



**NON CONFIDENTIAL INFORMATION FOR  
PROSPECTIVE EXTERNAL TECHNOLOGY  
SOLUTION PROVIDERS**

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## About This Document

This document identifies a collection of scientific and technical areas of interest to The Coca-Cola Company. This collection was compiled from the business needs and technical needs of the Company's R&D centers around the world. All information in this document is non-confidential. The information in this document is intended to inform potential technology providers and suppliers of the types and kinds of scientific and technical solutions of interest to the Company.

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## Ingredients

Ingredients should focus specifically on the benefit space of satiety for weight management and enhanced physical performance. The chemical properties of these ingredients should be (but not a must) beverage friendly (water soluble, acid stable pH range 3-7, ambient storage). No chemistry reactions between the functional ingredients with sugars, flavors, packaging, etc.. The efficacy of ingredients should be tested in humans or very strong pre-clinical testing results. The ingredients should have a clearly defined path to US and EU regulatory approval.

### ***Some Functional Benefit Areas of Interest***

#### **Weight Management**

- Satiety- Novel food ingredients, flavors, aromas etc. that promote a feeling of fullness
- Biochemical mechanisms (satiety hormone production)
- Mechanical mechanisms (stomach distension)
- Psychological mechanism (mood and satisfaction)
- Body Fat Reduction- Ingredients and technologies to either inhibit fat cell production or growth or increase the burning of fat. (e.g., green tea catechins)
- Fat Calorie blocking- inhibit the digestion of fat (e.g., lipase inhibitors/competitors or inhibitors of fat intestinal absorption (e.g., cyclodextrins)).

#### **Sports/Exercise Performance**

- Enhance recovery time for muscle soreness
- Reduce the degree of muscle soreness
- Expedite recovery from muscle fatigue
- Reduced\extend the time to muscle fatigue
- Reduce\lessen the degree of muscle fatigue
- Improved protein absorption and utilization (i.e. Lean muscle mass research with protein hydrolysates)
- Anti-oxidant benefits of the protein derivatives (i.e. research on peptides with antioxidant properties)

#### **Gut Health**

- New ingredient goo for gut health
- Ingredients bio-availability in human body
- Advanced colon models to mimic the human gastrointestinal tract
- Mechanism of ingredients with gut benefits

- Study on the beneficial gut bacteria
- Delivery system for probiotics for beverages

## **Beauty**

- Ingredients improving internal and/or external beauty.
- Functional ingredients improving blood circulation for increased benefits to the skin.

## **Tea Focus**

- Interest in any new technologies or ingredients for tea beverages.
- Process study to reduce bitterness and astringency
- Technology on prevention of tea browning and creaming

## **Dairy Focus**

- Any novel dairy ingredient or technology that could be relevant for beverages.
- Interest in Increasing nutrient delivery in dairy beverages
- Flavor optimization (lower satiation or reduced off-notes) for high protein or dairy beverages
- Anti-oxidant benefits of the protein derivatives, which is the research on peptides with antioxidant properties.

## **Cognitive Function**

- Improve task efficiency (faster with fewer errors)
- Improve ability to multitask
- Improve focus with mental fatigue
- Control delivery of caffeine (increase and delay)
- Promoting concentration
- Relaxation

These project areas are being pursued from both, short term/near market opportunities (0-2 years) and longer term relationships (3-5 years). For technologies assessed during 2009, short term/near market opportunities will be given priority.

A short term/near market opportunity must have:

- Significant efficacy validation (preferably accessed through human clinical studies)
- Ingredients should have regulatory approval (or pending approval) in a major business geography (EU, US, Japan, or China)
- The ideal ingredient solutions should be taste neutral, minimal color impact, stable in a broad range of pH (2.8 – 8.0), and soluble/dispersible in water. (again this is ideal not absolute)

Longer term opportunities which may require significant research, efficacy validation, safety work and regulatory approval will only be considered if the potential return on investment provides an obvious marketplace/competitive advantage. Longer term research partnerships must focus on the priority areas (weight management, sports/exercise performance or cognitive function) and will not support:

- New sources of existing commodities (e.g., antioxidants, Omega 3 oils, etc.)
- Ingredients sourced from genetically modified organisms/plants.
- Technologies that function by targeting mechanisms that specifically inhibit gene expression will not be considered.
- Pharmaceuticals development

We are interested in all approaches to ingredient discovery and development including those utilizing innovations in agriculture, engineering, chemistry, and biotechnology (e.g., cell-based and/or biochemical screening assays for modulators of specific receptors, enzymes, channels, etc.)

