Spiritwood Greenhouse CO_2 Supply

Rich Garman

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Project objectives

- Harness synergies at the Spiritwood Energy Park
- Utilize the CO_2 exhaust from an ethanol biorefinery in an economical manner
- Partner with world class greenhouse developer operator to utilize this CO_2 stream to enhance greenhouse production
- Demonstrate technology of CO_2 diversion to greenhouse as transferrable to other North Dakota locations

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Project organization

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Project team

Connie Ova
COO – Project Owner

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Rich Garman
Senior Project Manager

Corry Shevlin
Business Manager

Casey Houweling
President
Houweling's Group

Adam Dunlop
Director- Regulatory & Strategic Planning

Owners Engineer
TBD

General Contractor
TBD

Funding Sources
TBD

MASTERY UNDER GLASS
HOUWELING'S TOMATOES

MIDWEST AgEnergy

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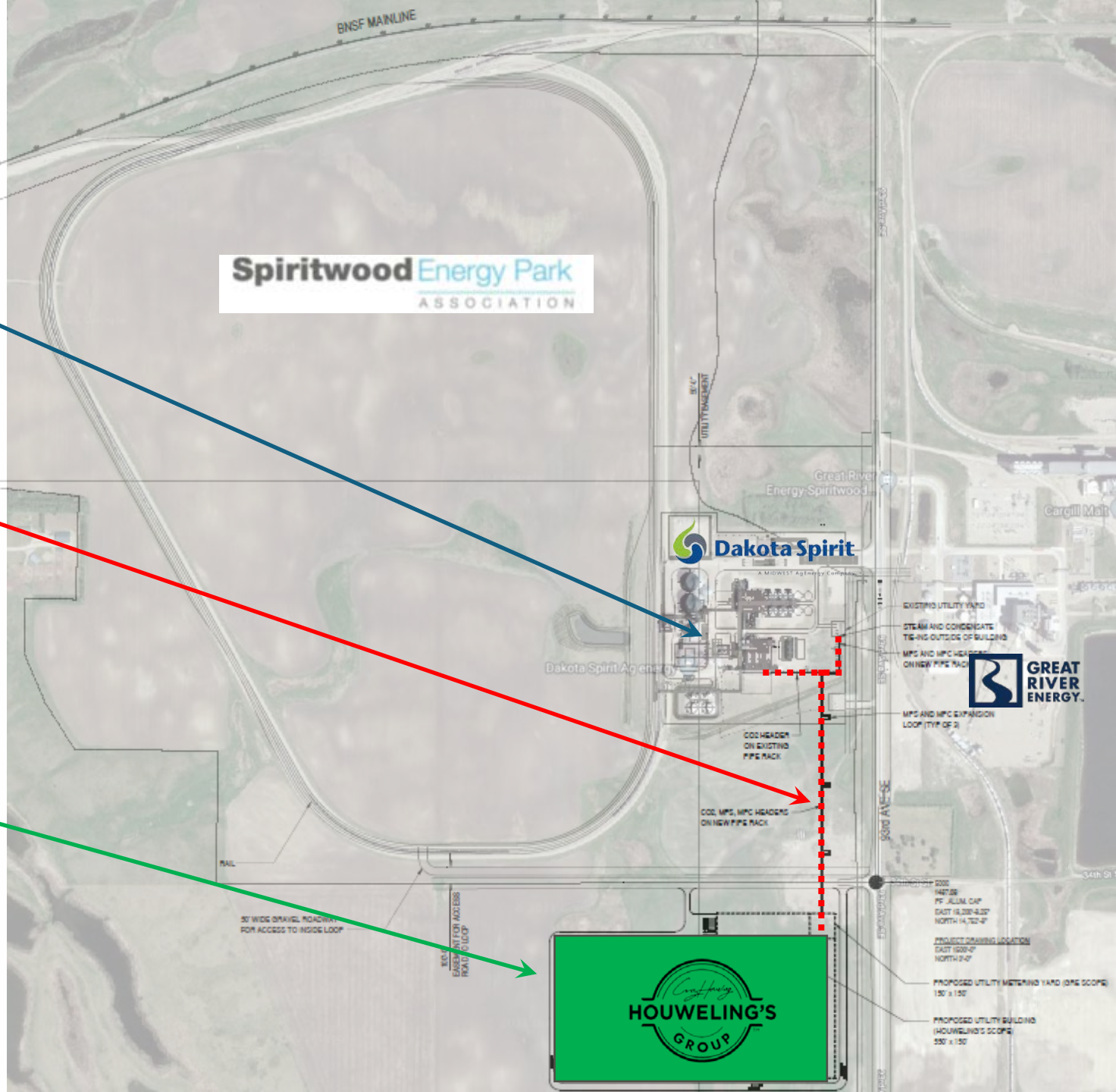
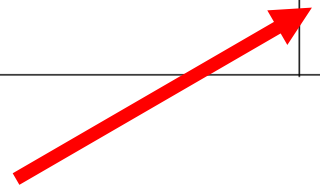
Site layout

- Dakota Spirit – source of 99% pure CO_2
- Utility supply for greenhouse
  - CO_2
  - Heating steam
  - Water
- Proposed site of 30 acre greenhouse



Project budget

Project Associated Expense	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)	Other Project Sponsor's Share
Engineering	$100,000			
Material Procurement	$200,000			$1,212,156
Construction	$200,000			$572,557
Project Administration			$180,000	
Office Facility			$20,000	
Land provided			$200,000	
Total	$500,000		$400,000	$1,684,713



