



30^{lat}
years

**Outsourcing of Lubrication Maintenance in Energy Industry. Practical use of
ICML 55.1 Standards Based on Experience in 25 Large-Scale Projects in Power
Plants and Refineries**

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Presentation agenda



1. Brief introduction to Ecol
2. Lubrication as a maintenance process
3. ICML 55 Lubricated Assets Management Standard /55.1, 55.2, 55.3/
4. Practical findings
5. Summary

Ecol - the industrial lubrication and maintenance outsourcing company



For over 30 years Ecol has been delivering most modern and unique **customized lubrication outsourcing, hydrodynamic and chemical cleaning services**, improving performance and equipment reliability in industrial plants, especially in power generation and oil&gas industries



(photos - Ecol)

Range of activity



Specialized reliability services for conventional and nuclear power generation and oil&gas industry

- Outsourcing of Lubrication Management
- World-wide specialized oil systems cleaning and flushing company for turbines and large equipment (e.g. feed pumps, aux. diesel engines), compressors, wind turbines
- Largest East Europe oil analysis laboratory
- Turbine oil and other lubricants supplies
- Lubricants care and handling (varnish mitigation, filtration, dehydration, handling)
- Chemical services (laboratory, chemical cleaning, turbine and equipment foam cleaning, corrosion prevention, steam blowing, commissioning)
- Specialized industrial cleaning for industry – ultra high pressure water cleaning



Ecol Group



Ecol North America

Ecol North America LLC,
Sarasota/Orlando, FL, USA



Ecol Industrial s.r.o. Vlasim,
Czech Republic



Ecol Sp. z o.o. , Rybnik,
Poland



Projects executed in 29 countries



- **ISO 9001** (*quality*)
- **ISO 14001** (*environment*)
- **OHSAS 18001** (*health and safety*)
- **ISO 17025** (*oil and grease diagnostics laboratory accreditation*)
- **SCC Petrochemical** (*health and safety*)
- **WHG Industrie Service** (*water consumption and waste management*)
- **UDT** (*Polish Technical Approval Authority*)
- **Member of VGBE**
- **Member of ICML – International Council for Machinery Lubrication**
- **Complyworks, ISNetworld approved**



Field of experience in Lubrication Service in outsourcing

Ongoing Lubrication Maintenance Long Term Service Agreements (LS/outsourcing/TFM)



- LS for Power Plant, supercritical thermal coal PP 2x900MWe
- LS for Power Plant, supercritical thermal coal PP 1x900MWe
- LS for Power Plant, supercritical thermal coal PP 480MWe
- LS for Power Plant, thermal coal PP 8x225MWe
- LS for Power Plant, thermal coal PP 6x225MWe
- LS for CHP Power Plant 3x100MWe
- LS for CHP Power Plant 2x70MWe
- LS for CHP Power Plant 7x50/70MW
- LS for Power Plant, gas fired CCGT 600MWe
- LS for Power Plant, gas fired CCGT 480MWe
- LS for Power Plant, gas fired CCGT 230MWe
- LS for CHP Power Plant, gas fired CCGT, 106 Mwe
- LS for Oil Refinery /15mln tons/a/
- LS for Olefins Plant
- LS for Polyethylene & Polypropylene Plant
- LS for Terephtalic Acid Plant (PTA)
- LS for Olefin Metathesis Plant
- LS for fertiliser /Nitrogen&Syngas/ plant
- LS for silica production plant
- LS/TFM for automotive factory
- LS/TFM for automotive factory
- LS for waste-to-energy plant; 20MWe
- Many other LTSA projects

General statistics by equipment type



Object type	
Object	quantity
Steam boiler	40
LUVO preheater	69
Turbines steam+combustion turbines	32 steam, 5CT
Boiler feed pumps	91
Flue gas treatment plants	16
Circulation pumps	63
Air compressors	139
Other eg. Electrostatic precipit.,	156
Fans	1293

>28 000 pcs. of equipment

Service points	
Overall numer of lubrication service points	>100.000
Number of lubrication staff	205
Main types of equipment	
Device	quantity
Pumps	4 042
Roller bearings	32 866
Electric motors	2 722
Turbines	37
Gearboxes	3 300
Valve drives and actuators	8 264
Belt conveyors	186