## **Taste Modulators**

We are interested in ingredient solutions that modify tastes other than sweetness, as well. These ingredients should either have regulatory approval in the US and EU or a clearly defined path to regulatory approval. The ideal ingredient solutions should be taste neutral, minimal color impact, stable in a broad range of pH (2.8 – 8.0), and soluble/dispersible in water. (This is ideal and not absolute).

Both cell-based and non-cell-based discovery and validation approaches will be considered. Advancement in the understanding and application of biological/neurological fundamentals of taste and taste modulation will be considered.

Areas of Interest:

- Astringency blocker
- Enhancer of Umami (i.e. especially in tea)

## ***Natural Enhancers of Sweetness***

Cost-effective, synthetic or natural (preferred) compounds which enhance the sweetness intensities of sucrose, fructose, glucose, erythritol or rebaudioside A or other natural sweeteners by  $\geq 1.5$ -fold when used @  $\leq 10$ PPM, w/o any sweetness of their own at the concentration employed and w/o any off taste (e.g., bitter, licorice-like, etc.).

## ***Bitterness Inhibitors***

Natural (preferred) or synthetic compounds which inhibit the bitterness of ingredients including (but not limited to) high potency sweeteners and health promoting ingredients such as polyphenols. Ideally, inhibitors/maskers can be used at concentrations that qualify them as flavors. Inhibitors should not interfere with the tastes or properties of sugars, flavors, packaging, etc.

## ***Salty taste modulators***

Natural (preferred) or synthetic compounds that either enhance or inhibit the salty taste of a variety of salts and/or ingredients present in beverages. Ingredients should be usable at concentrations that qualify them as flavors and should not interfere with the tastes or properties of sugars, flavors, packaging, etc.

## ***Trigeminal-active ingredients***

Natural (preferred) or synthetic compounds that mimic, enhance, or suppress the sensations of cooling, tingling, carbonation, burning, or heat. Ingredients should be



usable at concentrations that qualify them as flavors and should not interfere with the tastes or properties of sugars, flavors, packaging, etc.

These project areas are being pursued from both, short term/near market opportunities (0-2 years) and longer term relationships (3-5 years). Longer term opportunities which may require significant research, efficacy validation, safety work and regulatory approval will only be considered if the potential return on investment provides an obvious marketplace/competitive advantage.

## **Aroma/Olfaction**

### Areas of Interest:

- Fundamental knowledge about the neural mechanisms involved in perception of olfactory cues by humans.
- Leverage fundamental knowledge about olfaction into the discovery and/or development of novel taste and aroma sensations.

We are interested in all approaches to ingredient discovery and development including those utilizing innovations in agriculture, engineering, chemistry, and biotechnology (e.g., cell-based and/or biochemical screening assays for modulators of specific receptors, enzymes, channels, etc.)

## **Natural/Synthetic Preservatives and Preservation Technologies (i.e. active packaging)**

We are interested in both natural and novel synthetic preservation ingredients that are suitable for human consumption in still and/or sparkling beverages. Specific criteria (ideal, not absolute) include:

- Should be effective at pH values below pH 4.4. Any efficacy above 4.4 is a plus, but for shelf stable products above pH 4.4 we would need a review by the FDA (at least for the US and probably equivalent agencies in other geographies).
- Does not need to be biocidal, instead the goal is to retard microbial growth, therefore fungistatic and bacteriostatic properties are suitable.
- Must be effective against spoilage yeast, mold and bacteria. It is preferred – but not required – that preservation ingredients be effective against all three spoilage organisms. Many times we receive information from suppliers about preservative efficacy against organism that are irrelevant to our beverages (e.g. *Escherichia coli*, *Bacillus* spp. *Salmonellae* etc). Antimicrobial activity should remain consistent through the shelf life of the product.
- Must not breakdown into harmful by-products and must not produce undesirable sensory attributes.

