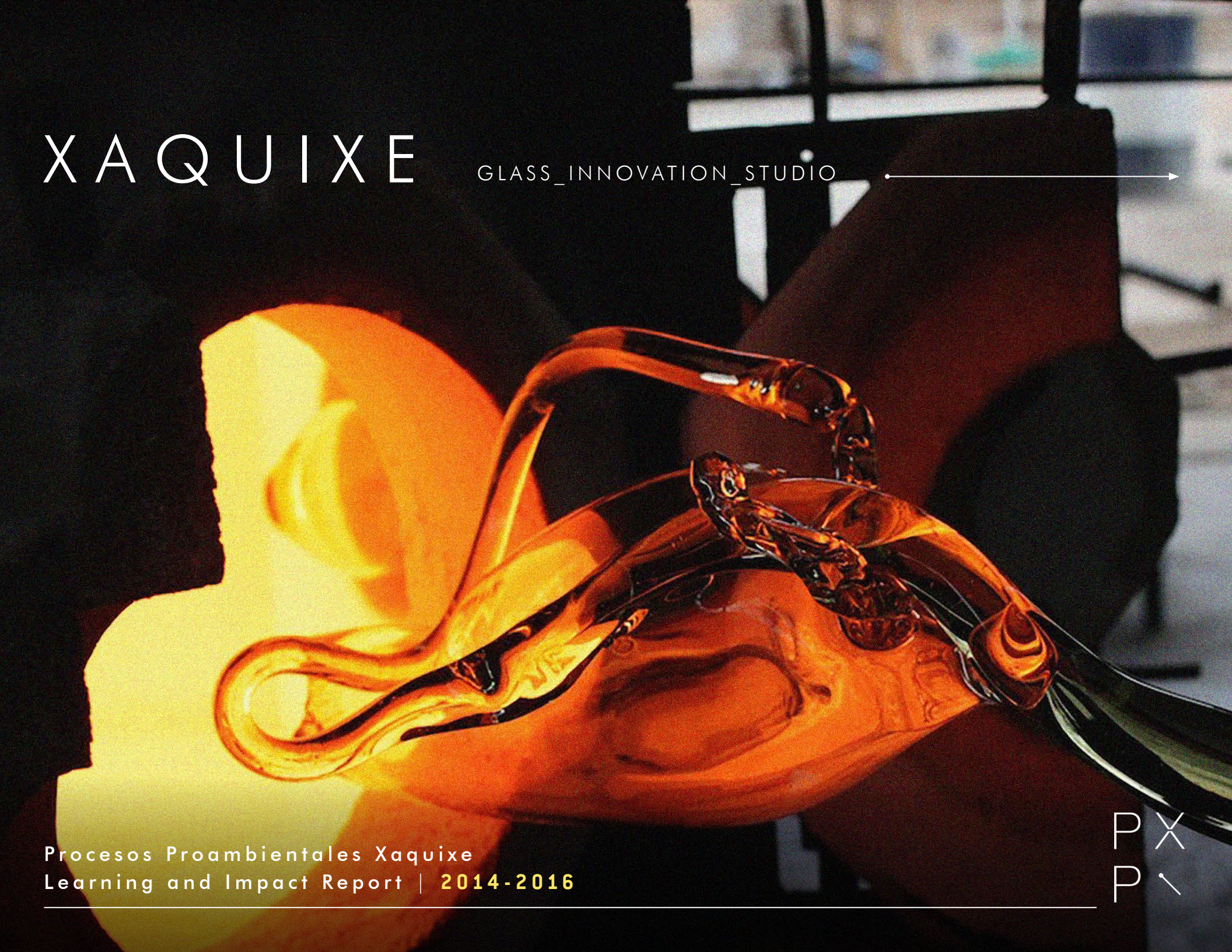


XAQUIXE

GLASS_INNOVATION_STUDIO

PX
P

Procesos Proambientales Xaquixe
Learning and Impact Report | 2014-2016

OUR VISION

MOBILIZE AN ECOSYSTEM OF SUSTAINABLE SMALL INDUSTRIES AND COMMUNITIES IN MÉXICO.

