

ADNOC Logistics and Services

ADNOC Logistics and Services (ADNOC L&S) is the largest fully integrated shipping and maritime logistics company in the UAE and GCC region. Energy efficiency is a strategic priority for the company, and we focus on digital transformation and innovation to decarbonize our operations. Over the past three years and through a dedicated energy efficiency program, ADNOC L&S successfully achieved 39% reduction in energy consumption following the implementation of energy management strategies through ISO 50001.



ADNOC L&S' Very Large Gas Carrier, serving AW Shipping Joint Venture with Wanhua Chemical.

Organization Profile

ADNOC L&S plays a critical role in enabling the UAE's oil and gas sector towards ADNOC's goal to maximize value from every barrel of oil it produces, processes, ships and sells.

ADNOC L&S has three business segments: Shipping, Integrated Logistics and Marine Services. The company's shipping arm ensures the reliable supply of crude oil, products, and gas/industry feedstock to over 100 customers in more than 50 countries. The Integrated Logistics segment delivers fully integrated and seamless maritime logistics solutions that enable the entire UAE's oil and gas supply chain- both upstream to downstream. The Marine Services segment is an established partner at all Abu Dhabi Petroleum Ports, offering comprehensive and specialist port management services, including the Oil Spill and Hazardous and Noxious Substances response, utilizing the largest inventory of OSR surveillance and state-of-the-art assets in the region.

By implementing ISO 50001 across these three segments ADNOC L&S delivered safe and efficient operations locally and internationally, emerging as a leader in shipping and integrated logistics for the energy sector in the entire region.

Vision and Goals

ADNOC L&S is shaping its sustainability vision for the future by integrating sustainable practices through ISO 50001 continual improvement initiatives. Decarbonization strategies are crucial to the ADNOC L&S business plans (2022-2026). ADNOC L&S made several acquisitions of efficient vessels that are designed for more efficient energy consumption and lower GHG emissions, including dual-fuel VLCC and LNG vessels. Meanwhile, fuel consumption, monitoring, voyage management and vessel performance improvements all contribute of enhanced energy management. The EnMS team incorporated significant measurements and responsibilities in procurement processes & digital technologies, key components to reduce the company's environmental footprint. ADNOC L&S Top Management further developed strategic collaboration engagements with all shipowners, shipbuilders operators and

Case Study Snapshot	
Industry	Shipping and Maritime
Product/Service	Shipping and Integrated Maritime Logistics Services
Location	Abu Dhabi, United Arab Emirates
Energy performance improvement percentage (over improvement period)	39% over 3 years
Total energy cost savings (over the improvement period)	US\$ 33,500,000
Cost to implement Energy Management System (EnMS)	US\$ 55,000
Total energy savings (over the improvement period)	3,050,000 GJ
Total CO₂-e emission reduction (over the improvement period)	183,000 Metric Tons

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market stakeholders. ADNOC L&S plans to double its deep-sea fleet between 2022 and 2026 and expand its offshore activities to cater for growth in ADNOC exports.

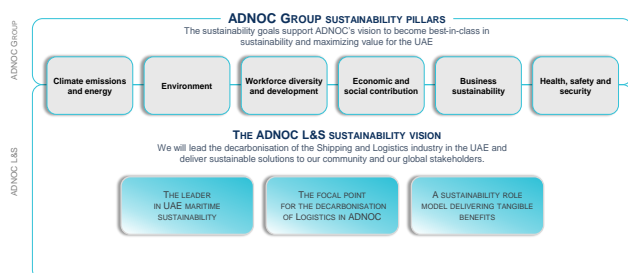


Figure 1. ADNOC L&S Decarbonization strategy



Figure 2. ADNOC L&S Sustainability Vision

Other initiatives being implemented in parallel relate to shore power at ADNOC L&S' integrated logistics bases in Mussafah and Ruwais. Alternative fuels (e.g., biofuel, methanol, ammonia, H₂), battery hybridization, & CCS are under review for future development. The goal is to reduce energy consumption and CO₂ emissions by 25% by 2030 in line with ADNOC vision.

