



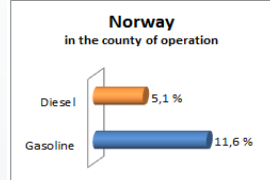
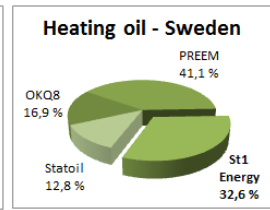
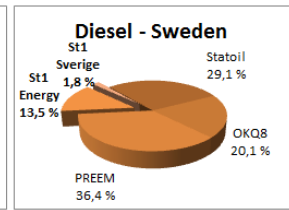
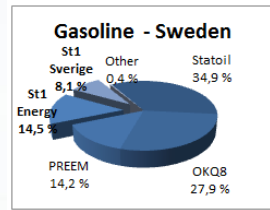
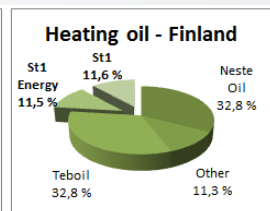
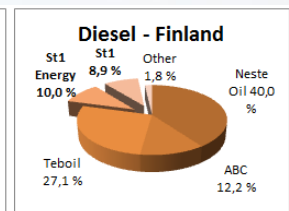
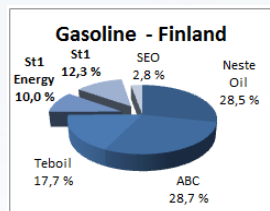
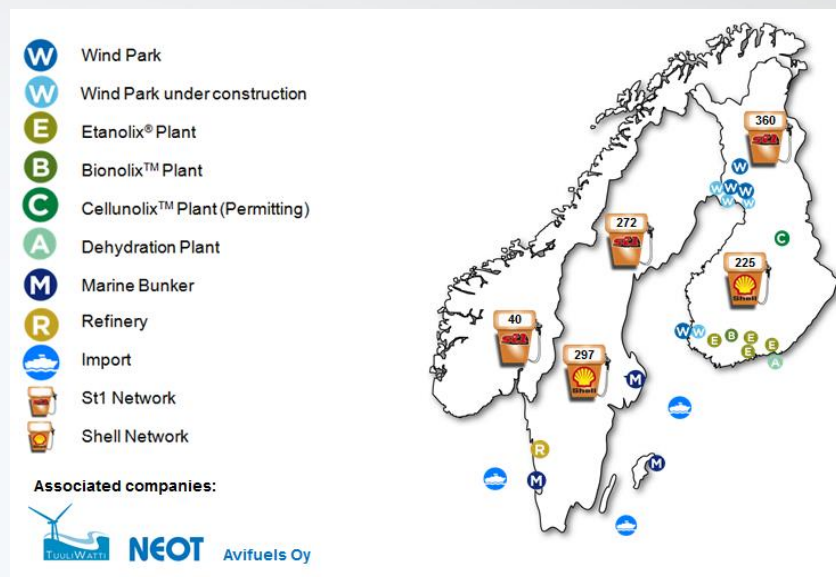
PulPaper 2014
Helsinki June 4th 2014

Biofuels production from waste and process residues

Patrick Pitkänen,
Head of Business Development and Sales
St1 Biofuels, Finland

St1

- Founded in 1995
- Privately owned
- Turnover €6,8 Billion (proforma '13)
- Areas of business
 - Fuel Retail through 1.100 St1 & Shell branded networks in the Nordics
 - Oil refining in Gothenburg, Sweden
 - B-to-B and B-to-C Direct Energy Sales
 - CO₂-aware Renewable energy production and sales
- Associated companies
 - North European Oil Trade Oy (NEOT Oy)/S-Group
 - TuuliWatti Oy/S-Voima Oy
 - Avifuels Oy/Statoil Fuel and Retail



St1 Vision and Strategy

To be the leading producer and seller
of CO₂-aware energy

Our goal is to

- Develop and commercialize functional and environmentally sustainable energy solutions
- Deliver these solutions profitably

Each solution must be

- Technically ready for use today
- Ecologically and ethically sustainable
- Logistically feasible

$$E = St^1$$



Why ethanol from waste and residues

Why ethanol?