What We Do

The team at Procesos Proambientales Xaquixe (PPX) has worked determinedly for 15 years to test sustainable technologies with small enterprises to decrease environmental degradation and galvanize local participation in the process, while improving socio-economic possibilities for communities.

How We Do It

We work across sectors using a whole systems approach to search for new solutions to entrenched local energy challenges. We observe, analyze and often ask “How can the waste from one process become a source of energy for another?” We commit to working over the long-term with producers of mezcal, ceramics and glass in order to create familiarity with corresponding technologies to improve the quality in production and reduce pollutant emissions that create negative impacts on their health, economy and work environment.

ACHIEVEMENTS OVER THE LAST **3 YEARS**

1. Consolidated Studio Xaquixe (XQ), an enterprise modelling the best in equipment, local talent and a whole systems approach to innovation. By abandoning our dependence on non-renewable energies we significantly reduced operating costs, while increasing sales. Our goal: to set the example for micro-industrial sustainability in the region.

2. Founded Procesos Proambientales Xaquixe (PPX), a non-profit education and laboratory arm of XQ to research and adapt green technologies based on local systems and resources.
We evolved PPX into a skills training center, consultancy and prototype lab to support small, artisanal enterprises.

3. Seeded innovations for the next stage of PPX — a regional platform for support, knowledge sharing and inspiration to increase cross-sector collaboration and technology experimentation in the region.

OUR SPACE

THROUGH VARIOUS COLLABORATIONS AND THE SUPPORT OF A BROAD NETWORK, PPX HAS CREATED A ONE-OF-A-KIND FACILITY IN MEXICO FOR INNOVATION AND LEARNING.

Our space includes:

- Mezcal distillation ovens with copper and clay stills
- Ceramic oven
- Lab equipment
- Multi-union solar cell tower with heliostats for solar concentration
- Biomass burners
- Multi-combustion burners
- Glass kilns
- Glass annealers
- Glass reheating furnaces
- Anaerobic biodigesters
- Solar concentration panel prototypes
- Rain catchment system

Completion of the Training Center would include the build out of:

- An education and work space for trainees and a biodigestion lab to collaborate with university students, technicians and experts in creating energy from local waste.
- The set-up and adaptation of the solar concentration equipment, with support to finance a final comparative study of the impacts.
- The build out and updating of our biodigestor.

IN NEED OF FINANCIAL SUPPORT

THE TEAM

A BROAD GROUP OF
LOCAL EXPERTS.

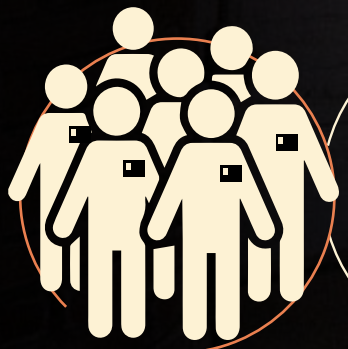
Our sizable strides at PPX over the last three years have been made possible by an incredible staff, a group of 15 team members and additional volunteers with a diverse background of skills: engineering, design, art, architecture and communications. We have endeavored to cultivate local talent, developing trained professionals in combustion, alternative energies, alternative business management and specialized engineering.

Xaquixe is led by **Christian Thornton**, the engineer of a myriad sustainable technologies for small scale producers in glass, ceramics and mezcal and **Salime Harp Cruces**, a Oaxacan native who mixes the multidisciplinary and systemic approach of an industrial engineer with considerable experience developing business models for social impact.