EnMS Drivers

The company acquired ISO 50001 certification in 2019. In 2020, ADNOC L&S developed milestones to adopt best practices for controlling and managing energy consumption across all its operations, legal system to comply with Emirate's 1999 Federal Law on Environment Protection and Development, initiatives to embrace an energy management focused culture and maximize the sustainable value of its operations to achieve 1% energy efficiency annually across the entire value chain by 2030.

In 2021, ISO 50001 policies implemented stringent controls across all internal and external processes, strengthened the company's Integrated Management System (IMS) standards to meet International Maritime IMO, International Safety Management (ISM) and International Marine Contractors Association (IMCA) requirements, annual Strategic Initiatives (2019 to 2022) to drive EnMS programs and support the delivery of the UAE 2030 Sustainability commitments; develop monitoring plan and interventions to reduce methane footprint by 2023, identify abatement opportunities through in-house Sustainability platform to integrate requirements of carbon competency role and training into the academy structure.

In 2022, ISO 50001 improvement action plans were developed to include delivery of 25% intensity reduction target and 50% intensity reduction target by 2030. These milestones include conducting asset level assessments, integrating abatement opportunities in 2023-2027 business plan, defining roadmap and comprehensive assessment sustainability report and developing focused action plan using Best Available Technology (BAT) assessments for greenhouse gas (GHG) emissions.

ADNOC L&S' LNG fleet has been selected to support the case study and highlight the company's decarbonization initiatives, as these encompass 70% of ADNOC L&S' Significant Energy Use (SEU), the substantial criteria for potential energy performance improvement. The SEU criteria was determined by the Energy Management team during the data collection and management review.

"The maritime industry is in the spotlight and our efforts towards decarbonization and achieving sustainable growth by means of ISO 50001 will shape our future and the way we serve our stakeholders."

— Abdulkareem Al Masabi, CEO, ADNOC L&S

Sustainability & Energy Efforts

ADNOC L&S' first EnMS implementation was driven and guided by its Corporate HSE, together with support from business units' focal points in a cost-effective manner.

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“The cost savings in environmental and energy management is projected to exceed 400 million by 2030.”

— Mohamed Al Maflahi, Vice President HSE, ADNOC L&S

Time	EnMS Plan	Investment Cost (US\$)	Cum. Cost Saving (US\$)
2017	EnMS Resources	33,750	-
2018	EnMS implementation in 1 site		35,500
2019	ISO 50001 Certification (Integrated all sites)	13,600	41,000
2020	ISO 50001 trainings	-	17,500
2021	ISO 50001 audits	-	23,000
2022	ISO 5001 re-certification	7,650	-

Figure 3. EnMS Implementation Overview

Business Benefits

Direct Benefits

- Total savings 39% in energy performance improvement from LNG fleet
- Total fuel consumption savings 10% (overall).
- Total energy savings 3,050,000 GJ
- Total CO2 emission reduction of 183,000 Metric Tons (equivalent 90,500 tCO2e/nautical mile per year)
- Average GJ Price US\$ 11 amounting to total savings US\$ 33,521,123

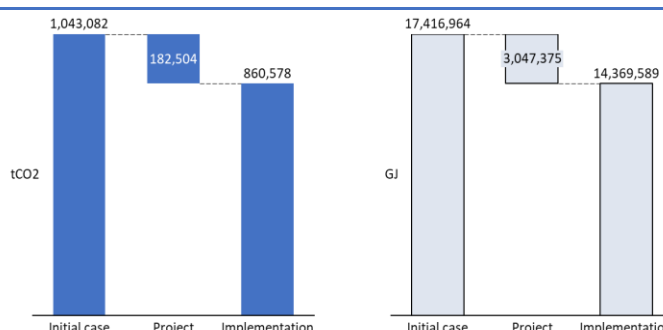


Figure 4. Energy performance cost savings and reduction in emissions (CO2 / GJ equivalent units)

Indirect Benefits

- 100% compliance with legal, statutory, and regulatory requirements
- Effective use of the company’s energy consuming assets
- Increased transparency and communication on the management of energy resources
- Assisted facilities in evaluating and prioritizing implementation of new energy efficient technologies
- Promoted energy efficiency throughout the supply chain, through application of best practices
- Improved fuel efficiency, significantly achieved GHG targets in last 3 years
- Successfully aligned with business objectives by incorporating energy goals, climate change, sustainability, decarbonization into business strategy, framework, and five-year business plans