- Liquid fuel that replaces gasoline directly in existing fleet, ensuring speed to market.
- Globally most widely used and well known biofuel.
- Possibility for vast reduction of fossil GHG emissions.
- Market exists still for decades.
- Superior weight efficiency vs. batteries.



Why from waste and residues?

- Unused or underused source of energy.
- No direct or indirect land use issues.
- No negative impact on the availability of food.
- No negative impact on food price.
- Avoidance of methane leak to atmosphere from landfills.



St1's RE85 High blend ethanol

- Contains 80–85% of bioethanol produced from Finnish biowaste
- Cuts transport-related fossil CO₂ emissions by up to 80%
- For Flex-fuel vehicles (FFV)
- Optimized to challenging Nordic climate conditions in development project with The Finnish technical research Centre of Finland (VTT)
- Distribution network expanding in St1 and Shell network
- RE85 has received the Key Flag symbol from The Association for Finnish Work as the first motorfuel in Finland



RE
85



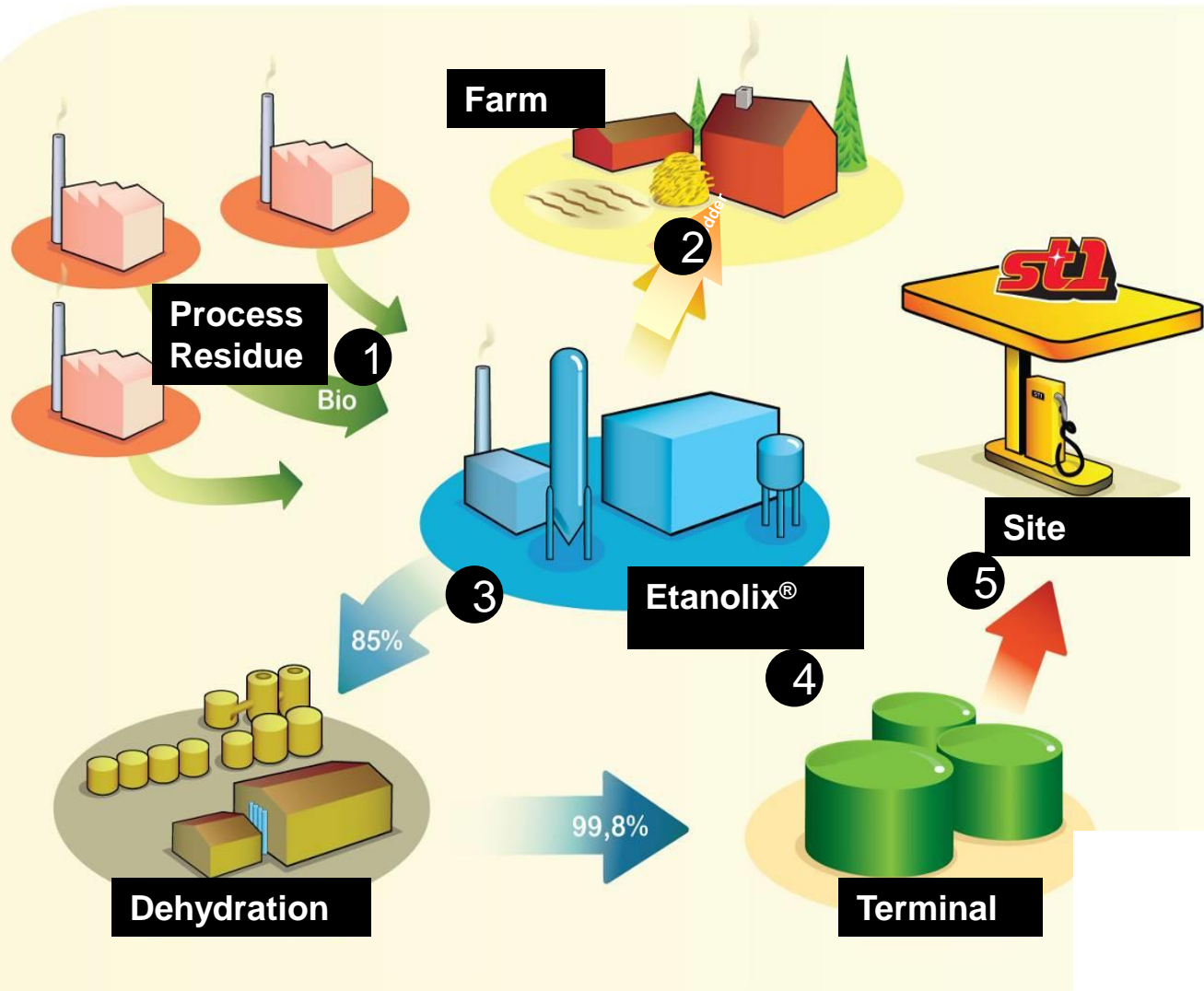


St1's RED95 Ethanol Diesel

- Contains 95% of bioethanol produced from Finnish biowaste
- Cuts transport-related fossil CO2 emissions by up to 90%
- Cuts near-emissions up to 70%
- For Scania Ethanol Diesel vehicles
- Trans ECO project with The Finnish technical research Centre of Finland (VTT)



Etanolix® - Idea of the dispersed ethanol production



1. "CO₂ aware" bioethanol is produced from process residue and/or waste in Etanolix® unit.
2. Side streams from Etanolix® is used as animal feed, liquid fertilizer or solid fuel
3. The 85% bioethanol is delivered for water removal in a centralised dehydration unit
4. Fuel grade ethanol is blended with gasoline components (low or high blend)
5. Fuel is distributed to sold from service stations



St1 Ethanol feedstock Roadmap

Feedstock



Etanolix® -concept

Feedstock:	Food industry residues Package removal included <u>No</u> traces of animals allowed
Product:	Ethanol
Capacity:	1 – 8 million liters/year/unit
