60 TPH	14 hari/ 14 days
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METODE DAN TAHAPAN / METHODS AND STAGES

Investment Grade Audit (IGA) akan dilaksanakan dalam beberapa tahap sebagai berikut: / *The Investment Grade Audit (IGA) shall be conducted through the following stages:*

i. Perencanaan Kegiatan Audit / Audit Planning

Auditor energi akan menyusun perencanaan kegiatan audit energi, termasuk: / *The Energy*

Auditor shall prepare an energy audit plan, including:

- a. Menganalisis data awal yang diberikan oleh Pemilik Fasilitas; / *Analyze the initial data provided by the Facility Owner;*
- b. Melaksanakan *kick-off meeting* dengan Pemilik Fasilitas dan WRI Indonesia; / *Conduct a kick-off meeting with the Facility Owner and WRI Indonesia;*
- c. Merencanakan dan menentukan titik pengambilan data/pengukuran beserta peralatan ukur yang dibutuhkan; / *Plan and determine the data collection/measurement points and the required measurement instruments;*
- d. Menyusun jadwal dan linimasa pelaksanaan pengambilan data dan pengukuran; / *Develop the schedule and timeline for data collection and measurements;*
- e. Mengidentifikasi dan meminta data tambahan yang diperlukan dari Pemilik Fasilitas; / *Identify and request any additional data required from the Facility Owner;*
- f. Melakukan wawancara untuk memahami gambaran umum operasi fasilitas, meliputi jadwal produksi bulanan, proyeksi produksi, target produksi, jam operasi, pola beban, serta data relevan lainnya yang diperlukan untuk analisis dan proyeksi kebutuhan energi di masa depan; / *Conduct interviews to understand the overall facility operations, including monthly production schedules, production projections, production targets, operating hours, load patterns, and other relevant data required for analysis and future energy demand projections;*
- g. Mengumpulkan data *nameplate* dan spesifikasi teknis seluruh unit pada *heating system*. / *Collect nameplate data and technical specifications for all units within the heating system.*

ii. Pengukuran Diagnostik / Diagnostic Measurements

Melakukan pengukuran dan inspeksi visual pada peralatan/unit berdasarkan metodologi pengumpulan data yang telah disiapkan pada fase perencanaan, dengan mengacu pada Bab 2 mengenai Ruang Lingkup Pekerjaan Penyedia Jasa. / *Conduct measurements and visual inspections of the equipment/units based on the data collection methodology established during the planning phase, with reference to Chapter 2 regarding the Vendor's Scope of Work.*

iii. Analisis Kinerja Energi pada Fasilitas dan Heating System / Facility and Heating System Energy Performance Analysis

- a. Menganalisis kinerja energi sistem Boiler terhadap fasilitas pabrik secara keseluruhan; / *Analyze the energy performance of the Boiler system in relation to the overall plant facility;*
- b. Menyusun neraca energi dan daya pada tingkat fasilitas dalam bentuk Sankey diagram (energy flow diagram); / *Develop facility-level energy and power balances in the form of a Sankey diagram (energy flow diagram);*

- c. Menganalisis dan mengevaluasi konsumsi energi serta biaya energi bulanan; / *Analyze and evaluate monthly energy consumption and energy costs;*
- d. Mengevaluasi Indikator Kinerja Energi (EnPI) pada tingkat fasilitas dan Specific Fuel Consumption (SFC) sistem Boiler. / *Evaluate facility-level Energy Performance Indicators (EnPI) and the Specific Fuel Consumption (SFC) of the Boiler system.*

iv. Analisis Kinerja Heating System / Heating System Performance Analysis

Setelah pengukuran dan inspeksi visual pada sistem terkait selesai dilaksanakan, Auditor Energi akan melakukan analisis dan menyusun laporan yang mencakup: / *Following the completion of measurements and visual inspections of the relevant systems, the Energy Auditor shall conduct an analysis and prepare a report covering:*

- a. Hasil temuan audit; / *Audit findings;*
- b. Evaluasi kinerja peralatan berdasarkan analisis data hasil pengukuran; / *Evaluation of equipment performance based on the analysis of measurement data;*
- c. Identifikasi dan kuantifikasi kehilangan panas atau energi (*heat/energy losses*) pada sistem Boiler. / *Identification and quantification of heat/energy losses within the Boiler system.*

v. Analisis Rekomendasi Efisiensi Energi / Energy Efficiency Recommendation Analysis

Setelah analisis terhadap masing-masing sistem selesai dilakukan, analisis tekno-ekonomi akan dilakukan terhadap salah satu rekomendasi efisiensi energi yang mempunyai potensi dari sisi efisiensi energi dengan mempertimbangkan aspek-aspek berikut: / *Once the analysis of each system has been completed, a techno-economic analysis will be carried out on one of the energy efficiency recommendations that shows strong energy-saving potential, taking the following aspects into consideration;*

- a. Menganalisis dan menyusun rekomendasi efisiensi energi yang berfokus pada sistem/intervensi seperti *Economizer*, *Air–Fuel Ratio Optimization*, dan *Blowdown Heat Recovery*, termasuk rekomendasi dengan kebutuhan investasi tinggi (*High Cost*); / *Analyze and develop energy efficiency recommendations focusing on systems/interventions such as Economizer, Air–Fuel Ratio Optimization, and Blowdown Heat Recovery, including recommendations requiring significant investment (High Cost);*
- b. Melakukan evaluasi tekno-ekonomi secara mendalam terhadap setiap rekomendasi efisiensi energi dengan menganalisis parameter sebagai berikut: / *Conduct an in-depth techno-economic evaluation of each energy efficiency recommendation by analyzing the following parameters:*

✓ **Parameter Penghematan Energi / Energy Saving Parameters:**

- Penghematan energi (kWh/tahun atau GJ/tahun); / *Energy savings (kWh/year or GJ/year);*
- *Saving Rate* (% terhadap *baseline*); / *Saving Rate* (% of *baseline*);
- Reduksi emisi karbon (ton CO₂/tahun); / *Carbon emission reduction (tons CO₂/year);*
- Penghematan biaya energi tahun (Rp/tahun); / *Energy cost savings (IDR/year);*

✓ **Parameter Keputusan Investasi / Investment Decision Parameters:**

- CAPEX (*Capital Expenditure*) (Rp); / CAPEX (*Capital Expenditure*) (IDR);
- OPEX (*Operating Expenses*) (Rp); / OPEX (*Operating Expenses*) (IDR);
- *Simple Payback Period (SPP)* (tahun); / *Simple Payback Period (SPP)* (years);
- *Net Present Value (NPV)*; / *Net Present Value (NPV)*;
- *Internal Rate of Return (IRR)*. / *Internal Rate of Return (IRR)*.