Plan

The implementation of ISO 50001 is the first step in ADNOC L&S’ sustainability journey, with top management continuously reinforcing the necessity of change. The roadmap required the development of specific plans to enhance efficiency and emissions reduction in line with our partners’ and stakeholders’ expectations, prior to the execution of improvements, projects, and other initiatives to help us achieve and get ahead of our own targets. The three pillars ‘People, Profitability and Sustainability’ form an integral part of EnMS strategy and implementation, supported by strong top-level commitment. ADNOC L&S conducts shipping activities responsibly, reducing harmful emissions. Since 2019, the company has acquired ISO 14001, ISO 45001, ISO 9001, ISO 55001, ISO 22001 and ISO 27001 certifications, this created an opportunity to include ISO 50001 in the integration of the management systems. The company’s HSE Policy supports UAE’s commitment to address the global climate change challenge, promote sustainability by implementing cost-effective measures to reduce energy consumption and improve energy efficiency.

Energy Plans and Reviews

- Develop plan identifying significant energy users (LNG fleet), defining baselines and energy performance indicators

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- Initiate work streams to identify projects with saving potential, adopting selection of hard and soft measures, setting mitigation plan with ‘base’ exceed and significant exceed targets
- Conduct quarterly management reviews, corrective actions plans and processes to capture organizational and behavioral changes.
- Quantitative reference(s) providing a basis for comparison of energy performance. ADNOC L&S set the year 2018 as the baseline to compare energy management performance. Energy consumption in ADNOC L&S may vary significantly due to clients’ requirements and external variables. Thereby, energy consumption should be normalized to ensure comparable values of relevant variables during energy consumption periods to determine energy saving, refer to ADNOC Standard Guideline for Calculating the Energy Saving. ADNOC L&S set the variance criteria as 10% with the baseline and to compare with the previous month, actions shall be taken to identify the source of such variance and to control it if related to internal variables.

Baseline scenario description and identified GHG sources

Name: Business as usual – shipping of LNG via the existing carrier fleet without energy efficiency measures

Short description: No energy efficiency measures were implemented on carrier fleet with the aim of reducing fossil fuel consumption and lowering CO₂ emissions.

Relevant GHG sources which are controlled by the project proponent, related to the project by material or energy flows, or affected by the project. The table below summarizes the GHG sources relevant for the baseline and project which are controlled by the project proponent and within the project boundary.

	Source	GHG	Included?	Justification
Baseline	Consumption of propulsion fuel (boil off gas and heavy fuel oil to) transport the LNG. The transport route= Journey (full LNG loaded) + Return-journey (no LNG loaded)	CO ₂	Yes	Main emissions source
		CH ₄	No	
		N ₂ O	No	
Project activity	Consumption of propulsion fuel (boil off gas and heavy fuel oil to) transport the LNG. The transport route= Journey (full LNG loaded) + Return-journey (no LNG loaded)	CO ₂	Yes	Main emissions source
		CH ₄	No	
		N ₂ O	No	

Table 1: Sources of GHG emissions in the baseline and project scenario

GHG source baseline scenario CO₂e emissions due to the combustion of propulsion fuel (heavy fuel oil and boil off gas) during LNG transport GHG source project CO₂e emissions due to the combustion of propulsion fuel (heavy fuel oil and boil off gas) during LNG transport.

For the normalization rationale, all fuel delivered and combusted for the propulsion of the fleet ships during the travelled ship transport route are considered, thus leakage emissions are neglected.

$$UER_y = \left(\sum_n dn,y \times Cn \right) \times PPER \times EF_{fuelmix,y} - \sum_n 0 \sum_i FC_{n,i,y} \times NCV_i \times EF_{co2,i}$$

$$UER_y = BE_y - PE_y$$

Parameters:

PE_y: Project emissions cause by the LNG fleet, FC_{n,i,y}: Amount of propulsion of fuel, NCV_i: Net calorific value of fossil fuel type I, EF_{co2,i}: CO₂ emission factor of fossil fuel type i, i: Fuel type, n: Ship of the LNG fleet, y: Period of time UER_y: Upstream Emission Reductions in period y (tCO₂), BE_y: Baseline Emissions in period y (tCO₂), PE_y: Project Emissions in period y (tCO₂)

Top Management Actions

The concept of EnMS certification arose from the management areas of Corporate Strategy, Commercial Shipping Business Development, ew Projects and was executed jointly with Plant Operations as part of sustainable development. Decision was made to start with the pilot plan at the Base Operations, and then expand this management system across L&S assets.

