Purpose built for biomass: How direct drive technology delivers 20% energy savings and simplifies maintenance

The hidden cost of complexity

Walk through any biomass pellet production facility and you'll hear the constant hum of belt drives and vibrations coming from every piece of equipment.

Beneath this familiar noise lies an expensive reality: belts need constant alignment and replacement, gearboxes require lubrication and eventual rebuild and that vibration is the sound of accelerating wear throughout the system.

In an industry where margins are measured in single digits and energy costs represent 15-20% of production expenses, inefficiencies compound.

Direct drive pellet mill technology represents a fundamental rethink of this mechanical complexity, eliminating belts and gearboxes entirely while delivering energy savings of approximately 20%, extending die life and simplifying maintenance procedures.

Technology that delivers results

Direct drive systems employ specially designed high-torque electric motors that deliver maximum force directly to the die assembly — even at speeds as low as 5 rpm.

Unlike conventional systems that use belts and gearboxes to convert high-speed motor output into the high-torque, low-speed force needed for pelleting, direct drive motors are purpose-engineered to maintain full torque output across a wide speed range.

The result is a drive system delivering up to 40% more torque than comparable gear-driven systems, while operating at die speeds continuously adjustable from 0 to 6.5m/s.

This torque characteristic enables effective processing of challenging materials like torrefied wood and agricultural residues that require significant compression force.

More importantly, eliminating mechanical transmission components removes multiple sources of energy loss, translating into measurable reductions in kilowatt-hours per ton of finished pellets.

Field validation: Third-party performance data

CPM validated this direct drive technology through an independent evaluation by FutureMetrics, a well-established biomass consultancy.

The field study was conducted at Kon Tum Bio Energy's facility in Vietnam, processing abrasive feedstocks including rubberwood, eucalyptus and acacia.

Over an extended evaluation period, FutureMetrics documented energy usage between 48 and 55 kWh/ton of finished pellets, compared to the 60-75 kWh/ton range typically seen in conventional systems.

This represents a validated energy reduction of ~20% under real production conditions.

Die life in the direct drive system reached up to 1,500 hours, with dies maintaining sufficient condition for refurbishment and reuse.

Vibration levels were so low that operators could balance a cigarette upright on the machine frame during operation — a telling indicator of mechanical stability that translates into reduced wear throughout the system.

The evaluation team noted that operators could easily access key components and that routine maintenance tasks were simplified compared to conventional machines.

The absence of belt alignment, gearbox lubrication and coupling adjustments meant maintenance schedules could focus on core pelleting components rather than drive system infrastructure.



A direct drive Picture by CPM

Most significantly, the system handled challenging feedstocks without the vibration and mechanical stress issues that often plague conventional mills when processing challenging materials.

Economic impact: Total cost of ownership

The documented 20% energy savings translate into substantial economic benefits across global markets. For example, in high-energy-cost regions like Germany, cutting 10 to 20 kWh/ton can significantly improve the cost per ton of finished pellets.

Energy savings represent only part of the economic equation. Eliminating gearboxes, belts and related transmission components removes major maintenance expenses.

Die life extension reduces the annual cost of die replacement. Having fewer of these mechanical issues translates to more labour savings and less downtime.

The combination of energy savings, reduced maintenance and improved reliability shortens the payback period, making direct drive technology attractive as both an operational improvement and strategic investment in plant efficiency.

Operational advantages for plant managers

Beyond quantifiable savings, direct drive systems offer operational advantages that matter daily for production teams.

Mechanical simplicity eliminates complex belt tension, alignment procedures and

gearbox lubrication schedules. Operators can focus on core pelleting processes rather than managing transmission system complications.

This simplification becomes particularly valuable in facilities with lean maintenance teams or those operating where specialised technical skills are harder to find.

Training programmes can concentrate on feedstock preparation and quality control rather than mechanical intricacies, allowing operators to become proficient faster and improving shift coverage.

The ability to fine-tune die speed continuously, rather than being constrained by fixed gear ratios, allows optimisation for feedstock characteristics or product specifications.

This flexibility proves valuable for facilities processing multiple raw materials or producing pellets for different end markets with varying quality requirements.

Direct drive systems typically require less floor space than comparable conventional mills, making upgrades feasible in existing facilities that might otherwise require building expansion.

The modular design also supports phased upgrades, allowing facilities to replace individual mills as capital becomes available.

Industry applications and future outlook

Direct drive technology appears particularly well-suited to current industry trends toward higher-density pellets and geographic expansion into regions with limited technical infrastructure.

The ability to deliver high torque at low speeds enables better compaction of challenging materials, while reduced maintenance complexity provides operational advantages that can outweigh higher initial capital costs.

Energy cost pressures, particularly in European markets where industrial electricity rates continue climbing, make the 20% energy reduction increasingly valuable for facilities operating on thin margins.

The technology shows immediate applicability for facilities processing challenging feedstocks, operating in high-energy-cost environments or planning major equipment upgrades where total cost of ownership benefits justify higher initial investment.

As biomass pelleting evolves from niche renewable energy application to large-scale industrial process, the operational advantages of direct drive technology – mechanical simplicity, energy efficiency and operational reliability – align well with the direction of modern production.

The early field results suggest direct drive pelleting has moved beyond experimental technology to become a proven alternative that deserves serious consideration for new installations and major equipment upgrades. ●

For more information:
Visit cpm.com. This piece was written by Brock Harrington, global alternative fuels and industrial sales director at CPM

CPM|Crown announces addition to Lifecycle360™ support services: Plant Operations

CPM|Crown has expanded its Lifecycle360™ offerings to include Plant Operations.

With this addition, Lifecycle360 is now a suite of eight support services that help oilseed, renewable fuels and speciality processing companies streamline and optimise the full lifecycle of their facilities, from pre-engineering to long-term maintenance needs.

The service is designed for clients seeking to enhance all facets of their operations, including the plant itself, production processes, equipment and the employees.

Plant Operations have engaged Crown's mechanical, process and automation experts to look holistically at the customer's full facility and team and help identify bottlenecks and improvement opportunities in technologies, training and other areas that can maximise levels of efficiency, productivity and capacity.

Each plant operations consultation begins with an on-site assessment, leading to a full analysis with solution recommendations that might include equipment or one or more of the other seven Lifecycle360 support services.

The objective is to help customers accomplish both quick and long-term wins for their team and business. Lifecycle360 Plant Operations Services include:

- Preventative maintenance plans;
- Shutdown steam purge planning and support;
- Debottlenecking;
- Process safety management/hazard analysis;
- Operating procedures (SOPs, start-ups, shutdowns, clean outs);
- Virtual plant monitoring;
- Smart operating controls improvements;
- Asset integrity/reliability;
- KPI metric evaluation and ROI;
- Project, automation and maintenance planning for day-to-day operations;
- Introduce the newest/improved innovations, parts and equipment;
- Risk assessments.

Kris Knudson, CPM|Crown's president, said: "Through the success of our Lifecycle360 rollout, we've had a chance to interact with customers and take their feedback.

"It became apparent that we had an opportunity to do more for them through our programme, so we added Plant Operations.

"Our team is a group of extremely talented individuals who have been doing their work for decades. This experience enables them to listen to the customer's team and help uncover where they're needing the most support, whether it be employee training or process optimisation."

Plant Operations and all other Lifecycle360 support services are now available to customers around the world. The other seven Lifecycle360 services include: Crown's Innovation Centre; Pre-Engineering; Construction Support; Automation, Maintenance Support, Training; and Optimisation.