- c. Memodelkan dampak proyeksi dari setiap rekomendasi menggunakan analisis sensitivitas berdasarkan variabel-variabel relevan; / *Model the projected impacts of each recommendation using sensitivity analysis based on relevant variables;*
- d. Menyusun *Design Development* untuk setiap rekomendasi yang diusulkan; / *Develop the Design Development for each proposed recommendation;*
- e. Menyusun estimasi biaya secara terperinci untuk setiap rekomendasi efisiensi energi; / *Develop detailed cost estimates for each energy efficiency recommendation;*
- f. Menyusun rencana implementasi untuk pelaksanaan setiap rekomendasi efisiensi energi. / *Develop an implementation plan for each energy efficiency recommendation.*

vi. Diseminasi Hasil dan Konsultasi / Results Dissemination and Consultation

Auditor energi akan mendiseminasikan hasil akhir audit kepada Konsorsium SETI dan peserta SETI dalam bentuk presentasi, serta memberikan penjelasan dan konsultasi terkait hasil analisis dan rekomendasi efisiensi energi yang diusulkan. / *The Energy Auditor shall disseminate the final audit results to the SETI Consortium and SETI participants through a presentation and provide explanations and consultations regarding the analysis results and the proposed energy efficiency recommendations.*

KELUARAN/CAPAIAN KERJA / OUTPUTS/DELIVERABLES

Laporan yang merangkum Ringkasan Eksekutif, Latar Belakang dan Metodologi, Gambaran dan Deskripsi Fasilitas, Analisis Sistem dan Temuan Audit, Rekomendasi Terapan Efisiensi Energi, serta Konsultasi dan Diseminasi Hasil. / *A report summarizing the Executive Summary, Background and Methodology, Facility Overview and Description, System Analysis and Audit Findings, Applied Energy Efficiency Recommendations, and Consultation and Dissemination of Results.*

I. Ringkasan Eksekutif / Executive Summary

- a. Profil Singkat Fasilitas: nama, sektor, kapasitas produksi, dan sistem boiler; / *Brief Facility Profile: facility name, sector, production capacity, and boiler system;*
- b. Tujuan dan Ruang Lingkup: ringkasan intervensi efisiensi energi; / *Objectives and Scope: summary of energy efficiency interventions;*
- c. Status Kinerja Energi Saat Ini (*Baseline*): ringkasan efisiensi aktual dibandingkan dengan desain; / *Current Energy Performance Status (Baseline): summary of actual efficiency compared with design performance;*
- d. Ringkasan Temuan Utama Audit; / *Summary of Key Audit Findings;*
- e. Tabel Ringkasan Rekomendasi dan Kelayakan Investasi; / *Summary Table of Recommendations and Investment Feasibility;*
- f. Langkah Tindak Lanjut. / *Follow-up Actions.*

II. Latar Belakang dan Metodologi / Background and Methodology

Bab ini akan menjelaskan pengantar umum *Investment Grade Audit (IGA)* yang mencakup: / *This chapter shall provide a general introduction to the Investment Grade Audit (IGA), covering:*

- a. Latar Belakang: memberikan detail mengenai latar belakang dan konteks pelaksanaan audit energi tingkat investasi; / *Background: provide details on the background and context of the Investment Grade Audit;*
- b. Tujuan Audit; / *Audit Objectives;*
- c. Ruang Lingkup Audit; / *Audit Scope;*

- d. Standar dan Referensi Teknis; / *Standards and Technical References*;
- e. Metodologi Pelaksanaan: memberikan perencanaan detail pelaksanaan *Investment Grade Audit* dan pengumpulan data, termasuk metodologi *sampling*, persyaratan peralatan untuk pengumpulan data, serta jadwal/linimasa pengumpulan data; / *Implementation Methodology: provide a detailed plan for conducting the Investment Grade Audit and data collection, including the sampling methodology, measurement equipment requirements, and data collection schedule/timeline*;
- f. Tim Auditor dan Kualifikasi. / *Audit Team and Qualifications*.

III. Gambaran dan Deskripsi Fasilitas / *Facility Overview and Description*

Bab ini berfokus pada penilaian energi secara keseluruhan pada fasilitas dan unit *Boiler*, yang mencakup: / *This chapter shall focus on the overall energy assessment of the facility and Boiler units, covering:*

- a. Profil Perusahaan dan Fasilitas Pabrik; / *Company and Plant Facility Profile*;
- b. Profil Konsumsi Energi dan Fasilitas: / *Facility Energy Consumption Profile*:
 - Neraca energi listrik dan bahan bakar fasilitas: neraca daya berdasarkan penggunaan peralatan serta distribusi energi listrik dan bahan bakar pada fasilitas yang digambarkan dalam *Sankey diagram*; / *Facility electricity and fuel energy balance: power balance based on equipment end-use and distribution of electricity and fuel consumption throughout the facility, presented in a Sankey diagram*;
 - Evaluasi konsumsi dan biaya energi per bulan: analisis data pemakaian dan tagihan energi bulanan (PLN dan/atau *captive power* [Gas/Diesel/Biomass]) serta konsumsi/tagihan bahan bakar selama 12–24 bulan terakhir. Hasil ditampilkan dalam bentuk grafik untuk mengevaluasi tren tahunan atau bulanan serta digunakan untuk memproyeksikan kebutuhan energi di masa depan; / *Evaluation of monthly energy consumption and costs: analysis of monthly energy consumption and billing data (PLN and/or captive power [Gas/Diesel/Biomass]) and fuel consumption/costs for the previous 12–24 months. The results shall be presented graphically to evaluate annual or monthly trends and support projections of future energy requirements*;
- c. Deskripsi, Distribusi, dan Spesifikasi Sistem *Boiler*; / *Description, Distribution, and Specifications of the Boiler System*;
- d. Analisis nilai EnPI fasilitas dan kinerja energi fasilitas: ringkasan kinerja fasilitas dan temuan audit energi. / *Analysis of facility EnPI and energy performance: summary of facility performance and energy audit findings*.