To be valid, any data presented by an external source should be based upon trials using an aqueous matrix with similar properties to a sparkling or still beverage. Antimicrobial data based upon surface sanitation/disinfection or well diffusion assays is not suitable. Data generated by non-conventional microbiological methods (i.e. redox assays, bioluminescence, molecular assays) should be accompanied by convincing validation/calibration data. A clearly defined path to US and/or EU regulatory approval is required - GRAS or potential GRAS status is preferred. Information on supply and sourcing is desirable.

## Encapsulation/Nanoencapsulation Projects

We are interested in novel ingredient delivery innovations including the areas of encapsulation (including nano- and near nano-encapsulation), targeted ingredient delivery, and controlled ingredient release. Areas of interest, desires, and some guidelines to consider:

- Encapsulated bioactives are stable at pH 2 to 4.
- Particle size of the encapsulated bioactives is less than 50 nm for clear beverage applications.
- Ratio of encapsulant to bioactive(s) is less than 2.
- Materials used need to be GRAS approved.
- Technologies employed are IP protected and not from third party providers.
- Regulatory status - Natural, GMO free, possibility to be certified as Halal or Kosher.
- Countries of primary focus - The 22 markets where our Company operates (Africa, Americas, Asia, Europe). Though consideration and applicability to the 200+ countries the Company operates is also important.
- Shelf Life of the ingredient - The encapsulated material should be preferable stored at room temperature or cold (4 to 10 Celsius).
- Shelf Life of the ingredient in the beverage - The encapsulated bioactives need to be physically stable in the beverage matrix for the duration of the shelf life (~6 to 9 months).
- Physical properties - The encapsulated material could be either a liquid or powder form.
- Type of beverage application - The encapsulation process (s) ideally should be compatible with pH ranging from 2.0 to 7.0, but is perfectly acceptable that different systems are used for different ranges of pH.
- Novel ingredient delivery systems, which also includes other delivery technologies that might be useful to beverages, such as double emulsion, multilayer emulsion and nano-emulsion, etc. One specific project example could be a nano-emulsion (or clear emulsion) system for the delivery of water-insoluble bioactive ingredients, such as EPA/DHA in clear beverages.

### Examples of Encapsulation Objectives of Interest

- Control of release of caffeine I - the objective of this encapsulation is to slow down the rate of absorption of caffeine by the human body. The proof of the efficacy would be a comparison versus non encapsulated caffeine, using exact same beverage matrix. The encapsulated caffeine would need to stay encapsulated for 6 months from the moment it was incorporated into a beverage.
- Control of release of caffeine II - The objective of this encapsulation is to speed the rate of absorption of caffeine by the human body. The proof of the efficacy

would be a comparison versus non encapsulated caffeine, using exact same beverage matrix. The encapsulated caffeine would need to stay encapsulated for 6 months from the moment it was incorporated into a beverage.

- Control of the oxidation of ascorbic acid - The objective of this encapsulation is to prevent the oxidation of ascorbic acid when added in beverages. The proof of the efficacy of the encapsulation would be a comparison versus non encapsulated ascorbic acid, in regards to oxidation. The encapsulated ascorbic acid would need to stay encapsulated for 9 months from the moment it was incorporated into a beverage.
- Control of taste of green tea catechins - The objective of this encapsulation is to minimize the sensorial perception of epigallocatechin gallate (ECGC) when added into a beverage. The proof of the efficacy of the encapsulation would be a direct triangle test and rank order.
- Control of microbiological growth - the objective of this encapsulation is to prevent the growth of lactobacillus when exposed to room temperature, even being present in a nutritive matrix such as sugar containing beverages. The proof of the efficacy of the encapsulation would be the stable count of viable cells upon beverage aging for a period of at least four months of storage at room temperature.
- Maintain enzyme bioactivity- this encapsulation will prevent the degradation and loss of bioactivity of enzymes in a nutritive or non-nutritive acidic beverage. The proof of efficacy will be stable enzyme activity at pH of physiological activity after beverage aging of at least four months of storage at room temperature.