General statistics by tasks type and lubricants consumption



Lubricants in use /oil+greases/		
	Monthly consumption, kg	Annual cons., kg
Oils+greases	42 979	466 318

>5000 tons of lubricants in service

Typical service tasks		
task		Quantity/year
Inspections and controls		175 972
Greasing+tap ups		97 372
Oil changes		7000
Oil samplings and following oil analysis		5000
Other tasks		76 685

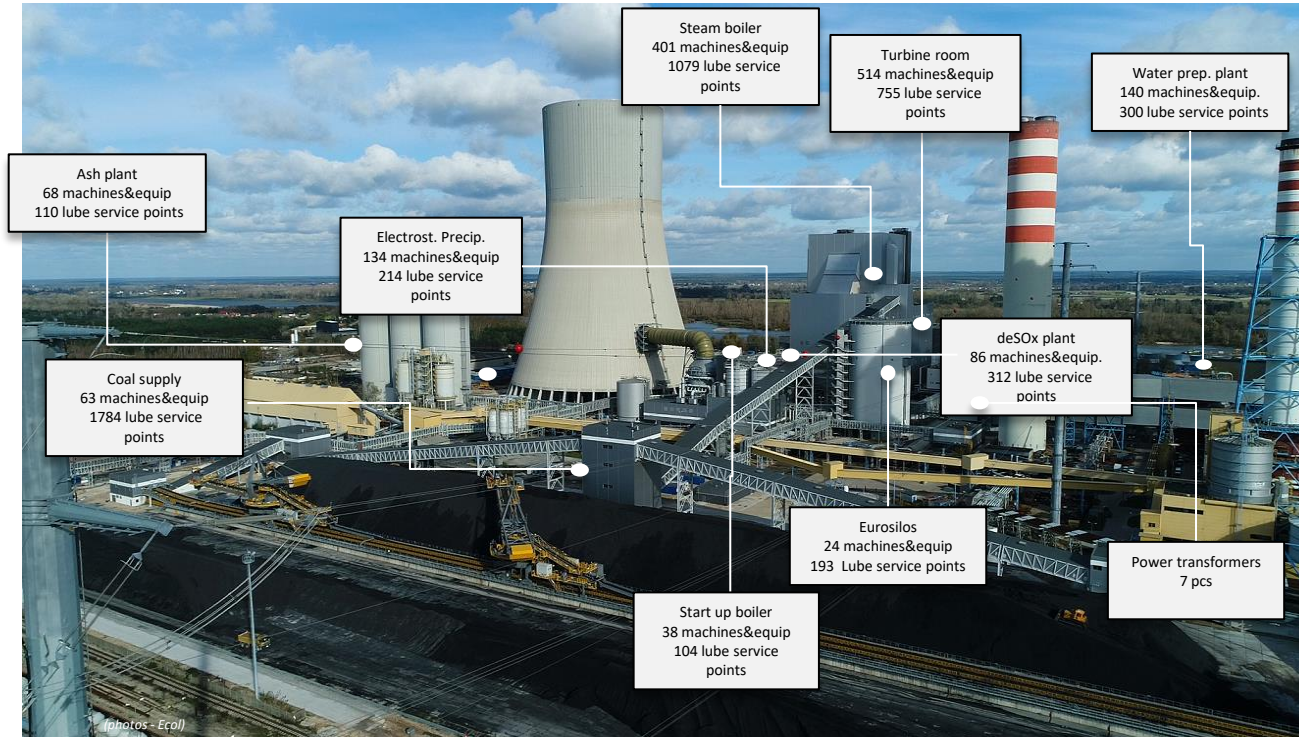
>500 000 lubrication - related tasks/year



How to approach such a complex process in a big plant?



Large industrial plants have thousands of machines and other lubricated equipment



Example coal-fired plant Power Plant block 1075MWe/

Many of machines and equipments are critical to plant operations and performance.



Lubrication related problems are common independently on the scale of the plant and equipment type.

One of the most underestimated processes in maintenance is lubrication.