IV. Analisis Sistem dan Temuan Audit / *System Analysis and Audit Findings*

Bab ini menjelaskan hasil dan temuan dari pengukuran diagnostik pada peralatan *Boiler*, yang mencakup: / *This chapter shall describe the results and findings from diagnostic measurements of the Boiler equipment, covering:*

- a. Instrumen pengukuran yang digunakan; / *Measurement instruments used*;
- b. Hasil pengukuran konsumsi energi dan parameter terkait: / *Energy consumption measurement results and related parameters*:
 - Evaluasi kinerja dan efisiensi termal *heating system* berdasarkan hasil sistem akuisisi data/pengukuran berkelanjutan; / *Evaluation of heating system performance and thermal efficiency based on data acquisition/continuous measurement results*;
 - **Sistem *Boiler***: konsumsi bahan bakar, laju aliran *feedwater*, laju produksi *steam*, daya peralatan bantu, kualitas air, dan profil beban harian; / ***Boiler System***: *fuel consumption, feedwater flow rate, steam production rate, auxiliary equipment power consumption, water quality, and daily load profile*;

- *Heat balance* lengkap beserta rincian seluruh komponen *losses*. / *Complete heat balance with a breakdown of all loss components*.
- c. Analisis dan Pemetaan Potensi Intervensi Efisiensi Energi – **Waste Heat Recovery**: / *Analysis and Mapping of Potential Energy Efficiency Interventions – Waste Heat Recovery*:
- Profil suhu dan laju aliran gas buang (harian, berdasarkan beban, dan siklus produksi); / *Flue gas temperature and flow rate profiles (daily, by load condition, and by production cycle)*;
 - Kuantifikasi daya termal panas buang yang tersedia (kW-th dan GJ/tahun) beserta batas suhu minimum pemanfaatan; / *Quantification of available waste heat thermal capacity (kW-th and GJ/year), including the minimum temperature threshold for heat recovery*;
 - Karakteristik gas buang yang memengaruhi desain; / *Flue gas characteristics affecting the design*;
 - Pemetaan kebutuhan panas internal fasilitas dan kesesuaiannya dengan panas buang yang tersedia, meliputi kesesuaian suhu, kapasitas, dan waktu ketersediaan; / *Mapping of the facility's internal heat demand and its compatibility with available waste heat, including temperature, capacity, and availability timing*;
 - Kalkulasi potensi pemanfaatan panas untuk pemanasan awal udara pembakaran atau pemanfaatan lain yang relevan, beserta proyeksi peningkatan efisiensi termal; / *Calculation of heat recovery potential for combustion air preheating or other relevant applications, including projected improvements in thermal efficiency*;
 - Evaluasi kinerja sistem pemanfaatan panas eksisting (apabila ada) dan potensi optimasinya; / *Evaluation of existing heat recovery system performance (if any) and its optimization potential*;
 - Profil suhu gas buang *stack* (harian dan berdasarkan kondisi beban); / *Stack flue gas temperature profile (daily and by load condition)*;
 - Hasil analisis integrasi panas dan prioritasasi opsi pemanfaatan panas. / *Results of heat integration analysis and prioritization of heat recovery options*.

Atau / Or

- d. Analisis dan Pemetaan Potensi Intervensi Efisiensi Energi – **Economizer**: / *Analysis and Mapping of Potential Energy Efficiency Interventions – Economizer*:
- Profil suhu gas buang *stack* (harian dan berdasarkan kondisi beban); / *Stack flue gas temperature profile (daily and by load condition)*;
 - Komposisi gas buang: O₂, CO₂, CO, NO_x, dan *excess air* (%) pada setiap kondisi beban; / *Flue gas composition: O₂, CO₂, CO, NO_x, and excess air (%) under each load condition*;
 - Kalkulasi potensi *economizer heat duty* dan proyeksi peningkatan efisiensi *boiler*; / *Calculation of potential economizer heat duty and projected improvement in boiler efficiency*;
 - Penilaian suhu minimum gas buang. / *Assessment of the minimum allowable flue gas temperature*.

Atau / Or

- e. Analisis dan Pemetaan Potensi Intervensi Efisiensi Energi – **Air-Fuel Ratio Optimization**: / *Analysis and Mapping of Potential Energy Efficiency Interventions – Air-Fuel Ratio Optimization*:
- Profil *excess air* aktual (%) dibandingkan dengan kondisi optimal pada berbagai beban; / *Actual excess air profile (%) compared with optimal conditions at various loads*;
 - Efisiensi pembakaran aktual dibandingkan dengan target; / *Actual combustion efficiency compared with the target*;
 - Evaluasi kinerja *burner* dan sistem kontrol eksisting; / *Evaluation of existing burner and control system performance*;

- Kuantifikasi potensi penghematan bahan bakar dari optimasi. / *Quantification of potential fuel savings from optimization.*

Atau / Or

- f. Analisis dan Pemetaan Potensi Intervensi Efisiensi Energi – **Blowdown Heat Recovery**: / *Analysis and Mapping of Potential Energy Efficiency Interventions – Blowdown Heat Recovery*:
 - Laju *blowdown* aktual (% dari produksi *steam*) dibandingkan dengan kondisi optimal; / *Actual blowdown rate (% of steam production) compared with the optimal condition*;
 - Neraca massa dan energi *blowdown*: kalkulasi *flash steam* dan *heat recovery potential*; / *Blowdown mass and energy balance, including calculation of flash steam and heat recovery potential*;
 - Identifikasi potensi *heat recovery* untuk *make-up water/feedwater*. / *Identification of heat recovery potential for make-up water/feedwater*.
- g. *Baseline Efisiensi Termal Boiler*: spesifikasi desain dibandingkan dengan hasil pengukuran aktual; / *Boiler Thermal Efficiency Baseline: design specifications compared with actual measurement results*;
- h. Analisis temuan dan potensi penghematan energi keseluruhan sistem *Boiler*. / *Analysis of findings and overall energy-saving potential of the Boiler system*.