Co-product:	Protein rich animal feed
Units:	4 units in Finland
Potential EU27:	200 – 300 million liters/a

Jokioinen Etanolix®



Lahti Etanolix®



Food Industry
Process Residue

Etanolix®

2007

2009

2011

2013

2020



Etanolix® Göteborg – integration to an Oil Refinery



Production capacity

- Ethanol (as per 100% ETOH) 5.000 cubic meters

Feedstock

- Industrial bakery waste / industrial process residue
- Packed and unpacked out dated waste bread from shops and markets
- Approx 20.000 tn/a feedstock is required (bread)

Products

- Anhydrous fuel grade ethanol
- Liquid animal feed for pig farms / feed for biogas plant (AD)

Time Line

- Production starts early 2015

Etanolix 2.0 LIFE+ project

Etanolix® concept further development & demonstration:

- New raw material handling.
- unique way of integrating the ethanol plant in a conventional refinery:
 - direct ethanol blending to vehicle fuels and in an effective way distribution to the consumers
 - utilize excess energy, cooling systems and wastewater treatment plant
- Refinery personnel's expertise and experience for safe and optimal operation.



St1 Ethanol feedstock Roadmap

Feedstock



Hämeenlinna Bionolix®

Bionolix™ -concept

Feedstock:	Source segregated biowaste Package removal included Traces of animals allowed
Product:	Ethanol
Capacity:	1 million liter/year/unit
Co-products:	Biogas to CHP Fertilizer
Units:	1 unit in Finland
Potential EU27:	200 – 400 million liters/year

Municipal
solid waste



Biowaste



Food Industry
Process Residue

Bionolix™

Etanolix®

2007

2009

2011

2013

2020



Bionolix™ Hämeenlinna – integration to Landfill

Source separated
biowaste from
households and
commercial

Bionolix™ - ethanol plant

Ethanol

CHP

Heat for District
Heating

Power to Grid

Methane gas
from Landfill

Liquid fertilizer and
organic soil
preparation to
Agriculture

AD



St1 Ethanol feedstock Roadmap

Feedstock

Recycled fiber
SRF
Saw dust
Wood chips
Waste wood
Wood Processing
Integrate waste

Straw

Municipal
solid waste

Biowaste

Food Industry
Process Residue

Cellulosic feedstocks:

Feedstock:	Cellulosic wastes and residues
Product:	Ethanol
Capacity:	10 - 100 million liters/year/unit
Co-products, eg:	Lignin Biogas etc.
Units:	Permitting 1st unit in Kajaani, Fin
Potential EU27:	29 – 72 billion liters/year (Straw only by Novozymes Report , May 2012)

Cellunolix™

Bionolix™

Etanolix®

2007

2009

2011

2013

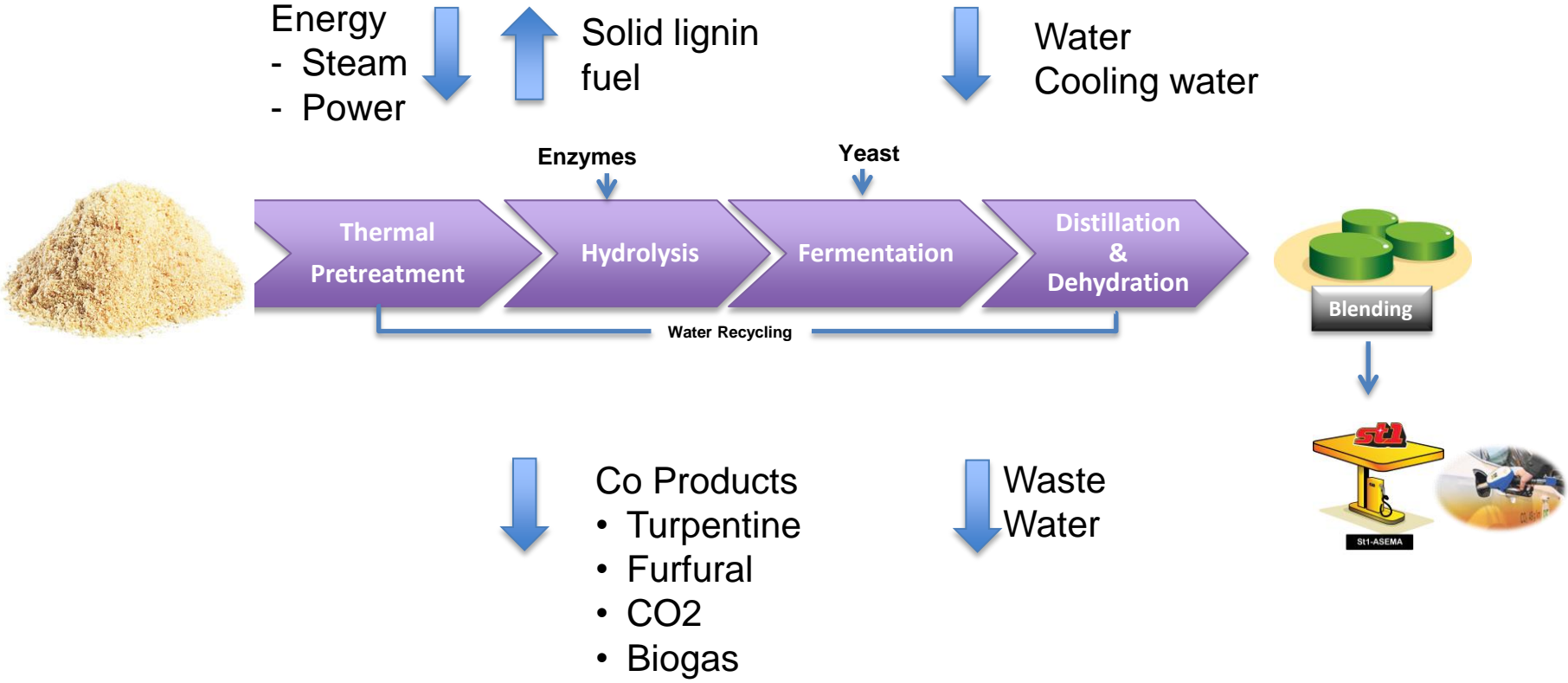
2020