## Rapid Screening Technologies for Natural Anti-Microbials

We are interested in technologies that permit the rapid screening for anti-microbial properties from natural extracts/compounds. Target criteria for such technology include:

- Medium to high throughput screening platform capable of screening 1000 - 10,000 natural extracts per day for anti-microbial efficacy.
- Screening platform must be effective using natural extracts/compound as starting material - preferably natural extracts recognized as a food.
- Ideally, screening platform would detect efficacy against yeast, mold and bacteria - particularly *Saccharomyces cerevisiae*, *Zygosaccharomyces fermentati*, *Penicillium* spp, *Acetobacter* spp, *Gluconobacter* spp, and *Lactobacillus plantarum*. However, an effective high-throughput screen against a subset of these targets would also be of interest.
- Mode of action can be sterilization or growth prevention.
- Screening platform should reflect anti-microbial effectiveness at pH 2 - 4 and in the context of a carbonated beverage.

### ***Antimicrobial Assays***

We are interested in research being conducted to develop technology directed towards more efficient antimicrobial assays. We interested in both short and long term goals:

**Short Term (up to nine months):** To include validation of the screening assay with limited microorganisms. This work will demonstrate whether the assay is suitable for our needs. If successful we anticipate our internal development centers using it for antimicrobial development.

**Long term (9-24 months):** Expansion of the assay to include other organisms, adaptation to a rapid detection method for beverages, and use in a antimicrobial screening project.

Our primary interest is in collaborating to develop/transfer antimicrobial assay technology which would be used internally within the major R&D centers and bottling operations for use in rapid testing of ingredients. Based on a successful implementation within The Coca-Cola Company, we would envision making the assay available for use by third-party providers of microbiological screening that conduct work for The Coca-Cola Company on a contractual basis.

## **Packaging**

### ***High Performance Plastic Materials***

We are interested in packaging materials that can be used across our product categories (sparkling, still, water, hot-fill) that provide a sustainable impact relative to current packaging technologies, with the following attributes:

- Scalable/Cost Competitive – material must be scalable with a clear path for reaching the amounts required by the Coca-Cola system. The material must be cost-competitive at scale
- Transparent & compatible with beverages
- Extend Shelf life Packaging Technologies (Barrier to CO<sub>2</sub>, O<sub>2</sub>, & UV) – that deliver a 2x reduction in CO<sub>2</sub> loss, O<sub>2</sub> ingress and/or greater than 90% transmittance at 380 nm for the UV transmission at low usage levels and low cost.
- Anti-microbials – technologies that provide biocidal properties at low cost and high efficiency. Must be FDA/EU/regulatory approved or clear path to approval.

### ***Flavor & Aroma Release Technologies***

Dosing of flavors, aroma, or ingredients from closures or packaging materials. Release at high temperature, wetting, mechanical activations, or other mechanisms.

### ***Ingredient Release Platform***

Closure devices that can deliver fresh, functional/sensitive beverage ingredients at the point of consumption with visual impact.

### ***Metal Packaging***

We are looking for alternative technologies to shape metal for beverage applications. The preferred technology must be scalable to meet The Coca-Cola Company volume requirements. A pathway leading to a cost effective solution that is viable and economical to implement must be defined. Target unit cost of less than 2x can costs, which is less than approximately \$0.14/unit.

### ***Design/Decoration***

New aesthetic decoration technologies, including digital printing, that enhance beverage package appeal.

## **Supply Chain**

### ***On-demand Printing***

We are interested in printing technologies that will enable direct printing to our packages, thereby eliminating the need for labels and driving mass production.

### ***Aseptic Systems***

We are interested in modular aseptic technologies that will enable production flexibility and rapid deployment.

### ***Sterilization***

We are interested in technologies that reduce sterilization time and space requirements including:

- We are interested in dry sterilization methods (no water or chemicals) for closures and bottles filled by the aseptic process (and ultimately all other filling processes)
- Ability to pasteurize at lower temperatures.
- Clean-in-Place (CIP): Technologies that lead to reduced water & chemical use, and reduced time.
- Water Treatment & Remediation Technologies: We are interested in technologies for water purification, filtration and waste water minimization.
- Sterilization: Package sterilization without chemicals.
- Non-thermal sterilization

### ***Lean and Green Energy Solutions for Beverage Industry***

***Application:*** We are looking for energy saving solutions in the following areas:

#### **At the Plant level**

- Process improvements that will allow the filling of carbonated soft drinks without the need for pre-cooling of the product and subsequent re-warming of the package.
- In the absence of a 100% ambient fill alternatives, we are interested in evaluating heat recovery technology to capture the waste heat from the cooling equipment for reuse in the warming tunnels.
- Conveying scenarios that can help us limit the square footage of conveyors in use. The less conveyors utilized the less energy utilized.
- Ways to cold clean in place (CIP), as an example ozone.
- PET bottles that can be blown at a lower pressure. The higher the pressure required to blow the bottle, the higher the energy requirements.