Other key actions involved: Monthly Management Leadership Visits and Quarterly Townhalls leading discussions on energy optimization projects, recognizing positive contributions, assigning synergies and accountabilities within business units, bi-annually reviewing the company's energy program, and making recommendations for improvement, ongoing resource allocations, added energy topics to the Board meeting agendas, monthly energy performance reports and updates. In addition,

- Review of the Energy Policy
- Appoint a company management representative
- Expand the energy management team
- Sustain EnMS scope and boundaries
- Create organizational awareness
- Ensure ongoing management responsibility

2022 Top Management Strategic Initiatives

1. ISO 50001 reviews to address execution of action plans to deliver 25% intensity reduction targets identified in the carbon strategy
2. Methane monitoring plans to meet Oil and Gas Methan Partnership (OGMP) requirements, identifying interventions to reduce methane footprint
3. Implement Sustainability platform "Project Light" within business units.
4. Implement L&S Open Channel Reward & Recognition Platform for employees
5. Achieve EnMS Certification for new KIZAD facility (5th largest warehouse facilities in the world, equivalent to 85 football pitches)

"Embracing energy efficiency at the heart of operations, with close follow-up by senior management, is the key factor to enable the role of an energy management system."

— Abdul Bari Alzubaidi, SVP Ship Management, ADNOC L&S

Hard and Soft Measures (ISO 50001 recommendations)

The following technical (hard measures) and operational (soft measures) were successfully implemented on all eight LNG vessels: Al Khaznah, Shahamah, Gha-sha, Ish, Mubaraz, Mraweh, Al Hamra and Umm Al Ashtan.

Advanced hull coating: Patented technology that utilizes the added effect of advanced hydrogel silicone and an efficient fouling preventing biocide to reduce the roughness of the hull surface and decrease the total resistance of the ship.

New propeller: Tailormade propeller blades resulted in a low induced vibratory force and power that delivers even higher propulsion efficiency and assurance until end of a ship's lifetime.

Mewis Duct: Consists of two strong fixed elements mounted on the vessel: a duct positioned in the front of the propeller, an integrated fin system reducing losses in the propeller slipstream, increasing thrust and power.

Propeller boss cap fins (PBCF): Consists of a propeller boss fitted with short blades inclined to convert hub vortex energy into additional torque and thrust transmitted back to the shaft. The PBCF improves the propeller performance characteristics, minimizes the hub vortex and rudder cavitation and thus enhances the propeller efficiency.

Marorka Online: Software system for performance monitoring, real-time data analysis, scorecards for EnPI indicators, advising ships' officers on how to improve hull efficiency, main propulsion performance and voyage management.

Ship Energy Efficiency Management Plan In line with IMO- International Maritime Organization

- Assessment of hull condition: hull roughness, hull fouling, the quality of coatings and paints.
- Assessment of engine condition: engine tuning options or identification of engine faults
- Feedback to a better ship design
- Improved commercial aspects for chartering and technology upgrades beneficial in charter party agreements.

- Long term operational optimization utilizing historical data trends.
- Environmental assessment: Regulatory data reporting & compliance with IMO DCS & EU MRV.
- Enhanced value of using ISO 50001 in supply chain engagements
- Data accessibility/shared data with stakeholders
- Identify energy risks across company's business
- Up to date modern technologies and design to save energy
- Continual improvement and competency program.

Financial Commitments

All investments required are evaluated either by retrofitting or by incorporating new technology, adopting a systematic approach for merit rating of the investment options and benefits of the proposed measures with reference to energy savings:

- Direct project capital costs, operating and maintenance cost
- Training of personnel on new technology etc.
- IT platform/system to create monthly energy consumption report, prediction trends energy data to analyze abnormal energy forecasts, with agreed baseline to measure system effectiveness
- Energy Efficiency and Performance Indicators associated for new and existing projects linked with financial budgets in company scorecard for future-proofing implementation on multiple sites.