Is really plant lubrication as easy as they say?



- Proper lubrication management is getting more and more important in industry and has become the reason of business advantages
- Strong economy and environmental impact
- Lubrication is one of key elements in chain of maintenance and impacts the reliability
- There is still underestimation of role of lubricants selection and their application and care in equipment
- Lubrication and tribodiagnostics are one of mainstream issues in 4.0 conceptions
- Lubrication perception has changed from simple-dirty jobs to sophisticated engineered tasks

Proper planning and execution of lubrication process of equipment in a plant at stage of erection, start-up and normal operation has the **strategic importance.**



Common reasons for bad lubrication



- Lack of strategy, planning and goals for lubrication
- Identifying a lubrication as overhaul process
- No data and analysis cost of lubrication vs. other production costs and gains
- No records from executed tasks and history of maintenance
- No dedicated IT tools in use
- No direct responsible entity for lubrication
- Lack or not enough cleanliness culture
- Lack or bad supervision over oil systems and oils in service
- Too many different lubricants in one plant
- Wrong planning (or lack of planning) of lubrication tasks
- No oil analysis program and other proactive maintenance diagnostic tools
- Wrong selected lubricants and poor quality of lubricants
- Unidentified technical issues in machinery impacting lubrication
- Execution of tasks by accidental and not trained employees
- No reaction after findings and information from lubrication technicians
- Low recognition of lubrication technicians position
- New machinery – obsolete standards
- No improvement of lubrication program and procedures

12 INTERRELATED AREAS of a LUBRICATION PROGRAM PLAN

01		SKILLS JOB TASK, TRAINING, AND COMPETENCY
02		MACHINE MACHINE LUBRICATION AND CONDITION MONITORING READINESS
03		LUBRICANT LUBRICANT SYSTEM DESIGN AND SELECTION
04		LUBRICATION PLANNED AND CORRECTIVE MAINTENANCE TASKS
05		TOOLS LUBRICATION SUPPORT FACILITIES AND TOOLS
06		INSPECTION MACHINE AND LUBRICANT INSPECTION
07		LUBRICANT ANALYSIS CONDITION MONITORING AND LUBRICATION ANALYSIS
08		TROUBLESHOOTING FAULT/FAILURE TROUBLESHOOTING AND RCA
09		WASTE LUBRICANT WASTE HANDLING AND MANAGEMENT
10		ENERGY ENERGY CONSERVATION AND ENVIRONMENTAL IMPACT
11		RECLAIM OIL RECLAMATION AND SYSTEM DECONTAMINATION
12		MANAGEMENT PROGRAM MANAGEMENT AND METRICS

Lubricated Assets Management - ICML 55.1, “Requirements for the Optimized Lubrication of Mechanical Physical Assets”



It is a tactical, lubrication-specific standard in alignment with the more general ISO 55000 /Assets management/

This standard provides a how-to guide for lubrication excellence and represents best practices by subject-matter experts (SMEs) from all over the world.

ICML has also intentionally aligned new MLE® (Machinery Lubrication Engineer) certification very closely with the structure of the ICML 55 standard. MLE exams started up in mid-April 2019, and certificants will be uniquely equipped to guide organizations toward ICML 55 certification as a tactical step toward ISO 55001 certification.



Ref. Courtesy of ICML

Logos Ref. Courtesy of ICML

Plant lubrication in practice - what is it?



Lubrication management should be a set of technical and organizational measures to ensure optimal conditions for lubricating of equipment.

Effective, modern lubrication managements include, among others, :

- development of maintenance strategy in the field of lubrication,
- lubrication management of the entire machine park of the enterprise,
- drawing up and updating operating instructions in the field of lubrication,
- training of employees involved in operation and repairs,
- selection of lubricants,

- supply and storage of lubricants and auxiliary materials,
- oil and grease replacement and replenishment,
- cleaning and flushing of oil systems and lubrication systems of machines and devices,
- oil care in operation,
- lubricants monitoring in operation and diagnosis of the technical condition of machines and equipment based on the results of oil tests and other measurements as well as diagnostics and management of test results,
- conducting other measurements and diagnostics supporting maintenance (thermovision, noise detection from wear processes),
- defining and planning remedial and corrective actions,
- management of used oils and other waste related to lubrication.

