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IFP Energies Nouvelles (IFPEN) and Axens to Expand Involvement with Anellotech Bio-TCat™ Process Development Program for Cost-effective Bio-based Aromatics

Milestone progress made on new, fully-integrated development and testing plant – Construction now complete; Installation to commence

IFPEN and Zeton representatives with Anellotech's TCat-8 development and testing unit for converting biomass to BTX. Photo courtesy of Zeton Inc.

Pearl River, New York –December 17 2015 – Through the joint development of pioneering Bio-TCat™ technology, Anellotech, IFP Energies nouvelles (IFPEN)**,** Axens and other industry-leading partners are accelerating the development and future commercialization of bio-based paraxylene and other important aromatics chemicals, including benzene, toluene, ortho-xylene and meta-xylene (BTX), from non-food sources. This alliance is paving the way for the low-cost production of bio-based aromatics for use in chemical production and as high octane, non-oxygenated bio-fuels blendstock.

Anellotech, IFPEN and Axens today announced a major step forward in the development of the Bio-TCat process for thermal catalytic conversion of non-food biomass to aromatics with the completion of construction on the new, fully-integrated development and testing plant ("TCat-8™"), following over one year of joint design collaboration. With TCat-8 construction now complete, Anellotech is ready to commence installation onsite. Operational in 2016, this 82 foot- (25 meter-) high unit will confirm the viability and suitability of the Bio-TCat process for scale-up and generate the data needed to design commercial plants using this proprietary technology.

As part of a multi-year R&D collaboration with Anellotech, IFPEN will be integral in the commissioning and operation of TCat-8, leading to commercialization and exclusive licensing of Bio-TCat technology by Axens. In addition to extensive activities at its R&D center in Solaize, France, IFPEN will dedicate three, full-time senior engineers and technical experts at Anellotech's U.S. location for two years to support the efforts,

beginning in 2016. Anellotech's highly collaborative program leverages IFPEN's extensive and comprehensive process development experience, and its specific expertise in catalytic reactor modeling, catalyst regenerator design and aromatics processing.

"IFPEN's engineers and experts will participate directly on the TCat-8 program," said David Sudolsky, President and CEO of Anellotech. "Their hands-on involvement in ongoing experimental planning, operations and data analysis will be critical to our success. IFPEN has already made significant contributions working alongside Anellotech on TCat-8 design, HAZOP studies, control systems, experimental planning, and chemical analysis method development. This collaboration will continue, while IFPEN also begins conducting advanced modeling and cold-flow hydrodynamic studies to support Bio-TCat reaction engineering and scale-up."

IFPEN and Axens: Two Highly-Motivated Partners

IFPEN's collaboration with Anellotech is consistent with its 2010 name change from Institut Français du Pétrole (IFP) to IFP Energies nouvelles (IFPEN). The new name reflects its increasing focus on "new energy" technologies. In fact, IFPEN's nascent research programs on renewable energies focus on three major priorities: producing fuels from biomass; using biomass for the production of major chemical intermediates; and developing wind and ocean energies to produce electricity without associated CO_2 emissions.

"IFPEN has an outstanding track record for successfully developing process technology for producing both fossil-based and bio-based chemicals and fuels," Sudolsky added. "They possess strong capabilities from decades of experience developing and improving many different process technologies, including designing and operating pilot plants for scale-up of processes that have proven commercially successful."

IFPEN's interest in green chemicals stems from its commitment to reducing oil dependency as well as combatting global warming due to CO_2 emissions. It is building an impressive portfolio of green processes, including Futurol™ (cellulosic ethanol) and Atol™ -C2 (Ethanol to Ethylene) for further conversion into bio-MEG), two processes already licensed worldwide by Axens. R&D programs include BioButterfly™ (bio-butadiene, an on-going joint development with Michelin and Axens) and BioTfuel™ (lignocellulosic bio-diesel, an ongoing joint development with Total, CEA, Thyssen Krupp Industrial Solutions, Avril and Axens), complemented with the development of the Bio-TCat process for bio-aromatics.