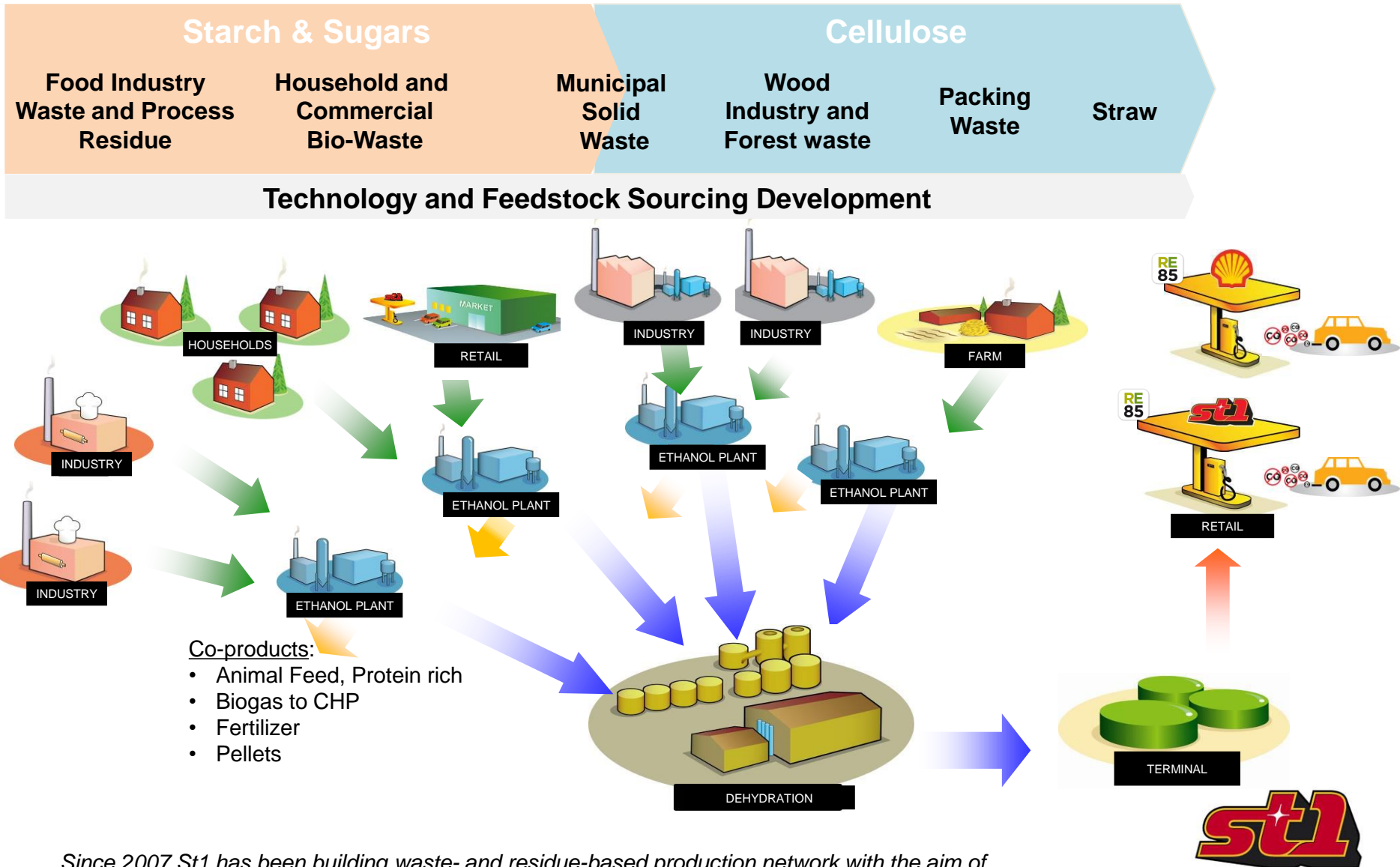
Cellunolix® Kajaani integration to Sawmill & Power Plant



St1 Cellunolix® - Ethanol from sawdust



Road Map to Significant Volumes



Since 2007 St1 has been building waste- and residue-based production network with the aim of producing up to 300 Million liters ethanol for traffic use by the year 2020's

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