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Project financing

Budget = $1.685M

NIDC

- $500K
- Grant

USDA – REDLG

- $1M
- 0% / 10 Year Loan
- Pending

BALANCE

- $185K
- Various potential sources
  - Partner funding, contingency funding

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Project schedule

BASELINE SCHEDULE

Lease agreement signed with Greenhouse
- 1/2/2021

Steam and CO_2 Agreement drafts
- 2/1/2021

Board approvals of agreements
- 2/1/2021-3/1/2021

Site infrastructure development
- 3/1/2021-9/15/2021

Facility construction
- 3/1/2021-11/1/2021

Operations start up
- 11/1/2021-2/1/2022

Full production
- 2/1/2022

CONTINGENCY SCHEDULE

Lease agreement signed with Greenhouse
- 5/1/2021

Steam and CO_2 Agreement drafts
- 5/1/2021

Board approvals of agreements
- 5/1/2021-6/1/2021

Site infrastructure development
- 6/1/2021-11/1/2021

Facility construction
- 3/1/2022-9/1/2022

Operations start up
- 9/1/2022-12/1/2022

Full production
- 12/1/2022

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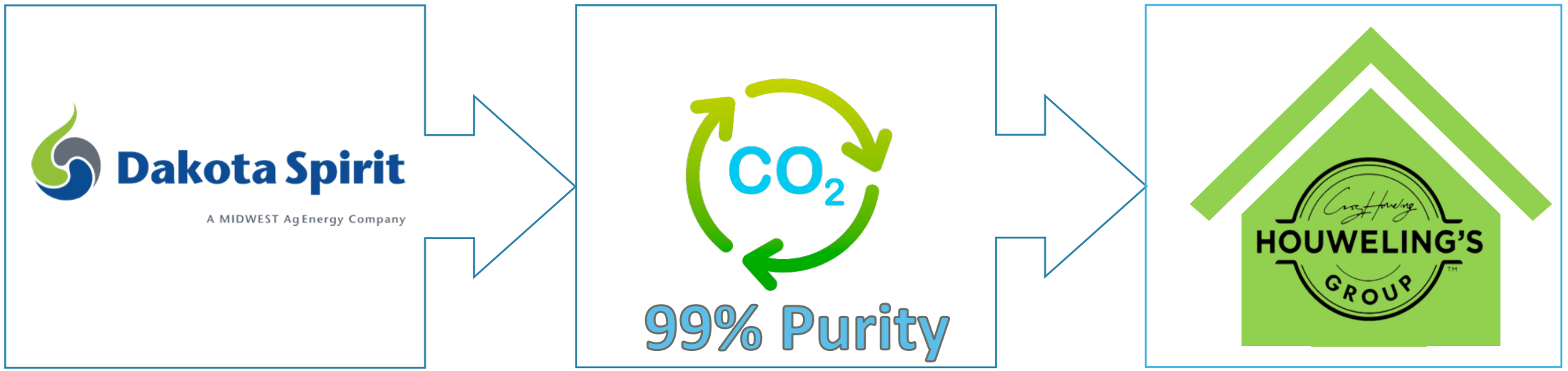
CO_2 Utilization



Divert CO_2 stream at stack

Blower w/ VFD

Corrosion resistant piping

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Synergies

- Carbon Dioxide (CO_2) will be supplied by the Dakota Spirit ethanol biorefinery via a direct pipeline, which is not currently captured or utilized by Dakota Spirit
- Steam supplied by Spiritwood Station for heating
- Water and wastewater infrastructure already in place will be utilized by the greenhouse development
- Existing transportation infrastructure will also be utilized by the greenhouse development
- Shared infrastructure costs

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Midwest AgEnergy competencies

Each Facility

24M bushels corn per year
70M+ gal/yr ethanol
2.5M gal/yr corn oil
200K tons of distillers grains per year

- Experience in the field of CO_2
- Carbon Capture & Storage (CCS) project at Blue Flint
  - Carbon Zero project
  - If project is successful Blue Flint facility anticipates sequestering all their CO_2, which equates to approximately 200,000 tons per year.
  - The result of the sequestration will be a lower carbon footprint for the facility and the ability to participate in the IRS 45Q tax credit program.

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Houweling's proven track record

- Facilities
  - Delta, BC – 150-acre facility
  - Camarillo, CA – 125-acre facility
  - Mona, UT – 30-acre facility
  - *Spiritwood, ND – planned 30-acre facility*

- Mona, UT facility
  - Flue gas from Currant Creek power plant stack diverted to Houweling's via above ground duct
  - Thermal energy is stored on-site for greenhouse heating on-demand
  - CO_2 is directed into greenhouse to promote plant growth
  - Condensate captured and utilized to supplement irrigation

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Houweling's Utah facility

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Spiritwood greenhouse overview

- **Footprint**
  - *30 acres under glass*
  - *80-acre site*
- **Power requirement**
  - *1 MW routine load*
  - *18 MW peak lighting load*
- **Water usage**
  - *160 GPM*
  - *Recycle all irrigation water*
- **CO_2 usage**
  - *15,000 tons per year*
  - *Diverted from Dakota Spirit stack*
- **Facility Heating**
  - *Provided by Spiritwood Station*

- **Employees**
  - *100+*
- **Production**
  - *450K+ Bushels (tomatoes)*

- **North Dakota Benefits**
  - *Extended growing season (4 seasons)*
  - *Crop diversity*
  - *Demonstrate technology of CO_2 diversion to greenhouse as transferrable to other North Dakota locations*
  - *Locally grown produce, reducing overall carbon intensity of food supply*
  - *Greatly increased food safety*

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Innovation

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Business model

This business model gives the ethanol biorefinery an economically viable outlet for their CO_2. This model could be easily transferrable to other ethanol biorefineries in the state allowing them a cost-effective way to utilize their CO_2 byproduct.

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Q&A

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