OUR WORK AT-A-GLANCE

1100+

STUDENTS
TECHNICIANS
TOURISTS
CREATIVES ▸

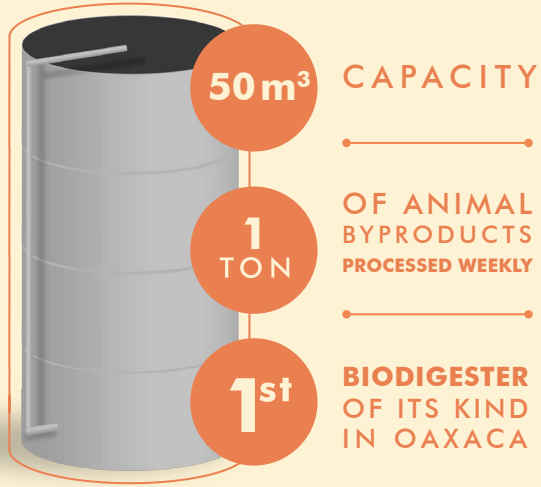


VISIT OUR SPACE EACH YEAR

PX
P\

OUR WORK AT-A-GLANCE

THE ANAEROBIC BIODIGESTER



RAINWATER HARVESTING SYSTEM

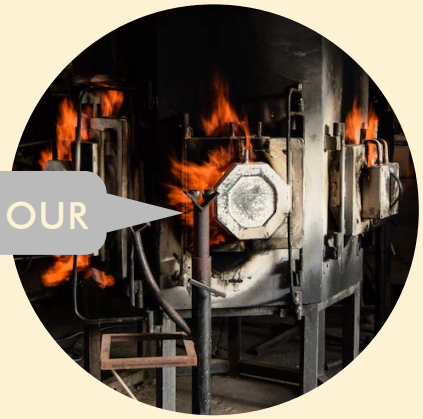
127,000 - LITER
CAPACITY

RAINWATER CAPTURE
FROM A **552 M²**
ROOFTOP

MULTI-COMBUSTION BURNER

CONVERTS
1000 LITERS
OF RESIDUAL OILS TO
732 KW
OF ENERGY

TO MAINTAIN OUR



REHEATING FURNACES
AT
2,372 °F
FOR
10 HOURS

OUR WORK AT-A-GLANCE

70%

The studio's **reduction in electricity** use owing to our multi-stage heat recuperation system.

95%

The amount of raw materials dervied from **recycled trash** & transformed into crystal-quality glass.

100%

Our **growth in sales** from 2013-2016.

60%

The **annual decrease in operating costs** due to energy savings.

WE HAVE REDUCED

80%

of firewood consumption with our ceramic kilns using residual oils.

92,266

KILOS

of annual CO_2 emissions from our production processes

90,000

LITERS

of yearly propane gas use from our processes, wiping out 80% of our gas consumption.

$27,000

USD

from our annual production costs by cutting propane gas use and increasing efficiency.

OUR WORK AT-A-GLANCE

Our partners investing in PPX to build new technologies and models for working:

CONACYT

Fundación Alfredo Harp Helú Oaxaca

cisco

Halloran Philanthropies

FONAES

FONART Fondo Nacional para el Fomento de las Artesanías

sprout Enterprise®

Collaborators we have loved dreaming and scheming with:

IT innovando la tradición ac

b-tu Brandenburg University of Technology Cottbus - Senftenberg

cideteq

Universidad La Salle México

Los Danzantes Mezcal & Restaurantes

Filmmaker Snejina Latev

Some accolades picked up along the way:

25 años Premio Adiat a la Innovación Tecnológica

SEED promoting entrepreneurship for sustainable development

Ashoka Fellow

Premio Nacional de Trabajo 2015

Clients we are proud to work with:

Francisco Toledo | *Alejandro Santiago*

ABC Home | *Dosa Inc* | *Ochre* | *Apoli*

Legorreta® | *Lanii* | *The Citizenry*

Our next generation of tech specialists:

Taller Ruiz López | *Arte Papel* | *Palenque*

Olegario Juárez | *The Olio* | *Green VI*

Mezcal Sombra | *Los Danzantes*

ON TRACK FOR 2017-2018

1 UPCOMING PROJECTS

A COLLABORATION WITH THE UNIVERSITY OF BRANDENBURG AND THE INBIA ENTERPRISE IN GERMANY.