Lubrication service organisation /internal or external/ is directly incorporated in plant maintenance



Subject of:

- Daily maintenance and care process
- Overhauls preparation support
- In overhauls as execution, but also as quality control over third parties
- In new investments (pre-/commissioning)



(photos - Ecol)

General steps on the way to lubrication management by outsourcing



Key steps. Plant asstes review and listing

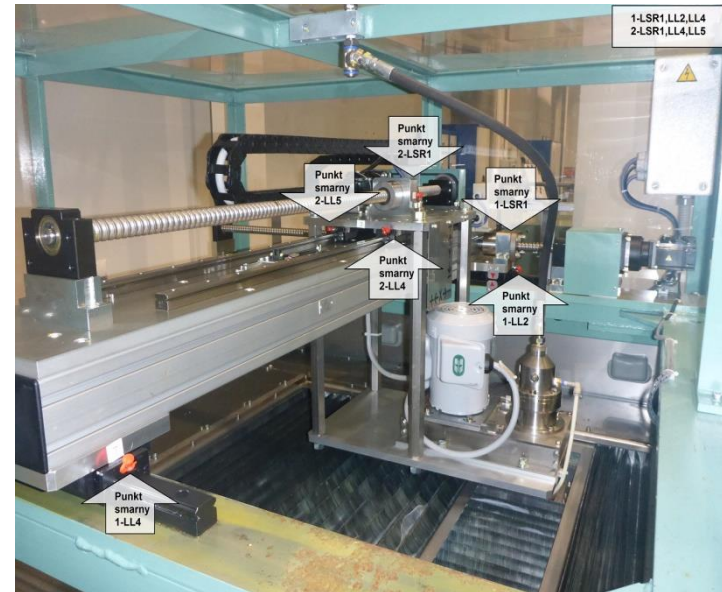


Inventory and it's listing on site is key part of whole proces design. It is the base for preparation of lubrication plan and mainenance strategy.

All data becomes input in EcolSystem CMMS software for lubrication management.

Complete base consists of:

- All objects, equipments and devices
- Names and plant coding
- Lubrication/Maintenance service points
- Design, capacity, volumes etc. of lubrication systems
- Lubricants in use
- Change and tap-ups frequency
- Oil care systems and consumables list
- Oil analysis plan and its components /where, what, limits etc./
- Other diagnostic plans and components
- Storeage and handling of lubricants
- Waste management plans



Crucial and demanding phase is application of lubrication management software that consists of dedicated database of equipment structure, documentation database, lubricating/service points with consumables and all types of tasks to be done as scheduled or/and random/on demand mode.

At Ecol we use own developed software SMART ECOL .

6 of IT professionals is continuously working on lubrication software development and maintenance (including hardware layer too)





Karta smarowania

HERRERO (AGUIRRE) - AG-3213

Il robot assembla i componenti (batterie) in sequenza

Lubrication/service points are labeled and use RFID tags. Kaizen approach is in use.



- Makes better identification for maintenance works
- Allows easy access on-site for appropriate data (e.q. maintenance history lube in use; etc.)
- Jobs to be done on-site
- Allows immediate on-site collection of maintenance information and walkdown/ inspection history





On-site tasks digitalization

RFID tagging and use of industrial tablets or phones allows precise data collection and input to the system right on site.

In ongoing projects we use more than 15.000 tags attached to machinery,



Source: Ecol Sp. z o.o.

Service facilities and equipment



For the purposes of implementing the outsourcing contract, the Contractor may build its own service facilities in the area made available by the Customer based on a design approved by the Employer.