V. Rekomendasi Terapan Efisiensi Energi / **Applied Energy Efficiency Recommendations**

Bab ini menjabarkan rekomendasi berdasarkan analisis data pengukuran serta hasil dan temuan di lapangan. Analisis rekomendasi efisiensi energi difokuskan pada proyek *retrofit/upgrading* berdasarkan potensi intervensi yang teridentifikasi pada masing-masing fasilitas. / *This chapter presents recommendations based on the analysis of measurement data and field findings. The energy efficiency recommendation analysis shall focus on retrofit/upgrading projects based on the intervention potential identified at each facility.*

a. Analisis Rekomendasi Efisiensi Energi / **Energy Efficiency Recommendation Analysis**

Analisis rekomendasi efisiensi energi dilakukan terhadap salah satu potensi intervensi yang teridentifikasi, yaitu *Waste Heat Recovery*, *Economizer*, *Air–Fuel Ratio Optimization*, atau *Blowdown Heat Recovery*, sesuai dengan kondisi dan potensi pada masing-masing fasilitas. / *The energy efficiency recommendation analysis shall be conducted for one of the identified potential interventions, namely Waste Heat Recovery, Economizer, Air–Fuel Ratio Optimization, or Blowdown Heat Recovery, depending on the conditions and identified potential at each facility.*

b. Evaluasi Teknis / **Technical Evaluation**

Memberikan dan melakukan evaluasi teknis secara terperinci terhadap rekomendasi yang dipilih, yang mencakup: / *Provide and conduct a detailed technical evaluation of the selected recommendation, covering:*

i. Analisis Rekomendasi – *Waste Heat Recovery* / **Recommendation Analysis – Waste Heat Recovery**

- P&ID sistem gas buang lengkap dengan unit pemanfaatan panas; / *Complete P&ID of the flue gas system, including the heat recovery unit*;
- *Mechanical drawing* unit penukar panas dan layout *ducting* gas buang; / *Mechanical drawing of the heat exchanger unit and flue gas ducting layout*;

- Spesifikasi material *tube*/permukaan penukar panas yang sesuai dengan suhu operasi dan karakteristik korosif gas buang; / *Specifications of tube/heat exchanger surface materials suitable for the operating temperature and corrosive characteristics of the flue gas*;
- Tekanan desain, suhu desain, *heat duty* (kW-th), dan *pressure drop* pada sisi gas buang maupun sisi fluida kerja; / *Design pressure, design temperature, heat duty (kW-th), and pressure drop on both the flue gas side and working fluid side*;
- Kebutuhan *upgrade ID fan/blower*, sistem insulasi, serta modifikasi struktur penyangga; / *Requirements for ID fan/blower upgrades, insulation systems, and supporting structure modifications*;
- Skema dan *I/O List* sistem kontrol dan proteksi, termasuk kontrol suhu *outlet* dan *interlock* dengan operasi *boiler*; / *Control and protection system scheme and I/O List, including outlet temperature control and interlock with boiler operation*;
- *Bill of Quantity (BoQ)* dan *Bill of Material (BoM)* sistem *Waste Heat Recovery*; / *Bill of Quantity (BoQ) and Bill of Material (BoM) for the Waste Heat Recovery system*;
- Proyeksi penghematan yang mencakup peningkatan efisiensi termal (%), penghematan bahan bakar (GJ/tahun), reduksi emisi CO₂ (ton/tahun), dan penghematan biaya (Rp/tahun). / *Projected savings, including improvement in thermal efficiency (%), fuel savings (GJ/year), CO₂ emission reductions (tons/year), and cost savings (IDR/year)*.

Atau / Or

ii. **Analisis Rekomendasi – Economizer / Recommendation Analysis – Economizer**

- P&ID sistem gas buang dengan *economizer*; / *P&ID of the flue gas system with the economizer*;
- *Mechanical drawing economizer*; / *Mechanical drawing of the economizer*;
- Spesifikasi material *tube*; / *Tube material specifications*;
- Tekanan desain, suhu desain, dan *pressure drop* gas buang; / *Design pressure, design temperature, and flue gas pressure drop*;
- *Bill of Quantity (BoQ)* dan *Bill of Material (BoM)* *economizer*; / *Bill of Quantity (BoQ) and Bill of Material (BoM) for the economizer*;
- Proyeksi penghematan yang mencakup peningkatan efisiensi *boiler* (%), penghematan bahan bakar (GJ/tahun), reduksi emisi CO₂ (ton/tahun), dan penghematan biaya (Rp/tahun). / *Projected savings, including improvement in boiler efficiency (%), fuel savings (GJ/year), CO₂ emission reductions (tons/year), and cost savings (IDR/year)*.

Atau / Or

iii. **Analisis Rekomendasi – Optimasi Air–Fuel Ratio / Recommendation Analysis – Air–Fuel Ratio Optimization**

- P&ID sistem kontrol *burner* (*O₂ trim control loop*); / *P&ID of the burner control system (O₂ trim control loop)*;
- Spesifikasi *O₂ analyzer*; / *O₂ analyzer specifications*;
- Spesifikasi *flow transmitter* udara pembakaran (*FD fan duct*) dan *fuel flow meter* atau sistem lainnya yang relevan; / *Specifications of the combustion air flow transmitter (FD fan duct) and fuel flow meter or other relevant systems*;
- *I/O List* dan *control philosophy* (*PID loop O₂ trim*); / *I/O List and control philosophy (PID loop O₂ trim)*;

- *Single Line Diagram panel kontrol burner; / Single Line Diagram of the burner control panel;*
- *Bill of Quantity (BoQ) dan Bill of Material (BoM) sistem Optimasi Air–Fuel Ratio; / Bill of Quantity (BoQ) and Bill of Material (BoM) for the Air–Fuel Ratio Optimization system;*
- *Proyeksi penghematan bahan bakar dari penurunan excess air dan peningkatan efisiensi pembakaran. / Projected fuel savings resulting from reduced excess air and improved combustion efficiency.*