Our partners were awarded a grant ("The Commission to promote research bodies with Argentina, Brazil, Chile, Colombia and Mexico") in 2016 by the German Federal Ministry of Education and Research that affords us the great opportunity to work with a team of experts in the research and analysis of vinasses, a toxic byproduct generated from the mezcal distillation process; our objective is to find a safe use for vinasses which are currently killing organic life in the rivers of producing populations in Mexico.

STATS

1. **3 scientific specialists in anaerobic digestion processes and efficiency.**
2. **3-5 years of support and visits to the PPX Training Center.**
3. **Access to the designer and designs of the most efficient biodigester on the planet (95% efficiency levels).**

B CAMINOS DEL MEZCAL

We will carry out mezcal distillation demonstrations at our Training Center with a group of 20+ local producers to disseminate our technology and initiate a jumping off point for a potential long-term collaboration.

STATS

1. **1 distillation test to measure: quality, energy consumption, reduced pollutant levels and emissions.**
2. **Facilitate 1 dialogue on the challenges for producers, including operational costs and pollutant impacts.**

ON TRACK FOR 2017-2018

1 UPCOMING PROJECTS

C LA SALLE UNIVERSITY, OAXACA

After three years of collaboration with La Salle, we have mapped out an exciting new path to catalyze projects with students and faculty in benefit of the Oaxacan community.

STATS

1. **Launch 1-2 creative projects in communities neighboring the university and PPX, working with the reuse of local waste.**
2. **Host 2-3 workshops with our German scientific allies, gathering participation from neighborhoods along the Atoyac River to study potential sustainable water treatment solutions.**
3. **1 collaboration with the machinist facility on campus to develop new technologies for small artisanal industries.**

D DESIGN OF TRADITIONAL TOSTADA OVENS (A FRANCISCO TOLEDO COLLABORATION)

These sustainable ovens used to make traditional regional tostadas will be delivered to local producers in the Isthmus region of Oaxaca whom, due the devastating earthquakes in September 2017, lost their homes, ovens and means of generating income.

STATS

1. **The construction of 3-4 prototypes.**
2. **A 96% decrease in CO_2 emissions for the new ovens.**
3. **The elimination of smoke output for the ovens that cause respiratory problems for producers.**
4. **The potential to create a sustainable alternative for the 8,000+ families that use this oven in the region.**

ON TRACK FOR **2017-2018**

2 IMPORTANT PROJECT FOLLOW-UP

A ON SITE TESTS WITH **MEZCALES MILAGRITO**

We will measure on site the impacts of our distillation technologies in the following areas: pollutant outputs, mezcal quality-taste and energy consumption. We will continue our work coaching Milagrito, as well as making adaptations to the equipment as they train their own team on the technology and its maintenance.

B COLLABORATIVE FEEDBACK SESSIONS WITH **CERAMIC ARTISANS AND DESIGNERS.**

We will gather a group of users across sectors (ceramic artisans, artists, designers and educators) with our partners at Taller Ruíz López. Using our new ceramic oven in the PPX Training Center we will review the design, run demonstrations and test the performance of the equipment. In creating a space for collaboration between sectors we hope to better evolve the next prototypes of our ovens and technologies, adapted for a diverse group of users.

ON TRACK FOR 2017-2018

3 UPCOMING EVENTS:

A STUDIO XAQUIXE'S
15TH ANNIVERSARY PARTY

There will be guided tours of our innovative recycling and energy processes and blown glass demonstrations.

Celebrate with us!

(projected date: November 2017).

B **1ST PUBLIC CONFERENCE**
TO UNVEIL THE PPX TRAINING CENTER AND BIOGAS PROJECT

in collaboration with the University of Brandenburg for artisanal producers, students and research faculty in Oaxaca, held at LaSalle University

(projected date: March 2018).