Means of transport, equipment and accessories intended for the provision of lubrication services:

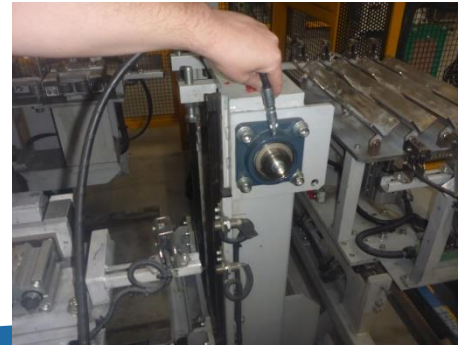
- Lube room
- means of road transport (trucks, vans, passenger cars);
- forklifts, platform trucks, melexes;
- vertical transport means (hoists, etc.);
- aggregates for filtration, drying and degassing oils.
- oil pumps, grease pumps with electric, pneumatic and manual drive;
- telephones and radiotelephones;
- diagnostic equipment (microscopes, water analyzers, videoendoscopes, stethoscopes, pyrometers, etc.);
- computer equipment (laptops, printers, photocopiers, faxes).



Scheduled lubrication works execution

Made by dedicated team of experienced and skilled lubrication technicians and professionals

- Scheduled controls of equipment (oil levels, filters, temperatures, noise, leaks etc.)
- Scheduled tap up and greasing in equipments
- Scheduled oils exchanges and greases not associated with system cleanings, flushings, other overhaul-like tasks
- Scheduled filter exchanges
- Scheduled sampling and other measurements
- Scheduled on-site testing
- Waste management
- Storage services
- 24/7 on-call duty



Unscheduled and random works execution



Made by dedicated team of lubrication technicians and professionals

- Emergency tap ups and greasing
- Unscheduled oil exchanges etc.
- Unscheduled oil care by external filtration/oil care systems
- Cleaning and flushing of oil systems
- Emergency oil analysis
- Repairs



Lubrication systems improvements is one of the common tasks



- Greasing automation
- Measurements automation (water sensors, particle counters etc., oil levels sensors)
- Greasing (and sampling) ports relocation (safety reasons; ergonomcy etc.)
- Filtration and oil care upgrades
- Filtration ports installation



Performing maintenance and lubrication diagnostic tasks



Oil/grease analysis from machinery is one of the key elements of lubrication plan.

Proper lubrication oil (and grease) analysis program for

- New lubricants in delivery and storage
- Condition monitoring of equipments
- Condition monitoring of lubricants.



Machinery diagnostics integrated techniques



We have a team of diagnostics and devices that perform measurements and assess the condition of machines, devices and installations in the scope of:

- temperature measurements (thermovision),
- ultrasound greasing support
- ultrasound leak detection and measurements, installation tightness, tanks, valves for various media etc.
- vibration measurement,
- liquid flows (ultrasound flow meters),
- video scan inspection of the installation,
- measurements of wall thickness of elements and thickness of protective coatings,
- measurements of purity of working liquids and oils,



Supply logistics and warehouse management in the field of lubricants, filtration and operating materials



Comprehensive logistics service in the purchase and supply of lubricants and consumables.

- Warehouse management in the field of the above-mentioned goods and materials:
- oils and greases,
- filter cartridges,
- other consumables and maintenance materials,
- spare parts for lubrication, filtration and care systems,
- waste from used oils and the above materials.



Lubrication waste management



Waste management related to lubrication proces (used oils, greases, filters, oily water and other wastes) is management by the service provides acc. to the law and safety standards. In a big plant nowadays waste management is very vital part of overall work plan.



SUMMARY



Advantages of comprehensive lubrication service:

- one process owner who is responsible for the lubrication management from A to Z,
- all lubrication points in the industrial plant, along the entire production line, are identified, allowing full supervision,
- thanks to the computer system, a complete service base is maintained in one place with access to the entire lubrication history (what?, where?, when ?, who? etc.),
- support of specialists in the selection of technical solutions for lubrication of devices,
- limiting the number of tender procedures (diagnostics, lubricants, workmanship, waste utilization, etc.),
- implementation of lubrication works based on high OHS and management standards (ISO 9001,14001,45001),

Expected effects from lubrication outsourcing /well implemented lubrication management program/



- Increased reliability of equipment and plant performance
- Equipment and lubricants life extension
- Most of works are subject of appropriate scheduling instead of emergency/random calls
- Improved costs of lubricants consumption
- Immediate action and support of professionals
- Lower overhauls costs
- Database of all lubrication history
- Enabling KPI's management
- Cost analysis and benchmarking
- Better profits



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