Atau / Or

iv. Analisis Rekomendasi – Blowdown Heat Recovery / Recommendation Analysis – Blowdown Heat Recovery

- *P&ID sistem blowdown lengkap; / Complete P&ID of the blowdown system;*
- *Spesifikasi plate heat exchanger; / Plate heat exchanger specifications;*
- *Layout dan routing pipa blowdown, flash steam, dan kondensat; / Layout and piping routing for blowdown, flash steam, and condensate;*
- *Bill of Quantity (BoQ) dan Bill of Material (BoM) sistem Blowdown Heat Recovery; / Bill of Quantity (BoQ) and Bill of Material (BoM) for the Blowdown Heat Recovery system;*
- *Proyeksi heat recovery (GJ/tahun), penghematan bahan bakar ekuivalen, dan pengurangan konsumsi make-up water. / Projected heat recovery (GJ/year), equivalent fuel savings, and reduction in make-up water consumption.*

v. Manfaat Pengurangan Emisi Gas Rumah Kaca / Greenhouse Gas Emission Reduction Benefits
 Menghitung manfaat pengurangan emisi gas rumah kaca (GRK) dari EE Measures yang direkomendasikan. / *Quantify the greenhouse gas (GHG) emission reduction benefits associated with the recommended EE Measures.*

c. Evaluasi Finansial / Financial Evaluation

Melakukan evaluasi finansial untuk setiap rekomendasi, yang mencakup: / *Conduct a financial evaluation for each recommendation, covering:*

- Biaya CAPEX berdasarkan estimasi biaya yang realistis dan spesifik terhadap implementasi yang direkomendasikan, bukan hanya menggunakan biaya referensi atau best practice; / CAPEX based on realistic and implementation-specific cost estimates, rather than solely using reference costs or best practices;*
- Biaya OPEX untuk setiap rekomendasi berdasarkan estimasi biaya yang realistis dan spesifik terhadap implementasi, bukan hanya menggunakan biaya referensi atau best practice; / OPEX for each recommendation based on realistic and implementation-specific cost estimates, rather than solely using reference costs or best practices;*
- Manfaat penghematan biaya berdasarkan potensi penghematan dan spesifikasi teknis yang realistis, bukan hanya menggunakan nilai referensi atau best practice; / Cost-saving benefits based on realistic saving potential and technical specifications, rather than solely using reference values or best practices;*
- Simple Payback Period (SPP), Internal Rate of Return (IRR), dan Net Present Value (NPV) dari EE Measures yang direkomendasikan. / Simple Payback Period (SPP), Internal Rate of Return (IRR), and Net Present Value (NPV) of the recommended EE Measures.*

d. Proyeksi Dampak dan Analisis Sensitivitas / *Impact Projection and Sensitivity Analysis*

Melakukan proyeksi dampak dan analisis sensitivitas terhadap manfaat teknis (penghematan energi dan pengurangan emisi GRK) serta manfaat finansial (penghematan biaya, *payback period*, *IRR*, dan *NPV*) berdasarkan berbagai variabel, termasuk namun tidak terbatas pada: / *Conduct impact projections and sensitivity analyses of technical benefits (energy savings and GHG emission reductions) and financial benefits (cost savings, payback period, IRR, and NPV) based on various variables, including but not limited to:*

- i. Variabel proyeksi produksi berdasarkan hasil wawancara dengan perusahaan; / *Production projection variables based on interviews with the company;*
- ii. Variabel biaya energi; / *Energy cost variables;*
- iii. Variabel biaya CAPEX dan OPEX; / *CAPEX and OPEX cost variables;*
- iv. Variabel operasi teknis lainnya. / *Other relevant technical operating variables.*

e. Penilaian Risiko, Mitigasi, dan Rencana Implementasi / *Risk Assessment, Mitigation, and Implementation Plan*

Penilaian risiko, langkah mitigasi, dan rencana implementasi mencakup: / *The risk assessment, mitigation measures, and implementation plan shall cover:*

- i. Risiko teknis dari implementasi proyek dan rencana mitigasinya; / *Technical risks associated with project implementation and the corresponding mitigation measures;*
- ii. Risiko operasional dari implementasi proyek dan rencana mitigasinya; / *Operational risks associated with project implementation and the corresponding mitigation measures;*
- iii. Risiko finansial dari implementasi proyek dan rencana mitigasinya. / *Financial risks associated with project implementation and the corresponding mitigation measures.*

VI. Konsultasi dan Diseminasi Hasil / *Consultation and Dissemination of Results*

Diseminasi hasil audit dilakukan untuk menyampaikan hasil akhir dan memastikan dukungan (*buy-in*) dari Pemilik Fasilitas, yang mencakup: / *The audit results shall be disseminated to communicate the final findings and facilitate buy-in from the Facility Owner, covering:*

- a. Menyusun presentasi hasil audit dengan berfokus pada temuan utama dan rekomendasi; / *Prepare an audit results presentation focusing on the key findings and recommendations;*
- b. Mendiseminasikan hasil audit kepada Pemilik Fasilitas dan pemangku kepentingan lainnya; / *Disseminate the audit results to the Facility Owner and other relevant stakeholders;*
- c. Memfasilitasi diskusi dengan Pemilik Fasilitas mengenai keputusan akhir terkait rencana implementasi, termasuk identifikasi dan pengembangan *design philosophy* untuk rekomendasi yang akan diimplementasikan; / *Facilitate discussions with the Facility Owner regarding final decisions on the implementation plan, including the identification and development of the design philosophy for the recommendations selected for implementation;*
- d. Menyediakan konsultasi pasca-diseminasi hasil apabila diperlukan, hingga 1 (satu) bulan setelah proses diseminasi selesai. / *Provide post-dissemination consultation, if required, for up to 1 (one) month following completion of the dissemination process.*