C **WORKSHOPS**

I. "Agave plant cooking ovens using hybrid sustainable technologies"
A collaboration between PPX, Los Danzantes & The National Institute for Entrepreneurs (INADEM)

II. "Sustainable interventions in public spaces"
With support from the Home Runs Banamex program and the collaboration of the Magdalena Apasco Etla Middle School.

ON TRACK FOR **2017-2018**

4 STUDIO XAQUIXE GOALS

A A **300%** increase in production, sales and exportation over the next 3 years, taking care to balance production capacity and the technical learning curve in the studio for the specialized field of glass blowing.

B With guidance and assessment from the team from the University of Brandenburg we aim to improve the efficiency of our systems to continue reducing our gas consumption levels.

C By early 2018 we will have completed the testing and assembly of our solar concentration system in order to reduce electricity use by another **35%**; in less than two years we expect our electricity to be **100%** solar powered.

5 RECEPTION OF VISITORS TO OUR SPACE

ESTIMATED NUMBER: 800

Students, industrial engineers, architects, designers, artisans, mezcal producers, scientists, technicians and tourists, among others.

STORIES FROM THE FIELD

Every project and collaboration is a world of exploration, challenges, learning and inspiration in cohort with our partners. The numbers don't tell the whole story. Thus, here are a few cases from the field to help share the shades of innovation and impact we are achieving with our tenacious partners. We hope that the challenges, exchange and learning can be taken forward so that the collaboration can benefit more than just one workshop, but can produce ripple effects in the creation of better designs and processes for use in the collaborations-to-come.

STORIES FROM THE FIELD

RUÍZ LÓPEZ WORKSHOP

In 2012 we began our collaboration with the Ruíz López Workshop, led by sisters Rufina and Leonila—two ceramic artisans from the village of Santa María Atzompa. A large economic decline due to the market's recent rejection of lead-based glazes, inspired the Ruíz sisters to innovate their production process and join up with the non-profit Innovando la tradición and PPX to co-design a ceramic kiln and multicombustión burner that could achieve the high temperatures necessary for non-lead glazes, while also offering a more energy efficient alternative to burning wood, a non-renewable resource. For five years we have continued to work with the Ruíz López family to install and continually test the technology in their workshop, guide them in its maintenance and improve its design and performance. The training and coaching process resulted in not only a basic handover of technology know-how—but also a rich exchange of knowledge, design and context that have helped shape the next stage of the project.

In 2016 we built a smaller version of the ceramic kiln for use in our Training Center with constant input and participation from Rufina. We learned from numerous on-site visits at the Ruiz López Workshop that using traditional materials (adobe, tabique), as well as a design that more-closely resembles the traditional kiln structure in Atzompa, helped to make the technology less intimidating and more-easily understandable for the artisans; the transfer of knowledge and the adoption of processes becomes more fluid. Likewise, the smaller size was a design adjustment we discovered with Rufina that would allow the workshop to use the kiln in smaller firings—a frequent need—making the kiln even more impactful in lowering energy costs.

RUÍZ LÓPEZ WORKSHOP

THE RESULTS

OUR TESTS WITH THE TECHNOLOGY ON SITE AT THE RUÍZ LÓPEZ WORKSHOP REVEALED:

- A **50%** reduction in the use of wood for kiln firings.
- A **30-50%** decrease in operational costs due to increased energy efficiency and a reduction in firewood consumption.

Through our long-term partnership with the Ruíz López family we also observed an unexpected flourishing of innovative thinking amongst the artisans during the process.

RUÍZ LÓPEZ WORKSHOP

WHAT WE LEARNED

In addition to detailed adjustments, we also learned that **good design requires a process of input and adaptations in-the-field,** with the user, over a significant amount of time. This confirmed for us that there are no "cookie cutter" technologies that can be applied uniformly at any workshop.