Do, Check, and Act

Environmental protection and energy efficiency are strategic priorities for ADNOC L&S.

In 2018, Top Management initiated development of energy policy. Subsequently, EnMS implementation team was formed within the HSE Department, comprising Manager HSE Support, Corporate Energy Specialist, and Site Specialist. The team started data collection and analysis in Base Operations to determine energy use and consumption. They developed the documentation, plan, conducted reviews and audits.

In 2019, to prepare for ISO 50001 certification, the Vice President HSE was given a pivotal mandate to re-structure the HSE unit and develop the normative-technical base consisting of:

1. Energy Policy issued and communicated
2. EnMS Framework and Integrated Management System Manual
3. Context analysis was carried out aligning the five pillars of organizational strategy, the stakeholders, internal and external risks and opportunities
4. The scope of the energy management system was defined for processes at Base Operations and Head offices.
5. Focal points from all departments were identified by EnMS team and workshops were held to explain processes, distribution of roles and responsibilities.
6. Methodology for monthly monitoring of base operations energy performance comparing to historical baseline
7. Energy performance indicators target setting in the corporate scorecard with KPIs and milestones
8. A survey was carried out to assess the current business plan factors such as new project costs, planned maintenance activities, and new IMO/ISM requirements.
9. Allocation of resources, dedicated EnMS team in the HSE org-chart
10. Employee engagements and awareness campaigns on energy policy, objectives and framework
11. The first internal audit was carried out both in base operations and head offices, verifying compliance
12. Communication channel developed for reporting and transparency
13. Audit report was prepared and communicated to stakeholders which detailed Minor Non-Conformities and Areas of Improvements, Root Cause Analyses was carried out and Audit Report to develop corrective action
14. Management Review was carried out to Top Management highlighting the progress and issues in implementation

In 2020 an EnMR representative was assigned as project proponent to monitor process, follow-up operations, review results/data, quality assurance of measurements and assign focal points in all departments to execute the monitoring, which includes inter alia: data recording; data maintaining and data storage, quality assurance and quality control of

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the data, equipment calibration, planned and unplanned maintenance, and adoption of corrective actions if needed. All relevant data is stored in a centralized database system.

“It is important for any organization to look at its energy use holistically, from top management’s commitment all the way through to implementation and feedback, and that’s what ISO 50001 offers.”

— Hassan Al Hamadi, Manager HSE Support

In 2021, to further improve EnMS,

- A tool was developed to qualify service providers who are ISO 14001 and ISO 50001 certified as approved and sustainable supply chain.
- Contractors HSE&AI Assurance Program (CHAP) KPIs was rolled out to improve energy efficiency; implement energy efficiency criteria in the procurement of equipment, resources, and technologies; design and build new ships utilizing energy efficiency principles.
- Level1 & Level2 EnMS trainings were carried out to improve knowledge and skills of workforce at all levels

The commitment of ADNOC L&S top management enabled the company to deliver strategic imperatives, enhance existing revenue streams, create new ones, and stay focused on improving return on investment, without compromising focus on the environment and the sustainability of our business.

The LNG vessel transport system presents infrastructure prior to the regasification plant and is therefore positioned in the supply chain prior to the facility at which the finished transport fuel is produced or (specifically for gas), prior than the facilities supplying the finished transport fuel to market. The calculations factored the vessel while at sailing condition. The energy report documented the energy efficiency from 01/01/2020 to 31/12/2021 in accordance with the rules given in the ISO/IEC Directives, Part 2.ISO (50001:2018).

Performance Reviews

By establishing a reliable monitoring system, site workshop technical staff in liaison with our corporate energy team coordinated implementation by conducting quarterly performance reviews, energy optimization trends and communicated upcoming initiatives to ADNOC L&S staff.

Top management rewarded and recognized individuals and marine vessels through “Best Ship” and “Best HSE Team” Monthly Awards. Energy Conservation, Energy Ration and Renewable Energy are some of the key activities implemented as part of HSE Communication Plan thereby achieving the campaign targets and improving energy performance. The Energy Management team monitors data on daily basis, in case of variance, data is checked for normalization in line with EnMS requirements. The adjustments made for weather, operation changes, etc. are taken into consideration when calculating the value.