JADWAL PELAKSANAAN PEKERJAAN/ *WORK IMPLEMENTATION SCHEDULE*

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ANGGARAN/ BUDGET

Mohon menyiapkan pengajuan anggaran dalam mata uang rupiah untuk jasa yang dijelaskan pada “Lingkup Pekerjaan”. Anggaran harus mencakup kewajiban pajak yang berlaku dari masing-masing pihak sesuai peraturan pajak Negara Republik Indonesia. / *Please prepare a budget submission in rupiah for the services described in "Scope of Work". The budget must include the applicable tax obligations of each party in accordance with the tax regulations of the Republic of Indonesia.*

Anggaran maksimum untuk 2 (dua) IGA adalah IDR 615.000.000, termasuk pajak. / *The maximum budget for 2 (two) energy audits is IDR 615,000,000, tax inclusive.*

Anggaran tersebut termasuk kewajiban pajak masing-masing pihak sesuai dengan peraturan perpajakan Republik Indonesia yang berlaku. / *The budget includes the applicable tax obligations of each party in accordance with the prevailing tax regulations of the Republic of Indonesia.*

Untuk pengadaan ini, aspek non-harga/teknis lebih penting dibandingkan aspek harga mengingat sifat pekerjaan yang sangat teknis dan kebutuhan hasil audit yang dapat menjadi dasar keputusan investasi. Namun demikian, kewajaran biaya, efisiensi, dan value for money tetap menjadi bagian penting dalam evaluasi. / *For this procurement, non-price/technical aspects are more important than price due to the highly technical nature of the assignment and the requirement for investment-grade outputs. Nevertheless, cost reasonableness, efficiency, and value for money remain important evaluation considerations.*

PERSYARATAN PENYEDIA/VENDOR REQUIREMENTS

A. Syarat Wajib/ General Requirements

Persyaratan dasar yang **harus dipenuhi** oleh Penyedia untuk dapat mengikuti proses pengadaan / *The basic requirements that **must be met** by the Vendor to participate in the procurement process.*

1. Legalitas / Legality

Berdomisili dan memiliki legalitas dan perijinan berusaha yang berlaku sesuai dengan peraturan di Indonesia / *Domiciled and have valid legality and business licenses in accordance with regulations in Indonesia.*

2. Pengalaman Usaha / Business Experience

Penyedia/Personel yang terlibat memiliki keahlian dan pengalaman melakukan pekerjaan audit energi dengan catatan kinerja dan integritas yang baik dalam kurun waktu 5 (lima) tahun terakhir. / *The Vendor/personnel involved must have expertise and experience in energy auditing, with a good performance and integrity track record over the past 5 (five) years.*

3. Portfolio proyek serupa / Portfolio of Similar Projects

Menyertakan portofolio proyek serupa, terutama audit energi sektor industri. Pengalaman audit energi pada industri Automotive dan Petrochemical lebih diutamakan. / *Include a portfolio of similar projects, particularly industrial energy audits. Experience in energy audits for Automotive and Petrochemical industries is preferred.*

4. Kapasitas dan Kompetensi Teknis / Capacity and Technical Competence

- ✓ Memiliki kemahiran berbahasa Inggris yang sangat baik. / *Demonstrate excellent proficiency in English.*
- ✓ Personel yang terlibat dalam pelaksanaan audit harus memiliki sertifikasi seperti Certified Energy Auditor (CEA) atau sertifikasi setara. Sertifikat auditor energi atau sertifikasi setara wajib dilampirkan pada saat proses pendaftaran. Kepemilikan sertifikasi Certified Measurement & Verification Professional (CMVP) akan menjadi nilai tambah. / *Personnel involved in conducting the audit shall hold a certification such as Certified Energy Auditor (CEA) or an equivalent certification. The energy auditor certificate or equivalent certification shall be submitted during the application process. A Certified Measurement & Verification Professional (CMVP) certification will be considered an advantage.*
- ✓ Memiliki kemampuan untuk menggunakan alat pengukuran dan perangkat lunak yang relevan untuk analisis data. / *Demonstrate the ability to use relevant measurement instruments and software for data analysis.*
- ✓ Memiliki kemampuan untuk menyusun laporan terperinci dan representasi visual (misalnya Sankey Diagram dan grafik) guna menyampaikan temuan dan rekomendasi secara jelas. / *Demonstrate the ability to prepare detailed reports and visual representations (e.g., Sankey Diagrams and graphs) to clearly communicate findings and recommendations.*
- ✓ Mampu memastikan bahwa seluruh pengukuran dan evaluasi dilakukan sesuai dengan standar industri dan praktik yang relevan. / *Ensure that all measurements and evaluations are conducted in accordance with relevant industry standards and practices.*
- ✓ Wajib menggunakan alat ukur yang telah dikalibrasi dalam 1 (satu) tahun terakhir. Sertifikat kalibrasi untuk alat ukur yang akan digunakan wajib dilampirkan pada saat proses pendaftaran. / *Measurement instruments used for the audit shall have been calibrated within the last 1 (one) year. Calibration certificates for the measurement instruments to be used shall be submitted during the application process.*
- ✓ Mampu menyajikan rencana yang jelas untuk pengumpulan data, analisis, dan pelaporan, termasuk jadwal untuk setiap tahapan proses audit. / *Demonstrate the ability to provide a clear plan for data collection, analysis, and reporting, including a schedule for each stage of the audit process.*
- ✓ Mampu melakukan simulasi terhadap rekomendasi Waste Heat Recovery (WHR), Blowdown Heat Recovery, Air–Fuel Ratio Optimization, atau Economizer dari aspek sistem mekanikal, elektrikal, dan kontrol. / *Demonstrate the capability to simulate the recommended Waste Heat Recovery (WHR), Blowdown Heat Recovery, Air–Fuel Ratio Optimization, or Economizer from mechanical, electrical, and control system perspectives.*

B. Syarat Tambahan / *Additional Requirements*

Persyaratan berikut tidak bersifat wajib, namun akan menjadi nilai tambah bagi penyedia dalam proses pengadaan / *The following requirements are not mandatory but will be considered as added value for the provider during the procurement process.*