An important facet to working with artisanal producers is an investment in building the right conditions (of trust and a clear shared responsibility) to achieve a fruitful exploration and adoption of new processes and technologies. This necessitates **programming a longer phase for coaching and accompaniment with the artisans.**

STORIES FROM THE FIELD

MEZCALES MILAGRITO

The growth of the artisanal mezcal industry has created a number of environmental and production challenges. First, for every 600 liters of mezcal produced it is necessary to use approximately 3 tons of firewood to cook and smoke the agave. Second, the distillation process generates a toxic byproduct known as “vinasses,” which are discharged into rivers with no oversight, killing all organic life.

PPX, within the framework of a project financed by CONACYT, partnering with Mezcales Milagrito, developed distillation ovens with the capacity to generate heat from a multi-fuel burner. With the new technology it was possible for Milagrito to substitute propane gas for firewood, with the additional benefit of eliminating other toxic alcohols in the end product and extending the shelf life of the equipment. Our vision was to respond to big environmental challenges present within the artisanal mezcal production process with sustainable ideas and innovations. Our exploration and work still continues.

MEZCALES MILAGRITO

THE RESULTS

We compared the combustion efficiency of our new distillation process and burner with other types of burners available on the market.

- We registered savings of up to **25-40%** in the consumption of propane gas when using the multi-fuel burner—proving its energy efficiency with mezcal production.

- In addition, we noted a **60%** reduction in CO_2 emissions due to the elimination of wood in the firing process.

MEZCALES MILAGRITO

WHAT WE LEARNED

Accustomed to a simple wood burn, the mezcal artisans felt unsafe when responsible to make manual adjustments to our gas burners. Thus, we developed a control panel to partially automate the process. However, we see the need to explore a fully-automated system with safety mechanisms in place. **Assured safety at a low production cost will be our biggest challenge** in the next development phase.

We learned an incredible amount when adapting the aesthetic design of our technologies for ceramic artisans that naturally transferred to our work with Milagrito. The adaptation of materials and overall end-design of the oven turned out beautifully.

When comparing our systems to the more-simple Venturi burners on the market **we can see potential to create a hybrid that will combine the ease-of-use of the Venturi burners, while streamlining energy efficiency**—channeling recuperated heat from the first distillation into the second. In terms of quality, our adjustable burner system allows the producer a "softer" burn and great control—which delivers far better mezcal quality. As for energy, we found that the PPX technology reaches ideal temperature in half the time it takes the Venturi; and throughout the burn used 30% less gas—a big savings in energy and cost for the producer. After initial lab studies, we noted that our burner system produced five times less copper content in the end product than other traditional gas-powered distillation processes.

Challenges lie ahead to explore a hybrid option. First on the list is the need for burner technicians in the region who can troubleshoot onsite demands that arise.

OUR LEARNING AND CHALLENGES

We are passionate about what we do and proud of all that our small team—with the support of a large network—has achieved over the last 15 years. But to be honest, along our incredible journey we have made some mistakes and missteps. We think those mistakes serve as great sources of learning for us and others taking similar strides. This story of challenges and learning reconfirms our commitment and enthusiasm for what we do and where we do it. PPX's sights are set on the work ahead and the challenges we foresee in our path. However, we would like to share a meditation on the stumbling blocks that have occurred and what we learned.

OUR LEARNING AND CHALLENGES

We learned the importance in maintaining direct communications with participating artisans and the various stakeholders involved.

By communicating through intermediaries (e.g. collaborators, NGOs, investors), several challenges arose along the way due to a lack of clear agreements, nor a deep understanding of the needs and challenges of direct users of our technologies. Our artisan entrepreneurs have to be a fundamental part in the design and adaptation of the technologies that they will use; each one, possessing their own set of specialties and skills, can contribute to a better design. This role cannot be achieved through communication via a third party.

There exists a resistance to sharing new processes and technologies locally.