- Innovative water heating technologies, as an example solar and high efficiency water heating. We need 185 degree F water for most processes.

## **At the Vehicle level**

An area of interest is energy solutions for our fleet of delivery trucks.

## ***Mixing Technology/Efficiency***

- Effective mixers along with technology to determine degree and efficacy of mixing for various ingredients (wet and dry).

## ***Filtration Techniques***

- Filtration to filter out microbes to make products commercially sterile (no added preservative products).

## ***Universal Filler***

- Filler that can accept any package design from its flexibility.

## ***Water Efficiency***

- Efficient metering in the in-plant water network. Metering systems that allow quantity use to be tracked and monitored to determine line and process efficiency.
- In-line, real time quality monitoring for water quality protection. Monitoring incoming water quality to assess threats and quality prior to treatment.
- Filters to handle high SDI waters that will treat to allow membrane treatment without performance degradation. Some waters have a high SDI and treatment via membranes results in frequent membrane failure or replacement.
- Innovative water treatment processes to achieve high quality water for in-plant uses. Many wastewater streams exist in a facility. Treating these streams at the point of generation may reduce the treatment requirements and volume. Small treatment systems with low energy and space requirements are needed to allow reuse of water within processes.

Nature of the proposal:

Two alternatives are envisioned, although this should not be interpreted in any limiting way:

- A research proposal aiming to develop a well defined idea or concept. The proposal should indicate the nature of the idea, plus timing and funding required achieving defined milestones. General, not targeted, research proposals will also be considered, but are clearly less desirable than a defined concept.
- A preliminary commercial base already exists, and potential supplier is seeking some type of partnership to fully develop the concept. The proposal should indicate the current development status, next steps, timing and funding required to achieve commercial production, plus nature of the desired commercial relationship.

## Cold Drink Equipment

### ***Communications***

The Coca-Cola Company is interested in low cost communication technologies to connect vending machines and coolers to back-office networks, in order to obtain operational data, track inventories, authorize and settle cashless transactions, and distribute marketing content. The System is currently using monthly subscription based models with traditional wireless carriers, such as Verizon and AT&T, to connect over CDMA and GSM networks. While various methods of connection have been used to network vending machines for many years, robust communication technologies and low cost of ownership and operation are of interest to the Company. Candidate communications technologies must be:

- **Reliable** – Candidate communication technologies must be at least as robust (i.e. reliable in building, and in other difficult RF environments) as current solutions from Verizon or AT&T over CDMA or GSM. Cashless transactions require authorization within 4 seconds to satisfy consumers, demanding very low network latency (the majority of the 4 seconds is consumed by the acquiring bank handling the authorization). Maintaining solid network connections is extremely important, as critical businesses processes, such as daily truck routing, depend on the data moving through the network. In-building coverage must be as good as CDMA or GSM technology. Strong coverage in basements, parking garages and high rise buildings would add considerable value.
- **Scalable** – Candidate communication technologies must be able to accommodate 500,000+ pieces of connected equipment, and must not require specialty infrastructure costs to scale. Any infrastructure costs required to scale shall be offset by operational cost savings over traditional subscription based models.
- **Cost Effective** – The current costs for connecting equipment vary widely by bottler, but \$3 per month per vender (or cooler) is achievable but aggressive. Radio modules also vary based on network types, carriers, etc. but range in price from \$40 to \$100 per unit. As mentioned above, these costs inhibit business cases and prohibit further scale, so candidate communication technologies must at least offer an incremental improvement.
- **Standards Based** – It is strongly preferred that candidate communication technologies follow industry standards. An example of a standards-based communication technology the System is watching closely is 802.16 or WiMAX. This technology promises to change the communication landscape over the next 5 years. Past implementations of communication technologies that were not standards-based proved difficult to support over time. In addition, innovation in radios or connecting products was very limited compared to the options available

for standards-based solutions. The costs to implement and support standards-based solutions are almost always cheaper over the long term.