1. Lebih diutamakan memiliki pengetahuan tentang isu transisi energi dan keberlanjutan. / *Preferably possesses knowledge of energy transition and sustainability issues.*
2. Memiliki kemampuan memberikan konsultasi penuh selama proyek dan hingga maksimal 1 (satu) bulan setelah diseminasi hasil. / *Able to provide full consultation during the project and for up to 1 (one) month after results dissemination.*
3. Memiliki kemampuan bekerja dengan klien untuk memahami persyaratan rinci yang memenuhi kebutuhan dan visi Pemilik Fasilitas. / *Able to work with clients to understand detailed requirements aligned with the Facility Owner's needs and vision.*

4. Lebih diutamakan memiliki pengetahuan atau pengalaman dalam perencanaan atau implementasi teknologi inovatif untuk dekarbonisasi industri, seperti optimasi boiler, Waste Heat Recovery, Economizer, Blowdown Heat Recovery, dan optimasi Air-Fuel Ratio. / *Preferably has knowledge or experience in planning or implementing innovative industrial decarbonization technologies, such as boiler optimization, Waste Heat Recovery, Economizer, Blowdown Heat Recovery, and Air-Fuel Ratio optimization.*
5. Memiliki upaya yang telah dilakukan dan komitmen terhadap isu konservasi lingkungan dan keberlanjutan / *Has demonstrated efforts and a strong commitment to environmental conservation and sustainability issues is highly desirable.*
6. Memiliki upaya yang telah dilakukan dan komitmen terhadap prinsip Gender Equality, Disability, and Social Inclusion (GEDSI) dalam pelaksanaan proyek. / *Has demonstrated efforts and a strong commitment to the principles of Gender Equality, Disability, and Social Inclusion (GEDSI) in project implementation.*

DOKUMEN YANG DIPERLUKAN / REQUIRED DOCUMENT

Calon Vendor harus menyerahkan dokumen berikut untuk memenuhi persyaratan RFP ini: / Prospective vendors must submit the following documents to meet the requirements of this RFP:

A. Dokumen Administrasi / Administrative Documents

- ✓ **Pernyataan Minat**, berikut penjelasan tim yang diusulkan dan bagaimana tim tersebut dapat memenuhi persyaratan yang telah ditentukan / **A statement of interest** describing the proposed team and how it meets the above requirements
- ✓ **Profil Organisasi/Perusahaan / Organization/Company Profile**
- ✓ **Keberlanjutan**, Informasi mengenai upaya yang telah dilakukan serta komitmen ke depan dalam mendukung konservasi lingkungan dan praktik keberlanjutan./ *Information on efforts undertaken and commitments to support environmental conservation and sustainability practices.*
- ✓ **Prinsip GEDSI**, Informasi tentang upaya yang telah dilakukan serta komitmen ke depan dalam mendukung prinsip Kesenjangan Gender, Disabilitas, dan Inklusi Sosial (GEDSI)./ *Information on efforts undertaken and commitments to support Gender Equality, Disability, and Social Inclusion (GEDSI) principles.*
- ✓ **Pernyataan kepatuhan hukum perusahaan**, silakan unduh pernyataan [disini](#) /**Statement of corporate legal compliance**, please download the statement [here](#).
- ✓ **Pakta integritas Perusahaan**, silakan unduh [disini](#)/ **Statement of Corporate Integrity**, please download [here](#).

B. Dokumen Teknis / Technical Documents

- ✓ Metodologi dan Rencana Kerja yang diusulkan, termasuk pendekatan IGA, rencana pengukuran, pembagian tim untuk 2 fasilitas secara paralel, jadwal rinci, daftar alat ukur, dan pendekatan analisis tekno-ekonomi. / *Proposed Methodology and Work Plan, including IGA approach, measurement plan, team deployment for 2 facilities in parallel, detailed schedule, measurement-equipment list, and techno-economic analysis approach.*
- ✓ Curriculum Vitae (CV) setiap anggota tim yang diusulkan, beserta sertifikasi CEA atau setara dan CMVP (jika ada). / *Curriculum Vitae (CV) of each proposed team member, together with CEA or equivalent certification and CMVP certification (if available).*
- ✓ Contoh dan referensi pekerjaan sebelumnya untuk audit energi industri dan/atau sistem boiler/heating, termasuk pengalaman pada sektor Automotive dan Petrochemical jika tersedia.

/ Examples and references of previous industrial energy-audit and/or boiler/heating-system work, including Automotive and Petrochemical experience where available.

- ✓ *Sertifikat kalibrasi alat ukur yang akan digunakan, dengan masa kalibrasi tidak lebih dari 1 (satu) tahun terakhir. / Calibration certificates for the measurement instruments to be used, calibrated within the last 1 (one) year.*

C. Dokumen Keuangan / *Financial Documents*

- ✓ **Anggaran yang Diusulkan**, anggaran dalam format Excel (.xls atau .xlsx) dengan rincian biaya yang cukup untuk menilai kewajaran dan kepatuhan terhadap persyaratan pemberi dana kami. / **A proposed budget in Excel (.xls, .xlsx) format with a breakdown of costs sufficient to assess reasonableness and compliance with our funder requirements**
- ✓ **Jadwal Pembayaran Kompetitif**, jadwal pembayaran yang mengaitkan jumlah pembayaran dengan pencapaian pekerjaan atau milestone. / **A competitive payment schedule associating invoice amounts with work milestones**

PENYAMPAIAN DOKUMEN / DOCUMENT SUBMISSION

- Pernyataan minat dan pertanyaan tentang RFP ini harus dikirim melalui email ke kontak di bawah ini paling lambat pada tanggal **19 Oktober 2026**. / All expressions of interest and questions about this RFP must be received via email by **October 19th, 2026**.
- Proposal harus dikirim melalui email ke kontak di bawah ini paling lambat pada **27 Oktober 2026**. / All proposals must be sent via email to the contact below by **October 27th 2026**.