Given a very limited local market for small businesses, the pervasive notion amongst entrepreneurs is of scarcity and fierce competition. This has weakened aspects of solidarity and collective learning in the industry. The moment that a producer achieves a niche in his market (for example, a better margin due to the reduction of energy costs), he has a fear and resistance to open his doors to share what he has learned. However, the PPX project seeks to cultivate solidarity through our process of training and support—creating spaces to convene the network of specialists and artisans. We hope to build a more-collaborative community of technology users to foment a base of specialists who can support each other; but we see the long-term work ahead to co-create this culture. Building trust and commitment among each generation of PPX specialists will be critical to counter-balance the dominant culture of competitive isolation.

OUR LEARNING AND CHALLENGES

Little substantive investment flows to support the early stages of research and development with small enterprises in Mexico.

The poorest communities and smallest enterprises are stymied by a lack of access to investment, training and new ideas that could inspire and support them to build their own creative technology solutions to growing energy challenges. Though not professional fundraisers, we often find ourselves working with artisanal entrepreneurs to locate funding to help them launch the first stages of research and development of sustainable processes and technologies. We hope to build stronger relationships with organizations who work in early-stage funding who might better connect and support our entrepreneurs in this phase.

Fifteen years have taught us the need to invest in cultivating a culture of innovation and self-sufficiency in parallel with technological solutions.

Alternative technologies are merely a tool. We need better operating systems to put them to use; helping communities to creatively confront challenges, not only today, but those that await them tomorrow, too. In the long-term, we need to encourage practices of innovation and self-reliance that do not inhibit collaboration between workshops and specialists. Our greatest risk factor in collaborating with allies (funders, investors) has been the dominant tendency in the social innovation sector to push entrepreneurs to scale large and quickly at the sacrifice of strengthening a platform for lasting collaboration and innovation.

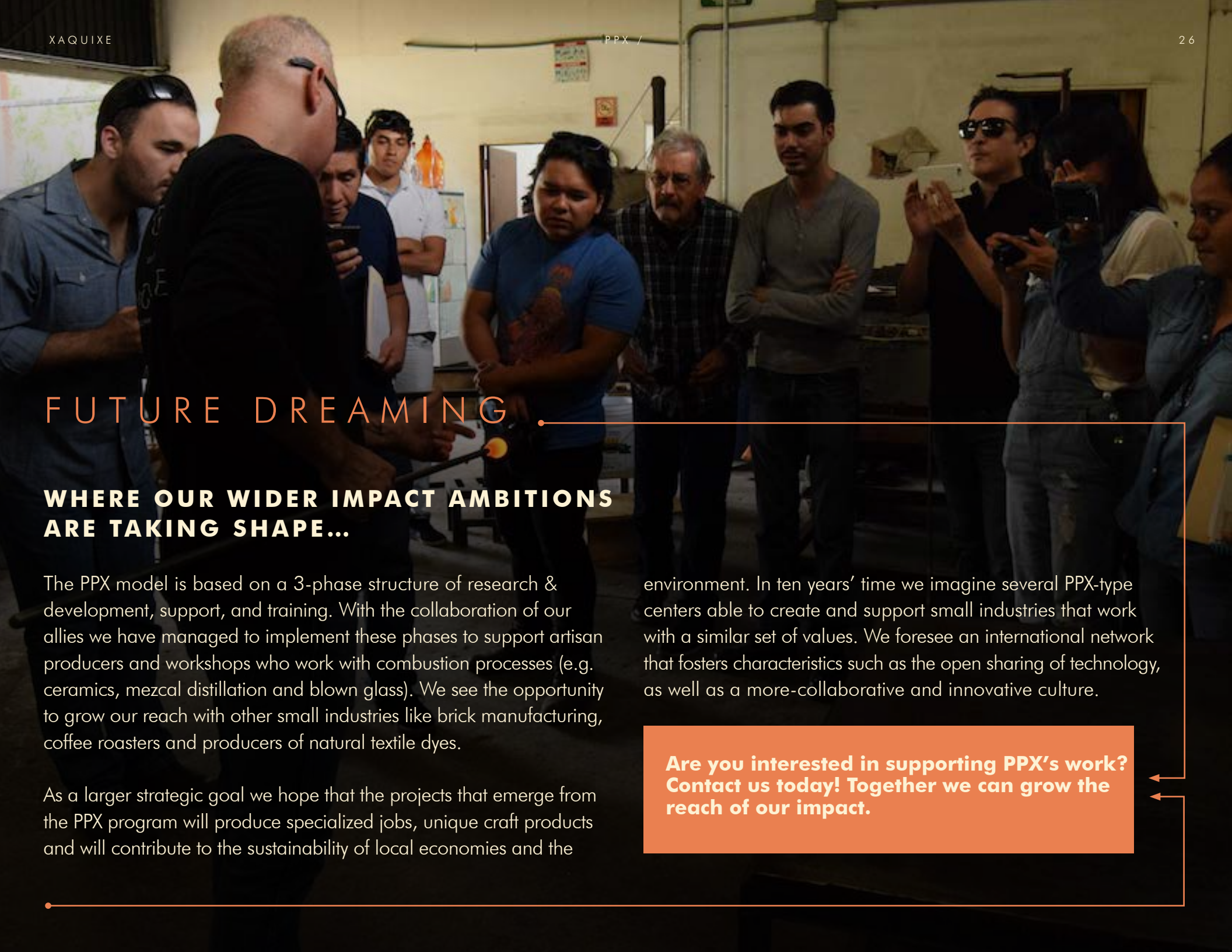
We see a great opportunity to grow our communication and promotion efforts.