### ***Sustainable Refrigeration, Insulation and Energy-Efficiency***

We are interested in technologies that improve the environmental performance of cold drink equipment. Examples may include cost-effective advances in vacuum insulation, rapid and energy-efficient cooling for individual products, next-generation refrigerant fluids, etc.

### ***Sales and Marketing Equipment***

Currently we are using commercially available refrigeration technology using grid power along with standard refrigerants. We are seeking more efficient alternatives that are cost competitive with existing technology. We are also interested in environmentally friendly off-grid power sources for our sales and marketing equipment."

## Water

Many water technologies are used in our production facilities. These technologies are important to beverage production and are a critical part of manufacturing. New technologies that do the same thing as existing processes are needed, but they must pass significant hurdles. Not only must the technology be better in what it does, it must also be significantly better in terms of cost, energy, water use, and savings. A new technology that is simply better does not offer the advantages to replace existing equipment.

Water is our main ingredient. Water also serves as our primary cleaner. Without sufficient supplies of good quality water our business will not succeed. Water must meet Company quality standards for use as an ingredient, rinse agent, cleaner or other uses. These quality standards are designed to protect to integrity of our beverages. As quantity and quality of water are threatened around the world, The Coca-Cola Company is focused on using water efficiently to produce beverages. Reduced water use is achieved through process efficiency and reuse/recycling of treated process wastewaters. When we look for ideas and innovation in water we look through the water cycle.



## **Water Source**

- Early warning systems for contaminant introduction
- Real time, in-line water quality monitoring
- We are interested in desalinization technology, including membranes and waves with a low cost to operate including depreciation. Efficient disposal of desalination reject and or evaporation systems.

**Early warning systems for contaminant introduction:** Being able to monitor a water source for possible contamination before it enters the plant allows preventative measures to be taken. Biological and chemical parameters must be assessed. This system must be accurate, reliable as well as affordable.

**Real time, in-line water quality monitoring:** The ability to measure and monitor contaminants prior to and following treatment in real time would allow assessment of water quality as it is produced. All contaminants (biological and chemical) must be assessed. This system must be accurate, reliable as well as affordable. Such systems could include:

- Real time, in-line water quality monitoring. This system could be used for either the raw, incoming water or the water produced by the plant's water treatment equipment. Water on a chip quality analysis.

**Demand/Supply forecasting:** Evaluating a water source, the watershed, and the users to predict the capacity of the source to meet future needs.

## **Water Treatment**

- Water purification wasting less water
- Trace and emerging contaminant removal

**Water purification wasting less water:** Water for beverage must be treated to meet Company quality specifications. Often, treatment involves wasting water and has high energy utilization. For example, a reverse osmosis process that recovers only 80% of the water. Cost effective, energy efficient processes that recover 95% of the water for use as treated water are desired. Such system could include Passive water purification systems – using hydrostatic pressure rather than pumps.

**Trace and emerging contaminant removal:** As more contaminants are detected at minute levels, existing technology to remove these constituents is challenged.

## ***Efficient Water Use***

- Water capture that collects more water
- Metering to measure water use
- Point of use treatment for reclaiming waters
- Cost competitive, environmentally friendly alternative hot water heating systems

**Water capture that collects more water:** Water splashes and sprays over equipment, floors, and other surfaces eventually making its way to the drain. Capturing water at its point of use for treatment and reuse is desired. This system would allow minimal treatment to be used and reduce contamination of waters for reuse.

**Metering to measure water use, energy use & integrate:** Water use often is only measured at the point of entrance to the plant or following water treatment. The ability not only to measure water use throughout the production process, but to monitor it is desired. This information coupled with energy use through the process could be used to develop optimal production processes.

**Point of use treatment for reclaiming waters:** In-line, point of use treatment schemes for reusing process wastewater from manufacturing processes. Cost effective, energy efficient systems that produce water for process use with minimal waste are desired.