"Collaborating with Anellotech offers us a unique opportunity to participate in the development of an innovative and cost-competitive path to bio-aromatics," remarked Jean-Pierre Burzynski, Director of the Process Business Unit at IFPEN. "It is consistent with our charter to develop cost-competitive renewable chemicals and fuels from non-food biomass. We share a common vision with Anellotech's other strategic partners, and a mutual goal to see this technology into fruition."

"The development of bio-BTX will rely heavily on IFPEN's expertise in fluid bed technologies scale-up and will provide the industry the key aromatic basic chemicals that are used in significant plastics, such as polyester (polyethylene terephthalate or "PET"), polystyrene, polyurethane, and nylon, Burzynski added."

According to Jean-Luc Nocca, Executive Vice-President and Chief Technology Officer at Axens, "Development and commercialization of breakthrough Bio-TCat technology will be a significant addition to our broad portfolio of the advanced technologies, catalysts, adsorbents and services for conversion of oil, coal, natural gas and biomass to clean fuels and major petrochemical intermediates that we provide to the global market."

IFPEN's commitment of resources comes on the heels of Anellotech's November announcement of a new $7 million investment (the first tranche of a total of $10 million) from a major multinational corporate partner, as momentum continues to build on the project.

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About the Anellotech Partnerships

Anellotech complements its own highly experienced R&D staff with in-depth, highly-interactive, long-term collaboration with a team of world-class partners. These partners are industry leaders in process development, catalysis, engineering design and licensing, and are working in close cooperation with Anellotech to accelerate development and drive cost-competitiveness. The Anellotech team is comprised of IFPEN as our process development and process scale-up partner, Johnson Matthey as our catalyst development and catalyst manufacturing scale-up partner, and Axens as our partner for industrialization, commercialization, global licensing, basic engineering design, initial operations guidance and technical support for licensees. Industry-leading strategic partners in the BTX supply chain, including a major multinational corporate investor announced in November, have also provided capital to Anellotech. These high-caliber, results-oriented partnerships provide the critical mass of expertise and market presence

for the successful commercialization and broad licensing and servicing of commercial plants based on the Bio-TCat process technology.

The Anellotech alliance network has grown out of a common desire to develop and commercialize technology that enables the production of renewable aromatics, the group of basic core chemicals that form the foundation for chemical intermediates and derivatives from which key everyday consumer products are derived. Alliance partners also understand that the Bio-TCat route to renewable aromatics, with its high octane, non-oxygenated advantages, can form the core of future renewable fuel initiatives, as an alternative path to fuels with reduced carbon footprint. Commercially, Anellotech's development partners' involvement is driven by future licensing royalties, engineering and technical services revenues and catalyst sales to licensees. Obtaining early access to cost-competitive bio-aromatics motivates Anellotech's operating company partners and ensures an end-to-end collaboration with a focus on technical and process economic success.

Seeking Forward Investment Partners

Anellotech continues to seek additional funding and strategic partners from the chemicals and refining industry sectors to support the development of the Bio-TCat technology and participate in its future success. These include companies interested in cost-competitive bio-based, benzene, toluene and paraxylene (and other xylenes) and their chemical derivatives. The technology also has appeal for refiners with aromatics processing capability or interest in aromatics as high-octane, non-oxygenated blendstock for gasoline, as well as for biomass suppliers and others in the supply chain.

About Anellotech

Anellotech is a green innovation and technology company developing an efficient and eco-friendly process for producing bio-based BTX from non-food biomass. We use proprietary breakthrough technology to produce these sustainable chemical building blocks as an alternative to their identical counterparts derived from fossil sources. By using biomass as a source feedstock for aromatic chemicals, Anellotech is helping broaden the world's access to renewable chemical and energy sources, while lowering these chemicals' lifecycle carbon footprint to reduce greenhouse gas emissions.

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