Tools and Resources used

- Project documentation included a monitoring system implemented according to the monitoring plan.
- Operating Procedures were developed with operating parameters e.g., fuel consumption, travelled distance, etc.
- The data collection methodology, responsibilities and monitoring instruments described in the respective Ship Energy Efficiency Management Plan II (SEEMP II) for each vessel was as per the ISO 50001:2018 standard.
- The data was collected daily on each LNG vessel with the noon reporting system, synchronized to a centralized software database, allowing analysis, reporting and data storage of the parameter data for each LNG vessel. Through quality assurance process, relevant parameters further measured daily emissions reductions.
- Management of Change / Operational Controls were successfully implemented in project design, modifications permanent or temporary changes or deviations from the applied methodologies, standardized baselines, etc.
- The energy performance improvement calculations were based on monthly consumption and monitoring data using Excel data analysis and linear regression tools.

Employee Engagement and Trainings

- Extensive training and upskilling of core members to continually improve the management system.
- Training on energy efficiency and management issues for energy management team leaders

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- Promote staff awareness and engagements at all levels by implementing Annual HSE Communication Plan
- Energy awareness days to educate workforce on efficient energy management in the workplace
- Internal ideation platform for employees to suggest energy improvement ideas.

Procurement, Processes & Audits - Based on EnMS data

ADNOC L&S procures energy efficient and sustainable services, products and equipment to suppliers through ADNOC L&S Procurement Business Unit and included in suppliers' selection checklist evaluation based on energy performance. ADNOC L&S has developed a bespoke matrix for measuring energy efficiency and established targets to achieve efficiency along the ADNOC L&S value chain, communicated to all stakeholders.

Third-party audits are carried out to ensure implementation, corrective and preventive actions are taken and efforts in place to demonstrate continual improvements.

Future Action(s)

- Replace non-energy efficient fleet with eco-vessels equipped with EnPI indicators
- Deploy technologies such as Variable Frequency Drive machinery, etc.
- Invest in in-house renewable-energy such as wind power for ship propulsion
- Energy trainings (in-house) with business unit focal points and project-based employees
- Acquisition of new sustainable LNG carriers and technology-enabled vessels that significantly reduce emissions, innovative air lubrication systems and partial reliquefaction systems to further reduce fuel consumption by 10%.
- Build an R&D center to promote decarbonization initiatives and implement pilot projects.
- Expansion and modernization platforms which act as key enablers of our growth strategy and help future-proof our fleet to offer unbeatable value to our customers for the next 25 years.

Transparency

ADNOC L&S communicates EnMS achievements in a clear and transparent way to all its stakeholders through:

- Corporate HSE communication on ISO 50001 internally, ADNOC Group level, contracted partners; external International Maritime Organization (IMO), our customers, etc. through Annual Sustainability Report
- ADNOC L&S and ADNOC LNG's partners (Total) board engagements
- ADNOC L&S efforts recognized by the global maritime industry, by winning two awards from the Maritime Standard Awards, "Environment Protection Award, and the Green Shipping Award in 2021", thus giving visibility to the company's ongoing commitments
- Internal & external third-party audits for LNG vessels, IMO compliance by Class Lloyds Register.
- Conducting regular Contractor Leadership Forums and Workshops
- Trainings and inductions to employees on ISO 50001 new changes, initiatives, and best practices.
- Townhall (quarterly) to communicate ISO 50001 performance, challenges, and improvement plans.
- IMS Reviews Internal, Board, Group, Contractors & Partners to discuss EnMS performance and Action Plans
- Forums, Conferences and Workshops (ADIPEC, etc.)

What We Can Do Differently

If ADNOC L&S were to start the process all over, the following will be considered:

- Establish adequate resources and assign EnMS Champions to lead implementation across departments
- Develop robust plans to reach the established EnMS KPIs based on previous lessons learned
- Improve the strategy on review processes by developing Steering EnMS Committees
- Increase trainings for all onshore and offshore personnel and include key contractors
- Develop Action Tracking System (ATS) to assess implementation and improvement plans
- Train more internal auditors on EnMS requirements
- Develop company intranet and mobile app to communicate EnMS requirements and awareness periodically.