## ***Wastewater Treatment/Reclamation***

- Treatment concepts for membrane reject streams with high dissolved solids. Membrane reject must be treated prior to discharge and inorganic components are difficult to remove or impact current wastewater treatment processes

## ***Water Summary***

- Localized water production
- Water delivery systems
- Sanitation systems
- Efficient agricultural irrigation methods
- Early warning systems for contaminant introduction
- Real time, in-line water quality monitoring
- Demand/Supply forecasting
- Water purification wasting less water
- Trace and emerging contaminant removal
- Water capture that collects more water

- Metering to measure water use
- Point of use treatment for reclaiming waters
- Treatment for low wastewater flows or intermittent flows
- Concentration of high strength waste streams
- Treatment of high TDS waste streams

## ***Energy Targets***

### **Overall Strategy**

The Coca-Cola System is seeking to identify, test and ultimately replicate products and services that can deliver energy and carbon savings beyond the levels provided by the incumbent baseline technologies discussed below. We do not plan to be involved directly with the initial development and commercialization of new products and services but instead would prefer to work with vendors that either have a commercialized offering or are seek partners to provide Beta testing. It is very important that any project undertaken be widely repeatable throughout our System and either provide immediate economic benefit or have the promise of doing so through minimal future development. Below are the baseline economic parameters required for serious consideration:

Minimum IRR:	15% over 10-yrs
Electricity Price:	US\$0.10/kWh
Boiler Fuel Price:	US\$7.50/mmBTU
RECs/Carbon Credits:	Retained by Coca-Cola
Typical Plant Size:	100,000-250,000 square feet

1-5 MW in electrical demand  
100-250 boiler HP of capacity

### **Plant Level**

Energy improvements are being sought in the following areas:

- Facility lighting – Currently we are using as a baseline technology of T-8 fluorescent lighting in highly reflective fixtures utilizing automatic motion sensors and daylight harvesting (where applicable). We are seeking improvements that can deliver incremental savings beyond the use of this baseline system without compromising lighting output, quality or reliability.
- HVAC (Heating, Ventilation and Air Conditioning) – Currently we are using commercially available rooftop HVAC units and in some cases air-cooled chillers in combination with gas or steam heating. We completely condition



our office and lab spaces and some of our production areas (roughly 10-20% of the total plant area) and heat the remaining space for freeze protection only. We are seeking improvements that can deliver incremental savings beyond the use of these baseline systems without compromising space conditions or reliability.

- **Process Cooling (Ammonia Chillers)** – Currently we are using as a baseline technology of reciprocating ammonia chillers and water cooled condensers and in some case screw compressors for chilling feed water to 36-40 deg F. We are seeking improvements that can deliver incremental savings beyond the use of this baseline system without compromising product quality or reliability. Specifically, we are interested in technology that can recover high grade heat (energy between systems of ~115 deg F differences or higher) from the ammonia chiller condensing circuit.
- **Compressed Air (High & Low Pressure)** – Currently we are using variable speed, oil-free screw compressors with refrigerated dryers to generate low pressure (80-100psi) air and large reciprocating compressors to generate high pressure (up to 600 psi) as a baseline technology. We are seeking improvements that can deliver incremental savings beyond the use of these baseline systems without compromising product quality or reliability. Specifically, we are interested in technology to allow PET bottle blowing at lower pressures.
- **Process Heating (Steam/hot water generation)** - Currently we are using natural gas and light fuel oiled fired low pressure (less than 100 psi) steam boilers as a primary heating source for generating hot water at temperatures varying from 110 deg F to 210 deg F. We are seeking improvements that can deliver incremental savings beyond the use of this baseline system without compromising product quality or reliability. Specifically, we are interested in technology that will directly generate hot water more economically.
- **Alternative Energy Production** - Currently we receive our electrical power from the local utility and our fuel from either the gas pipeline or a local fuel oil supplier. We are seeking alternative energy sources (solar, wind, biofuels, etc.) that can deliver reliable energy supply with an improved carbon footprint at a cost equal to or lower that of the default supplier without being required to sell the environmental benefits to finance the project. We are also interested in environmentally friendly, cost-effective off-grid power sources for our sales and marketing (i.e. coolers and vending machines) equipment.

## Vehicle Level

We currently have a fleet of Hybrid Diesel Electric delivery vehicles up to 55,000 pounds gross vehicle weight (GVW). We are interested in lower cost batteries for this application.

- Improvement in fleet and routing efficiencies (fuel additives, aerodynamic improvements, improvements in combustion efficiency, constant speed transmissions, hybrids and other alternative power trains.