Nama Kontak/ Contact Name: Procurement WRI Indonesia; Caesar Bayu Kusuma, Atanasius Brantyopati Wibisono, Hitomi Hadinuryana

Alamat email/ Email address: Procurement-Indonesia@wri.org; Caesar.Kusuma@wri.org, Brantyopati.Bregas@wri.org, Hitomi.Hadinuryana@wri.org

EVALUASI DAN SELEKSI/ EVALUATION AND SELECTION

Kriteria Evaluasi/ Evaluation Criteria

Elemen-elemen berikut akan menjadi pertimbangan utama dalam penilaian proposal yang diserahkan untuk RFP ini. / The following elements will be the primary considerations in evaluating proposals submitted in response to this RFP:

- 1. Kelengkapan, Kualitas dan Pemenuhan Persyaratan Keseluruhan Proposal / Completeness, Quality, and Compliance with Overall Proposal Requirements**
 - Kelengkapan proposal sesuai yang dicantumkan di dalam RfP & kualitas keseluruhan proposal. / *Completeness of proposal as stated in RfP & overall quality of proposal.*
 - Kerapian, kejelasan, dan kualitas penyajian proposal secara keseluruhan. / *Completeness of proposal as stated in the RfP, and overall clarity, coherence, and quality of the submission.*
- 2. Pengalaman Perusahaan / Company Experience**
 - Pengalaman melaksanakan pekerjaan sejenis / *Experience carrying out similar work.*
 - Rekam jejak, pengalaman pada proyek serupa, pengalaman bekerja di lokasi pekerjaan yang sama, / *Track record, experience on similar projects, experience working at the same job site.*

3. Kualitas Unsur Teknis / *Quality of Technical Elements*

- Pemahaman yang komprehensif tentang isu dan ruang lingkup pekerjaan/ *Demonstrates an understanding of the issues at hand and the scope of work.*
- Kualitas metodologi yang diusulkan untuk mencapai hasil yang diinginkan. / *The quality of the proposed methodology to achieve the desired outcomes.*
- Kualitas metodologi pengukuran diagnostik, rencana penggunaan alat terkalibrasi, metode baseline/EnPI, serta pendekatan analisis teknis dan tekno-ekonomi. / *Quality of diagnostic measurement methodology, plan for calibrated instruments, baseline/EnPI method, and technical and techno-economic analysis approach.*
- Kejelasan program kerja, jadwal kerja, dan realisasi jangka waktu pelaksanaan / *Clarity of proposed methodology, work plan, schedule, and implementation timeline.*
- Kualitas rencana pelaporan IGA, Design Development, P&ID/drawing, BoQ/BoM, analisis sensitivitas, penilaian risiko, dan diseminasi hasil. / *Quality of the IGA reporting plan, Design Development, P&IDs/drawings, BoQ/BoM, sensitivity analysis, risk assessment, and results dissemination.*

4. Kualifikasi Tenaga Ahli / *Expert Qualification Elements*

- Sertifikasi CEA atau setara dari personel kunci (wajib), CMVP (nilai tambah), serta kualifikasi profesional yang relevan dengan sistem boiler/heating, mekanikal, elektrikal, kontrol, dan analisis energi. / *CEA or equivalent certification of key personnel (mandatory), CMVP (an advantage), and professional qualifications relevant to boiler/heating systems, mechanical, electrical, controls, and energy analysis.*
- Pengalaman profesional anggota tim dalam proyek serupa / *Professional Experience of team members on similar project*
- Komposisi dan konsistensi penugasan / *Composition and consistency of assignment*

5. Keberlanjutan / *Sustainability*

- Penerapan praktik keberlanjutan dalam pelaksanaan project, seperti penggunaan teknologi ramah lingkungan atau metode yang mendukung konservasi sumber daya / *Sustainability practices proposed for project implementation, including environmentally friendly technologies or resource-efficient methods.*
- Penerapan praktik keberlanjutan dalam operasional Perusahaan / *Implementation of sustainable practices in the company's operations.*

6. Prinsip GEDSI (Gender Equality, Disability, and Social Inclusion) / *GESI Principal*

- Penerapan unsur GEDSI dalam pelaksanaan project / *Incorporation of GEDSI elements in project implementation.*
- Penerapan unsur GEDSI dalam operasional Perusahaan / *Incorporation of GEDSI elements in the company's operations.*

7. Unsur Biaya dan Nilai Tambah/ *Cost Elements and Value for Money*

- Keseluruhan biaya yang diajukan dalam proposal, dengan penekanan pada: kewajaran biaya, kejelasan struktur biaya, kesesuaian jadwal pembayaran dengan capaian, efisiensi biaya dan nilai tambah / *The overall costs proposed in the proposal, with an emphasis on the reasonableness of*

the cost, the clarity of the cost structure, the suitability of the payment schedule with the achievements, cost efficiency and value for money.

PROSES SELEKSI / SELECTION PROCESS

WRI Indonesia menerapkan proses seleksi sebagai berikut:

1. Penyaringan awal / *Shortlisting*
2. Wawancara bagi Penyedia yang masuk ke penyaringan awal / *Interview for shortlisted vendor*
3. Persetujuan final dari pejabat berwenang internal WRI Indonesia / *Final approval from the authorized internal officials of WRI Indonesia*
4. Pengumuman penyedia terpilih/tidak terpilih. / *Announcement of selected/non-selected provider.*

DISCLAIMER

- Biaya-biaya yang timbul dalam pengembangan proposal tidak dapat ditagihkan ke WRI Indonesia dan seluruh biaya ditanggung oleh calon Vendor. / *No proposal development costs shall be charged to WRI Indonesia, and all expenses are to be borne by the bidders.*
- WRI Indonesia dapat memilih calon vendor dengan nilai terbaik tanpa diskusi. Namun demikian, WRI Indonesia memiliki hak untuk mendapatkan klarifikasi dan bernegosiasi dengan para calon vendor yang menawarkan harga yang kompetitif. / *WRI Indonesia may award to the bidder offering best value without discussions. However, WRI Indonesia reserves the right to seek bidder clarifications and to negotiate with those bidders deemed to be within a competitive range.*
- WRI Indonesia dapat, atas keinginannya sendiri dan tanpa penjelasan kepada calon vendor, untuk menghentikan kegiatan pengadaan ini tanpa kewajiban apapun terhadap para calon vendor. / *WRI Indonesia may, at its discretion and without explanation to the prospective vendors etc., choose to discontinue this RfP without obligation to such prospective vendors.*