We faced several challenges in recent years (a couple of hacks to banking and social media accounts) that flooded us with tasks and made us wary of investing in wider promotion. In addition, we recognize our tendency towards “doing” at PPX: often leaning towards our work in the studio in sacrifice of sharing our work more widely with the public. However, a path of action without a pause for reflection and sharing is not a complete process. Thus, we aim to invest more time and resources to spread the word about what we are doing and to learn among our rich network. We want to extend the endemic solidarity thread throughout this project to our communication practices. This report is a first step towards that goal.

FUTURE DREAMING.

VINASSES: WHERE OUR TECHNOLOGY EXPLORATION IS HEADED...

Each technological challenge that arises when we collaborate with a new artisanal producer provides us with an opportunity to stretch our thinking towards a newfound innovation. Our newest challenge is the critical need to find a sustainable channel for toxic vinasse byproducts found in the mezcal distillation process. These toxins are quickly destroying all organic life in the river systems of producing populations. What if rather than a problem, the vinasse byproducts could be transformed into a source of energy for producers? We have gathered some of the foremost minds in biodigestion analysis and experimentation to tackle this question in the next 3-5 years. Our remaining hurdle is to finance the build out of a biodigestion lab in our space to host meetings of experts from Germany, regional universities and students, as well as local specialists. The potential impact is big: artisanal mezcal producers from more than 7 states in Mexico, and their surrounding environs, could benefit from the results.



FUTURE DREAMING

WHERE OUR WIDER IMPACT AMBITIONS ARE TAKING SHAPE...

The PPX model is based on a 3-phase structure of research & development, support, and training. With the collaboration of our allies we have managed to implement these phases to support artisan producers and workshops who work with combustion processes (e.g. ceramics, mezcal distillation and blown glass). We see the opportunity to grow our reach with other small industries like brick manufacturing, coffee roasters and producers of natural textile dyes.

As a larger strategic goal we hope that the projects that emerge from the PPX program will produce specialized jobs, unique craft products and will contribute to the sustainability of local economies and the environment. In ten years' time we imagine several PPX-type centers able to create and support small industries that work with a similar set of values. We foresee an international network that fosters characteristics such as the open sharing of technology, as well as a more-collaborative and innovative culture.

Are you interested in supporting PPX's work? Contact us today! Together we can grow the reach of our impact.

PPX

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